



WAYNE STATE
UNIVERSITY

Project Manual | Volume 01 | Divisions 00 - 14

Wayne State University
Health Science Research Building
Detroit, Michigan

Compiled Set
October 17, 2025



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WAYNE STATE UNIVERSITY
HEALTH SCIENCES RESEARCH BUILDING
DETROIT, MICHIGAN



2025-10-17

PROJECT MANUAL
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2025-09-29	☒	22 0513	Common Motor Requirements For Plumbing Equip	OEC
2025-09-29	☒	22 0517	Sleeves and Sleeve Seals For Plumbing Piping	OEC
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2025-09-29	☒	32 1216	Hot-Mix Asphalt Concrete Paving	SDA
2025-09-29	☒	32 1313	Cement Concrete Pavements, Curbs, And Gutters	SDA
2025-09-29	☒	32 1415	Pavement Marking	SDA
2025-09-29	☒	32 9200	Fine Grading, Lawn Seeding and site Stabilization	ISDS
2025-09-29	☒	32 9310	Planting	ISDS
2025-09-29	☒	32 9320	Landscape Maintenance and Guarantee	ISDS

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DIVISION 33 - UTILITIES

2025-09-29	☒	33 0500	Common Work Results for Utilities	SDA
2025-09-29	☒	33 4100	Storm Sewers, Underdrains And Drainage Structures	SDA
2025-09-29	☒	33 4613	Foundation Drainage System	HKS

ADDITIONAL REPORTS – FOR REFERENCE ONLY

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	☐	Environmental Assessment Report- Available Upon Request	TEC

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31 1000	Site Clearing
31 1012	Fine Grading
31 1018	Soil Erosion Control
31 2000	Earth Moving
31 2319	Dewatering

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 1216	Hot-Mix Asphalt Concrete Paving
32 1313	Cement Concrete Pavements, Curbs and Gutters
32 1415	Pavement Marking

DIVISION 33 – UTILITIES

33 0500	Common Work Results for Utilities
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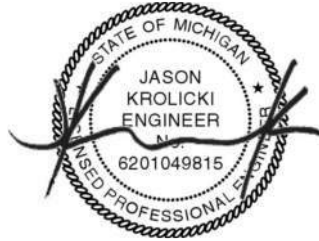
31 2400 Green Stormwater Infrastructure

DIVISION 32 – EXTERIOR IMPROVEMENTS

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32 9310	Planting
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SECTION 007200

GENERAL CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

- A. The General Conditions of this Contract are that which is referenced in the Owner-Contractor Agreement and hereinafter is referred to as the "General Conditions."
- B. The General Conditions shall apply to each and every Section of the Work as though written in full therein and are made a part of the Contract Documents by reference.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

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SECTION 007300

SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

- A. The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.
- B. The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.
- C. Correlation and Intent of the Contract Documents:
 - 1. Sections of Division 01 - General Requirements govern the execution of all sections of the specifications.
 - 2. Summary paragraphs placed at the beginning of the Sections present a brief indication of the principal Work included in that Section, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.
 - 3. The Relation of Specifications and Drawings shall be equal authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above mentioned disagreements, shall be determined by the Architect.
 - 4. Should the Drawings disagree themselves, figures shall govern over scaled measurements, large scaled Drawings shall govern over small scale Drawings, the greater quantity of work or materials shall be furnished and performed; the descriptive writings shall govern over legends indicating material or conditions and the Agreement takes precedence over all other Contract Documents.
 - 5. Failure to report a conflict in the Contract Documents shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner.
 - 6. Instructions, directions and requirements as specified shall be considered to be followed by the phrase "unless otherwise specified or indicated".

1.2 INTERPRETATION

- A. In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.3 INFORMATIONAL SUBMITTALS

- A. Informational submittals may be so identified in the Contract Documents.

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1.4 PROFESSIONAL CERTIFICATION

- A. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

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SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Owner-furnished, Owner-installed (OFOI) products.
2. Owner-furnished, Contractor-installed (OFCI) products.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

1.2 OWNER-FURNISHED, OWNER-INSTALLED (OFOI) PRODUCT

- A. The specific product is not in this contract, and actual installation of the product will be made by the Owner.
- B. Products will be indicated as follows:
1. Product prefixed with "Space for"
 2. N.I.C.
 3. Owner Furnished - Owner Installed
 4. Product noted as "Future"
- C. Roughing-in for Owner Furnished, Owner Installed Product is provided by applicable Sections governing the type of work. Obtain rough-in requirements from Owner.

1.3 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFCI) PRODUCT

- A. Install products indicated as follows:
1. "Owner Furnished, Contractor Installed".
 2. "Reuse".
 3. "Relocate".
- B. Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:
1. Relocated Products:
 - a. Removing installed product from the Owner's existing facility, as required.
 - b. Transportation of product from Owner's facility to the job site.
 2. Receiving and storage of Owner furnished, Contractor installed product, as required.

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3. Providing materials and components for the product as necessary to install in an operating condition, but not including repairing of existing damages to the product.
4. Modification of product only as specified under the particular item.
5. Installation of product in this project, complete and in operating condition, including the adjusting and calibration of the product as necessary for proper operation.
6. Testing of product.
7. Paying of fees, licenses, and taxes in conjunction with the installation of the product.
8. Roughing-in and final utility connections for the Owner furnished, Contractor installed product remains the work of Sections governing the specific utility.

1.4 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Confine constructions operations to work in areas indicated on drawings.
 2. Allow for Owner occupancy of site and use by the public.
 3. Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times.
 4. Do not use drives and entrances for parking or storage of materials.
 5. Schedule deliveries to minimize use of driveways and entrances.
 6. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 7. Coordinate use of premises under direction of Owner.
 8. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
 9. Move any stored Products, under Contractor™™s control, which interfere with operations of the Owner or separate contractor.
 10. Obtain and pay for the use of additional storage or work areas needed for operations.
- D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing and/or adjacent building(s), as applicable, during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

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2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Coordinate the limitations relative to working hours in the existing building with Owner.
- C. Existing Utility Interruptions: Refer to Division 01 Section "Execution" for requirements.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Owner not less than 72 hours in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

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2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Documentation: Show compliance with requirements for accepted alternates and the following, as applicable:
1. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate accepted alternates.
 2. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 3. Samples, where applicable or requested.
 4. Certificates and qualification data, where applicable or requested.
 5. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 6. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 7. Detailed comparison of Contractor's construction schedule using accepted alternates with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 8. Cost information, including change in the Contract Sum.
- B. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

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1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- D. Execute accepted alternates under the same conditions as other work of the Contract.
- E. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
- F. Acceptance of Alternates will be exercised at option of Owner in any order or combination.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

END OF SECTION

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SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 SUBMITTALS

- A. Substitution Requests: Submit electronic copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Submit electronic file using Architect's Substitution Request Form.
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.

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- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Contractor of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Prior to starting Substitution Process, review proposed recommendations with Architect.
- B. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.
- C. Contractor Representations: By making substitution request, Contractor:
 - 1. Recognizes burden of proof of equality for requested substitution rests with Contractor.

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2. Represents and warrants that Contractor has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.
 3. Represents and warrants that Contractor will provide same warranties for requested substitution that Contractor would for specified Work.
 4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
 5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.
 6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Contractor shall replace accepted substitution with specified Work at no additional cost to Owner.
- D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
- E. Substitutions for Convenience:
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.

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- g. Requested substitution has received necessary approvals of authorities having jurisdiction.
- h. Requested substitution is compatible with other portions of the Work.
- i. Requested substitution has been coordinated with other portions of the Work.
- j. Requested substitution provides specified warranty.

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 012600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, using Architect's Supplemental Instructions Form.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect Proposed Change Form. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Include updated Submittal Schedule showing effect of the change.
- B. Contractor-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect using Contractor's Standard Form.

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1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Include updated Submittal Schedule showing effect of the change.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.
- C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

1.5 CHANGE ORDER PROCEDURES

- A. Upon Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Contractor using Architect's Change Order Form.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive using Architect's Construction Change Directive Form. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 012900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Accepted Alternates.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
 - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:

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- a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
- a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
9. Change Orders: Provide a separate line item in the schedule of values for each change order.
10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
- a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

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1.3 ARCHITECTS COST DATA

- A. In addition to the Schedule of Values, submit itemized cost data reporting using Architect's Project Cost Summary Form. Initial submission shall be included with contractors first Application for Payment. Final updated submission shall be included with contractors final Application for Payment.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 - 1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
 - 2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

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- F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from General Contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
 - a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. When applicable, this application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. If applicable, final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.

1.2 DEFINITIONS

- A. Project communications documents shall be defined as the following:
 - 1. Letters.
 - 2. Memoranda.
 - 3. E-Mail Communications/Internet Communications/Project Management Software Communications.
 - 4. RFI (Request for Information - Contractor).
 - 5. RFI-A (Request for Information - Architect).

1.3 FORMAT

- A. Letters and Memoranda: Submit in formats acceptable to the Architect.
- B. E-Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.
- C. RFI (Request for Information - Contractor): Submit using Architect's Request for Information Form, or on other forms approved by the Architect.
- D. RFI-A (Request for Information - Architect): Architect will submit to Contractor using Architect's standard form.

1.4 PROJECT COMMUNICATIONS DOCUMENTS

- A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

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- B. E-Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Contractor. The Contractor shall keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor's right to rely on such communications and such communications shall be deemed to have not taken place.
- C. RFI (Request for Information - Contractor) shall be defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:
1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Contractor shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
 2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.
 - a. The Contractor shall include a "Proposed Solution" to the issue requiring interpretation or clarification.
 3. RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
 4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.
 5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
 6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. The Contractor shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.

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7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:
 - a. Project name.
 - b. Name and address of Contractor.
 - c. Name and address of Architect.
 - d. RFI number including RFIs that were returned without action or withdrawn.
 - e. RFI description.
 - f. Date the RFI was submitted.
 - g. Date Architect's response was received.
 8. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
 - a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- D. RFI-A (Request for Information - Architect) shall be defined as a request by the Architect for information relating to the obligations of the Contractor under the Contract.
1. After receipt of an RFI-A the Contractor shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
 2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.
- E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Contractor shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

1.5 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

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1. Post copies of list in project meeting room, in temporary field office, and Project Web site. Keep list current at all times.

1.6 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

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- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - e. Indicate required installation sequences.
 - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 - 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 - 2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 - 3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 - 4. If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
 - c. Distribution: Digital data files shall be distributed via the Architect's file transfer site with acceptance of Architect's data licensing agreement.

1.8 PROJECT WEB SITE

- A. Use Architect's Project Web site implementing Architect's electronic project management software system for purposes of managing project communication and documentation until Final Completion.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

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1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
 4. Attendance: Document attendance of all participants.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, at a time to be decided prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

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- c. Submittal of written warranties.
 - d. If applicable, requirements for completing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. If applicable, coordination of separate contracts.
 - l. If applicable, Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regular intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following or as needed:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) If applicable, resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) If applicable, status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Work hours.
 - 12) Hazards and risks.
 - 13) Progress cleaning.

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- 14) Quality and work standards.
 - 15) Status of correction of deficient items.
 - 16) Field observations.
 - 17) Status of RFIs.
 - 18) Status of proposal requests.
 - 19) Pending changes.
 - 20) Status of Change Orders.
 - 21) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) If applicable, resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Change Orders.

PART 2 - PRODUCTS

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. General: So as to expedite electronic review process, process all documents through a web-based software service. Sending documents via email, FTP or paper will not be accepted.

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1. Basis of Design (Product Standard):

a. Newforma, Inc.; Newforma Project Cloud, web-based software.

- 1) Website: www.NewformaProjectCloud.com
- 2) E-mail: projectcloud@newforma.com
- 3) Phone: (800) 303-4650

B. Performance Requirements:

1. Project License:

- a. Cloud based (no hardware required).
- b. Unlimited user accounts.
- c. Functionality to support subcontractors, contractors, architects and consultants.
- d. Provide access to data for all project team members at no cost to the individual users.

2. Training and Support:

- a. Dedicated project training.
- b. Phone support.

3. Archive:

- a. Export all data to an offline archive at the completion of the project.
- b. Provide archive to architect, contractor and owner.
- c. Archive shall include all attachments, meta data, review comments and time stamp history.

4. Submittals and RFIs:

- a. Customizable logs and reporting accessible by all users.
- b. Logs shall automatically update as submittals and RFIs are processed.
- c. Automated routing of submittals and RFIs to design team based on trade.
- d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
- e. Automated weekly email to design team users of overdue items.
- f. Automatic sequential numbering per spec section for submittals.
- g. Two sets of due dates - one overall due date and a consultant due date.
- h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.

5. Submittal Register:

- a. Software vendor shall take specifications and build the required list of submittals and import into the software.

6. Drawing Management:

- a. Provide current set of drawings and specifications through a centralized index.
- b. Automated association of PDFs to the centralized index.

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- c. Manage drawing revisions with customizable review states.
 - d. Drawings shall be accessible offline via mobile devices.
7. File Sharing:
- a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
 - b. Access permissions (view/edit) at a folder level.
8. Punch List and other Field Task Management:
- a. Unlimited customizable field task types including punch list.
 - b. Locate and assign tasks from a mobile device.
 - c. No additional fees to individual users to access mobile apps.
 - d. Data shall be accessible offline on mobile devices.

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's review. Architect's responsive action is required.
- B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.
- C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.
- D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.
- E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

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- a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
- 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - 1. Distribution: Digital data files shall only be distributed with acceptance of HKS data licensing agreement.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review.
- D. Paper Submittals: Architect reserves the right to require paper submittals.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

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1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number, including revision identifier.
 - a. File Naming Convention (separate by dashes - or underscores _):
 - 1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. HKS Job Number and Add Service Number (e.g. 14424.000)
 - b. Project name.
 - c. Number and title of appropriate Specification Section.
 - d. Manufacturer name.
 - e. Product name.
 - f. Submittal revision number.
6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Basis of Design; (Product Standard):
 - a. Newforma, Inc.; Newforma Project Cloud, web-based software.
 - 1) Website: www.NewformaProjectCloud.com

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2) E-mail: projectcloud@newforma.com
3) Phone: (800) 303-4650

- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On page, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in file name and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.
- I. Distribution: Furnish electronic copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.

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- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's installation instructions.
 - c. Mill reports.
 - d. Standard product operating and maintenance manuals.
 - e. Certification that products are appropriate for installation indicated.
 - f. Manufacturer's catalog cuts.
 - g. Manufacturer's product specifications.
 - h. Standard color charts.
 - i. Statement of compliance with specified referenced standards.
 - j. Testing by recognized testing agency.
 - k. Application of testing agency labels and seals.
 - l. Notation of coordination requirements.
 - m. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Dimensions.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Design calculations.
 - i. Schedules.
 - j. Compliance with specified standards.

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- k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship and attachment to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer.
- 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - 4. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - 5. BIM File Incorporation: When applicable, develop and incorporate Shop Drawing files into Building Information Model established for Project.
 - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
 - b. Refer to Division 01 Section "Project Management and Coordination" for requirements for coordination drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. This is in addition to physical samples.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

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6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 4 sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

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- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

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- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-ENGINEERING SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Where applicable, incorporate delegated-design drawing and data files into Building Information Model established for Project.
 - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

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3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as follows:
1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
 2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
 3. Submittals Not Required: Where a submittal is primarily for record purposes, special processing, or other Contractor activity, the submittal will be returned, marked "Not Reviewed; Submittal not required by Contract Documents".
- B. Architect's Acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.
- C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.
- G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

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SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Mockups establish the standard by which the Work will be judged.
 - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 2. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

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- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

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- C. If work is required in a manner that makes it impossible to produce such work of the quality required by or reasonably inferred from the Contract Documents, or should discrepancies appear among the Construction Documents, the Contractor shall request in writing an interpretation from the Architect before proceeding with the work. If the Contractor fails to make such request, no excuse will be entertained thereafter for failure to carry out work in the required manner or to produce required guarantees, warranties, or bonds, and the Contractor shall not be entitled to any change in the Contract Sum or the Contract Time on account of such failure.

1.4 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

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1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Statement whether conditions, products, and installation exceed manufacturer's statements.
 8. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

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1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

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1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Clean exposed faces of mock-up.
 3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Protect accepted mock-up from the elements with weather-resistant membrane.
 6. Obtain Architect's acceptance of mock-ups before starting fabrication.
 7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
 8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
 9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.
- L. Integrated Exterior Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- M. Laboratory Mockups: See Division 01 Section "Preconstruction Laboratory Mockup Testing for Building Enclosure Systems."

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1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

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2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 5. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
 - a. Prepare in tabular form and include the following:
 - 1) Specification Section number and title.
 - 2) Entity responsible for performing tests and inspections.
 - 3) Description of test and inspection.
 - 4) Identification of applicable standards.
 - 5) Identification of test and inspection methods.
 - 6) Number of tests and inspections required.
 - 7) Time schedule or time span for tests and inspections.
 - 8) Requirements for obtaining samples.
 - 9) Unique characteristics of each quality-control service.

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1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner may engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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SECTION 014200

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

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- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
 2. DOC - U.S. Department of Commerce; www.commerce.gov.
 3. DOD - U.S. Department of Defense; www.defense.gov.
 4. DOE - U.S. Department of Energy; www.energy.gov.
 5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov.
 6. DOS - U.S. Department of State; www.state.gov.
 7. EPA - United States Environmental Protection Agency; www.epa.gov.
 8. FAA - Federal Aviation Administration; www.faa.gov.
 9. GPO - U.S. Government Publishing Office; www.gpo.gov.
 10. GSA - U.S. General Services Administration; www.gsa.gov.
 11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
 12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
 13. NIST - National Institute of Standards and Technology; www.nist.gov.
 14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
 17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
 19. USP - U.S. Pharmacopeial Convention; www.usp.org.
 20. USPS - United States Postal Service; www.usps.com.

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- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
 2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
 3. DSCC - Defense Supply Center Columbus; (see FS).
 4. FED-STD - Federal Standard; (see FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from U.S. General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specifications and Standards; (see DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
 2. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 014519

FIELD TESTING FOR AIR AND WATER LEAKAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Field testing of cladding systems in accordance with performance requirements indicated, including joints in adjacent construction designed to remain permanently closed and watertight.
 - 1. Resistance to water leakage.
- B. Owner will engage a qualified testing agency and pay costs of initial testing.
- C. Contractor shall be responsible for and pay costs of remedial work and subsequent re-testing.
- D. Contractor shall perform out of sequence work as required to allow testing to occur at normal intervals.

1.2 DEFINITIONS

- A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
 - 1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.
 - a. Water present within the adjacent wall system or adjacent construction assembly is considered water leakage.
 - 2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces

1.3 SUBMITTALS

- A. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

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1.5 CONTRACTOR RESPONSIBILITIES

- A. Coordinate with Testing Agency. Provide labor, materials and equipment used for testing by testing agency personnel.
 - 1. Contractor shall be responsible for coordinating and scheduling tests.
 - 2. Provide powered scaffold, hose, water supply, communication system and manpower to perform tests. Schedule any work necessary, such as out of sequence sealant work, so that testing can be performed.
- B. Satisfactory results of testing do not relieve Contractor from conforming to requirements of Contract Documents, shop drawings, and project specifications. Installation work on remainder of building shall match area checked, unless otherwise instructed in writing.
- C. Pending actual performance, extent of or absence of water leakage in initial water penetration test, and measures adopted by the Contractor to eliminate leakage, Architect will determine need and scope of additional tests and test methods. Remedial measures are subject to approval by Architect and shall maintain standards of quality and durability.
- D. Remedial measures found necessary and effective in eliminating leakage in area checked shall be used in fabricating and installing remainder of the work.
- E. Notify Architect and testing agency when wall construction is ready for testing. Provide safe access for Architect and Testing Agency to interior and exterior of test locations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Refer to Technical Sections for performance requirements of each system or product to be tested.
- B. Water Spray Test: Selective field testing will be conducted in accordance with AAMA Standard 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtainwalls, and Sloped Glazing Systems.
 - 1. Water Spray Test without Air Pressure Difference: Designated areas shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
- ~~C. Field Chamber Water Penetration Test: Selective field testing will be conducted in accordance with ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference - Procedure A.~~
 - ~~1. Water Penetration Test with Static Air Pressure Difference: Designated areas shall be tested in accordance with ASTM E 1105 at a minimum static air pressure differential specified for laboratory testing in Performance Requirements and shall not evidence water penetration.~~

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Exterior wall construction shall be completed and shall be fully glazed to provide complete wall installation. Work shall be done in accordance with approved shop drawings and specifications.
 - 1. Sealants shall be fully cured as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL TESTING

- A. Testing Services, General: Testing and inspecting of representative areas of exterior walls shall take place as installation proceeds to determine compliance of installed assemblies with specified performance requirements.
- B. Testing Agency Field Service: Owner will employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be performed at Contractor expense.
- C. Architect shall designate test procedure and areas of completed walls to be checked.
 - 1. Field Testing shall be performed at intervals and locations including but not limited to the following:

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- a. Water Spray Test per AAMA 501.2: Test at intervals and locations as directed by Architect; however, not less than the following:
 - 1) Four locations at 5% completion, four locations at 50% completion, and four locations at 90% completion.
- b. Field Chamber Water Penetration Test per ASTM E 1105: Test at intervals and locations as directed by Architect; however, not less than the following:
 - 1) Two locations at 5% completion, two locations at 50% completion, and two locations at 90% completion.
- c. Perform one on more tests at locations with a re-glazed lite.
- 2. Performance Requirements: Systems shall be tested in accordance with definitions and at performance requirements, without reduction for field installation, as indicated in Technical Sections.
- 3. Test shall be performed prior to installation of interior finishes.
- D. All joints or other conditions within designated areas where leakage may occur will be tested.
- E. Indoor side of wall in this area shall be unfinished and left open and unobstructed, permitting full length of joints to be examined from indoor side.
 - 1. Do not install framing system trim and sealants prior to testing.
 - 2. Where testing is performed with interior construction in place, Contractor shall remove interior construction as needed to allow inspections.
- F. If operable joints such as those around doors and operable parts of windows occur within wall area involved, appropriate modifications both of procedure and performance requirements will be made in respect to such joints.

3.5 TEST REPORTS

- A. Testing laboratory shall be responsible for conducting and reporting tests, state in report whether test specimen conforms to requirements of Contract Documents and approved drawings, and specifically note any deviations.
 - 1. Include written documentation describing remedial work, including repairs and modifications required.
 - 2. Required corrections shall be performed in presence of Architect.
- B. Testing shall be witnessed by the Architect; acceptance of test assembly and test results shall be determined by the Architect.
- C. Test reports shall be prepared according to testing standard indicated. Testing laboratory shall submit reports directly to Owner and Architect.

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3.6 REMEDIAL WORK BY CONTRACTOR

- A. In event of failure to meet test requirements, Contractor and subcontractors shall redesign, rework, and/or re-fabricate, reship and re-erect assemblies as required until test requirements are met, at no additional cost to Owner.
 - 1. For each failed test, Contractor shall provide three additional consecutively successful test on like specimens at locations selected by the Architect.
- B. Wherever leakage has occurred, joints shall be made watertight in manner acceptable to Architect.
- C. Remedial work involving use of curing-type compounds shall be allowed to cure for one week minimum, but not less than manufacturer's written recommendation, before re-checking for leakage.
- D. After required remedial work and curing time are completed, repaired joints shall be retested.
- E. If leakage continues, additional remedial measures shall be performed; checking shall be repeated until joints in designated area are found to be acceptable.
 - 1. Re-checking, when required, shall be performed at the Contractor's expense by testing laboratory originally employed.

END OF SECTION

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SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used, indicated by utility company meter readings, by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used, indicated by utility company meter readings, by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

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1. Locations of dust-control partitions at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste handling procedures.
 5. Other dust-control measures.
- D. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- E. Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
1. Building Code requirements.
 2. Health and safety regulations.
 3. Utility company regulations.
 4. Police, Fire Department and Rescue Squad rules.
 5. Environmental protection regulations.
 6. City ordinances and regulations.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- C. Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8 inch OD line posts and 2-7/8 inch OD corner and pull posts, with 1-5/8 inch OD top rails.
- D. Portable Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8 inch OD line posts and 2-7/8 inch OD corner and pull posts, with 1-5/8 inch OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- E. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2 by 4 inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.
- F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- G. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.
 - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.
- H. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- I. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site.
 - 2. Conference room of sufficient size to accommodate. Provide electrical power service and 120-V ac duplex receptacles. Furnish room with conference table, chairs, and tack and marker boards.

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3. Drinking water and private toilet.
 4. Heating and cooling equipment necessary to maintain a uniform indoor.
 5. Lighting fixtures capable of maintaining average illumination at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- E. Air-Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

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3.2 TEMPORARY UTILITY INSTALLATION

- A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.
- B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.
- C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.
- F. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Existing Toilets in Occupied Facilities: Use of Owner's existing toilet facilities will not be permitted or allowed.
- G. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

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- H. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- I. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Provide telephone line(s) for each field office.
- M. Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed for use by Architect and Owner to access Project electronic documents and maintain electronic communications

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

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- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Provide dust-control that is nonpolluting and nontracking. Reapply as required to minimize dust.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Coordinated parking with Owner's requirements.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.
 - 3. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Coordinated signs with Owner's requirements and requirements of authorities having jurisdiction.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. Comply with progress cleaning requirements in Division 01 Section "Execution."
- I. Existing Elevator Use in Occupied Facilities: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- J. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

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- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

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- K. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 2. Construct dustproof partitions with two layers of 6 mil polyethylene sheet on each side. Cover floor with two layers of 6 mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain walk-off mats in vestibule, for dust control.
 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 5. Protect air-handling equipment.
 6. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and authorities having jurisdiction; manage fire-prevention program.

3.5 MOISTURE CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.

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6. Discard, replace, or clean stored or installed material that begins to show discoloration.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

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SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Division 01 Section "Substitution Procedures".
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers
- D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.
- E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments.

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1.3 SUBMITTALS

- A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.
- C. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Compliance: Contractor shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

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5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
 2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.
- B. Product Selection Procedures:
 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:

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- a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
- a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.
- C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.
- D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.
- 1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
- F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

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1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.
1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.
- H. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

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PART 3 - EXECUTION

3.1 RESTRICTION OF HAZARDOUS SUBSTANCES

- A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.
- B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.
- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

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SECTION 017419.11

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL - LEED

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste energy processes.
- E. Material Stream: A flow of materials coming from a job site into markets for building materials. Examples of material streams include deconstructed materials sent to reuse markets, commingled waste sent to mixed-waste recycling facility, source separation where each material is sent to a specific facility, manufacturers' or suppliers' take-back of materials, and reuse of deconstructed materials on-site.
- F. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- G. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- H. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- I. Source Separation: The act of keeping different types of waste materials separated starting at the first instance a material is considered waste.

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1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.4 SUBMITTALS

- A. Waste Management Plan: Submit plan within 14 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons (tonnes).
 - 4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - 5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Qualification Data: For waste management coordinator and refrigerant recovery technician.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional as a Waste Management Coordinator. The Waste Management Coordinator may also serve as the LEED coordinator.
- B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop and implement a Construction Waste Management Plan (CWMP) consisting of waste identification, waste reduction work plan, waste diversion goal, whether separated or comingled and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use the same units of measure throughout the CWMP.

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- B. Waste Identification: Indicate anticipated types and quantities of waste generated by the Work. Include estimated quantities and assumptions for estimates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials for the following.
1. Demolition Waste:
 - a. Landscape Debris and Soil: Do not include as part of demolition waste quantities.
 2. Construction Waste:
 - a. Divert 75% by weight.
 - b. Divert at least 4 materials streams.
 - c. Refer to Project Scorecard.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
1. Comply with operation, termination, and removal requirements in Division 1 Section "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
1. Periodic Observations: Contractor's qualified waste management coordinator shall periodically inspect waste collection bins to ensure collection is proceeding in accordance with requirements.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
1. Distribute waste management plan to everyone concerned.
 2. Distribute waste management plan to entities when they begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

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1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, or sold.
2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Not allowed unless noted otherwise.
2. Clean, repair, service, and refinish salvaged items, unless noted otherwise.
3. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
4. Store items in a secure area until installation.
5. Protect items from damage during transport and storage.
6. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING WASTE, GENERAL

A. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

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3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

- A. General: Grind, chip, separate, sort, stack and store as necessary to process waste material.

3.5 RECYCLING CONSTRUCTION WASTE

- A. General: Grind, crush, remove reinforcing and metals, separate, sort, stack and store as necessary to process waste materials

- B. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

- C. Wood Materials:

1. Lumber Treated with Heavy-Metal Preservatives: Do not grind, chip, or incinerate; must be reused or landfilled.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.

- C. Burning: Do not burn waste materials.

- D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

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SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.2 SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.
- C. Certificates of Release: From authorities having jurisdiction.
- D. Certificate of Insurance: For continuing coverage.
- E. Field Report: For pest control inspection.
- F. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

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3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request, in writing, reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.
- E. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list). Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the format agreed upon by the Owner and Architect.

1.6 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

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- B. Partial Occupancy: Submit properly executed warranties within minimum number days, as required by the Contract, of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations, as applicable, before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.

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- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Remove all graffiti and construction writing.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive and as follows:
- 1. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
 - B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

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2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 4. Replace all lamps and starters to comply with requirements for new fixtures.
- C. All Warranties remain in effect.

END OF SECTION

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SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and before commencing demonstration and training. Architect will return copy with comments.

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1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Architect.
 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 8. Cross-reference to related systems in other operation and maintenance manuals.

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- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.

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2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

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2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.

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2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

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1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

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SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project as constructed record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit-annotated PDF electronic files and directories of each submittal.

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PART 2 - PRODUCTS

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination", in addition to the printed documents described elsewhere in this Section.

2.2 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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2.3 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.4 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.5 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

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PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

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SECTION 017846.13

EXTRA STOCK AND MAINTENANCE MATERIALS - ARCHITECTURAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Extra stock and maintenance material requirements for contract closeout.

1.2 SUBMITTALS

- A. Extra Stock and Maintenance Materials: Furnish maintenance materials, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.
1. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in containers and packaging as recommended by manufacturer.

PART 2 - PRODUCTS

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

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1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.

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- f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

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PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

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SECTION 018112.11

HEALTH AND ENVIRONMENTAL PERFORMANCE REQUIREMENTS - LEED

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain the following LEED Certification:
 - 1. LEED Version 4 for Building Design and Construction (LEED v4 BD+C) New Construction.
 - a. Certification Level: As indicated on Project Scorecard.
 - 2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 3. A copy of the LEED Project Scorecard is attached at the end of this Section.
 - a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.

1.2 DEFINITIONS

- A. LEED: USGBC's LEED for Building Design and Construction, version indicated.
 - 1. Definitions that are a part of LEED for Building Design and Construction apply to this Section.
- B. Bio-based Materials: Products meet the Sustainable Agriculture Network's Sustainable Agriculture Standard, or bio-based raw materials shall be tested using ASTM Test Method D6866 and shall be legally harvested as defined by the exporting and receiving country.
- C. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.2-2017, for the emissions testing and requirements of products and materials
- D. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- E. Cradle to Cradle Certification: End use product has been certified by the Cradle to Cradle Product Innovation Institute
- F. Declare Label: International Living Future Institute, Declare Product Label indicating all ingredients have been evaluated and disclosed down to 1000 ppm.

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- G. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
1. Product-Specific Declarations: A product with a publicly available, critically reviewed life-cycled assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 2. Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 3. Product Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicitly recognized by the program operator. EPD must conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- H. Extended Producer Responsibility: A formal, widely available program undertaken by a manufacturer to accept its own or other manufacturers' products as postconsumer waste at the end of the products' useful life for use in new products of the same type.
- I. GBCI: Green Business Certification Institute; the Certification body that oversees LEED and WELL Certifications.
- J. Health Product Declaration (HPD): End use product has published a complete Health Product Declaration in compliance with the Health Product Declaration Open Standard and with a chemical inventory of the product to at least 1000 ppm or to at least 100 ppm with no known GreenScreen v1.2 Benchmark Level 1 Chemicals.
- K. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.
- L. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.
- M. Manufacturer's Material Ingredient Inventory: For Material Ingredient Disclosure, the Manufacturer has published a complete content inventory for the product in accordance with one or both of the following:
1. Disclosure to at least 0.1% (1000 ppm) with all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN). Materials defined as trade secret or intellectual property may withhold the name and/or CASRN but shall disclose role, amount and GreenScreen Benchmark.
 2. Disclosure per GreenScreen List Translator Score as defined in GreenScreen v1.2. For Material Ingredient Optimization, the Manufacturer must disclose to at least 100 ppm with no known GreenScreen v1.2 Benchmark Level 1 Chemicals.
- N. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

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- O. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.
- P. Product: A permanently installed building product is an item that arrives on the project site either as a finished element ready for installation or as a component to another item assembled on-site. The product unit is defined by the functional requirement for use in the project; this includes the physical components and services needed to serve the intended function of the permanently installed building product. In addition, similar product within a specification, each contributes as a separate product.
- Q. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- R. Regional Materials: Materials that have been extracted, harvested or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
 - 1. Regional Materials do not contribute on their own to the Responsible Sourcing of Raw Materials cost calculation but do double the cost value of a product or the percentage of the cost value if the product complies with Responsible Sourcing of Raw Materials.
- S. Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method definition.

1.3 PRECONSTRUCTION AND COORDINATION MEETINGS

- A. Preconstruction Conference: Conduct conference with Owner and Architect at a mutually agreed upon time within 21 days prior to commencement of the Work.
 - 1. Participants:
 - a. Owner.
 - b. Owner's Commissioning Agent.
 - c. Architect.
 - d. Architect's Consultants.
 - e. Contractor, including superintendent.
 - f. Contractor's Major Subcontractors
 - g. If requested, other concerned parties needed to conduct the conference.
 - 2. Minimum Agenda: Include, but not be limited to, following topics:
 - a. Review Sustainable Design requirements and Contractor's Action Plans for meeting requirements.
 - 1) LEED Prerequisites and Credits.

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3. Record discussions, including decisions and agreements, and prepare report.

B. Coordination Meetings: Conduct meetings with Owner and Architect at a mutually agreed upon times.

1. Requirements: Participants, minimum agenda and meeting minutes similar to preconstruction conference.

1.4 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Work Includes: Completed building and application for sustainable design certifications. Work is not complete until Owner has accepted Certifying Agency's final review of sustainable design certifications.

1. Provide documentation as required for sustainable design certifications.

B. Provide materials and procedures necessary to obtain sustainable design goals required in this Section. Other Sections may specify requirements that contribute to sustainable design goals.

1. Refer to other sections for additional materials and procedures necessary to obtain sustainable design goals.

C. Respond to questions and requests from Architect and the Certifying Agencies regarding Sustainable Design credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the Certifying Agency has made its determination on the Project's Sustainable Design certification application. Document responses as informational submittals.

D. Submit documentation to Certifying Agency and respond to questions and requests from Certifying Agency regarding Sustainable Design credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the Certifying Agency has made its determination on the Project's Sustainable Design certification application.

1. LEED Online Submittals: Upload LEED documentation submittal data directly to USGBC project "LEED Online" website. Complete online forms at least weekly and as necessary to document LEED credits for submittals required in this Section.

1.5 INFORMATIONAL SUBMITTALS

A. Sustainable Design Documentation Submittals:

1. Construction and Demolition Waste Management: Comply with requirements of Division 1 Section "Construction Waste Management and Disposal."

2. Construction Indoor-Air-Quality (IAQ) Management Plan:

a. Construction IAQ Management Plan developed in accordance with Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, Version indicated.

b. Product data for temporary filtration media.

1) Provide minimum MERV 8 filtration when mechanical system is used during construction.

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- c. Product data for filtration media used during occupancy.
 - d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - B. Qualification Data: For Sustainable Design coordinator.
 - C. Sustainable Design Action Plans: Provide preliminary submittals within 14 days of date established for commencement of the Work, indicating how the following requirements will be met:
 - 1. Environmental Product Declarations.
 - 2. Sourcing of Raw Materials:
 - a. Responsible Sourcing of Raw Materials.
 - 3. Material Ingredients:
 - a. Material Ingredient Reporting.
 - 4. Waste Management Plan complying with Division 1 Section "Construction Waste Management and Disposal."
 - 5. VOC Emissions Compliance. For wet-applied products, compliance with VOC Content Limits.
 - 6. Construction IAQ Management Plan complying with Division 1 Section "Indoor Air Quality Management".
 - D. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.
- 1.6 QUALITY ASSURANCE
- A. Contractor's LEED Coordinator: Engage an experienced LEED-accredited professional, with experience managing/coordinating at least 3 prior LEED certified projects, to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide products and procedures necessary to obtain Sustainable Design credits required in this Section. Although other Sections may include requirements that contribute to Sustainable Design credits, the Contractor shall provide additional materials and procedures necessary to obtain Sustainable Design credits indicated.
 - 1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, e.g. formwork for concrete.

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2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

- A. Environmental Product Declarations: Provide at least 20 different permanently installed products from at least three different manufacturers having Environmental Product Declarations that comply with LEED requirements:
1. Product-Specific Declaration: Valued as one whole product.
 2. Industry-Wide (Generic) EPD: Valued as one whole product.
 3. Product-Specific Type III EPD (Internally Reviewed): Valued as one whole product
 4. Product-Specific Type III EPD (Externally Reviewed): Valued as one and one half (1.5) product.
- B. Responsible Sourcing of Raw Materials: Provide products that meet at least one of the responsible extraction criteria below for at least 15%, by cost, of the total value of permanently installed building products in the project:
1. Extended producer responsibility program.
 2. Bio-based materials.
 3. FSC Certified Wood.
 4. Materials Reuse.
 5. Recycled Content.
- C. Material Ingredients – Material Ingredient Reporting: Provide at least 20 different products from at least three different manufacturers that comply with LEED requirements for material ingredient reporting.
1. Comply with any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:
 - a. Health Product Declarations (HPDs).
 - b. Cradle to Cradle (C2C) certifications.
 - c. Declare Product Labels.
 - d. ANSI/BIFMA e3 Furniture Sustainability Standard.
 - e. Product Lens Certification.
 - f. Facts – NSF/ANSI 336: Sustainability Assessment for Commercial Furnishings Fabric.
- D. Material Ingredients – Material Ingredient Optimization: Provide products that document their material ingredient optimization using the paths below for at least 5 permanently installed products in the project, which meet one of the following disclosure criteria:
1. Comply with any of the following report types:
 - a. No GreenScreen LT-1 hazards or GHS Category 1 hazards, assessed to 100ppm.
 - b. At least 75% by weight of product is assessed using GreenScreen, remaining 25% by weight has been inventoried and GreenScreen assessment is publicly available, assessed to 100ppm.
 - c. At least 95% by weight of product is assessed using GreenScreen, no BM-1 hazards are present, remaining 5% does not contain LT-1 hazards.
 2. And comply with any of the following disclosure criteria:
 - a. Health Product Declarations.

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- b. Cradle to Cradle Material Health Certificate or Certified, version 3 or later, bronze or better.
- c. Declare Product Labels: Red List Free.

2.3 LOW-EMITTING MATERIALS

- A. General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method, version indicated, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of Total VOCs (TVOC) after 14 days measured as specified in the CDPH Standard Method CATEGORIES as follows:

- 1. 0.5 mg/m³ or less,
- 2. Between 0.5 and 5.0 mg/m³ or,
- 3. 5.0 mg/m³ or more.

- B. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

- 1. South Coast Air Quality Management District (SCAQMD): Use only paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 5, 2016.

2.

Product Type	Allowable VOC Content (g/L)
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes – Sanding Sealer	275
Clear wood finishes - Lacquer	275
Colorant – Architectural Coatings, excluding IM coatings	50
Colorant – Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete – Curing compounds	100
Concrete – Curing compounds for roadways and bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings – Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings – Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50

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Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings – High temperature IM coatings	420
Industrial maintenance coatings – Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings – Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	150
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings – repair	340
Swimming pool coatings – other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

3. California Department of Public Health (CDPH): Compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", version indicated.

a. At least 75 percent of paints and coatings.

- C. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

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1. South Coast Air Quality Management District (SCAQMD): For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on October 6, 2017.

2.

Architectural Applications	Allowable VOC Content (g/L)
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	250
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Sealants:	
Architectural sealant	250
Marine deck sealant	760
Nonmember roof sealant	300

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Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other	
Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250

- a. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.
3. California Department of Public Health (CDPH): For field applications that are inside the weatherproofing system, compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", version indicated.
 - a. At least 75 percent of adhesives and sealants (by volume or surface area).
 - D. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 1. At least 90 percent of flooring (by cost or surface area).
 - E. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde (NAF).
 1. At least 75 percent of composite wood (by cost or surface area).
 - F. Wall Panels: Wall Panels shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Wall panels includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments.
 - G. Ceilings: Ceilings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Ceilings product category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights.

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- H. Insulation: Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation.
- I. Furniture: The following percent of furniture, measured by cost, shall be tested in accordance with ANSI/BIFMA Standard Method M7.1-2011; comply with ANSI/BIFMA e3-2014e Furniture Sustainability Standard, Sections 7.6.1 (for half credit, by cost) and 7.6.2 (for full credit, by cost), using either the concentration modeling approach or the emissions factor approach; and model the test results using the open plan, private office, or seating scenario in ANSI/BIFMA M7.1, as appropriate.
 - 1. At least 75% of furniture (by cost).
- J. Furniture: The following percent of furniture, measured by cost, shall be tested in accordance with ANSI/BIFMA Standard Method M7.1-2011; comply with ANSI/BIFMA e3-2014e Furniture Sustainability Standard, Sections 7.6.2 and 7.6.3, using either the concentration modeling approach or the emissions factor approach; and model the test results using the open plan, private office, or seating scenario in ANSI/BIFMA M7.1, as appropriate
 - 1. At least 50% of furniture (by cost).
 - 2. At least 75% of furniture (by cost).
 - 3. At least 90% of furniture (by cost).

2.4 INDOOR WATER USE REDUCTION

- A. Indoor Water Use Reduction, Fixtures and Appliances: Provide "Water Sense" or performance equivalent fixtures with required performance water flow.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

- A. Smoking of any kind is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, outdoor-air intakes, decks, patios, balconies, rooftops and other regularly occupied exterior building spaces. Applicable during construction and during building occupancy.

3.2 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Division 1 Section "Construction Waste Management and Disposal."

3.3 CONSTRUCTION IAQ MANAGEMENT

- A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

END OF SECTION

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LEED v4/v4.1 BD+C for New Construction

Project Scorecard seeking LEED Gold

Job Number: 26234.000

Project Name: Wayne State University Health Sciences Building

Date: September 29, 2025

City, State & Zip code: Detroit, MI 48201

LEED AP: Sammy Shams

*Indicates Credit Documentation Awarded

*Indicates Documentation Complete for LEED Design Review

*Indicates Documentation **needed** for LEED Design Review

*Points needed to achieve LEED Gold

RP *Indicates Regional Priority Credit

1					Credit 1 D Integrative Process	1
Yes	75%	50%	25%	No	LOCATION & TRANSPORTATION	
					Credit 1 D LEED for Neighborhood Development	8-16
1					Credit 2 D Sensitive Land Protection	1
RP 1				1	Credit 3 D High Priority Site	1-2
RP 4				2	Credit 4 D Surrounding Density and Diverse Uses	1-5
				5	Credit 5 D Access to Quality Transit - v4.1	1-5
1					Credit 6 D Bicycle Facilities - v4.1	1
1					Credit 7 D Reduced Parking Footprint - v4.1	1
				1	Credit 8 D Electric Vehicles - v4.1	1
8				25	LT TOTAL	(16 Points)

Yes	75%	50%	25%	No	SUSTAINABLE SITES	
Y					Prereq 1 C Construction Activity Pollution Prevention	Required
1					Credit 1 D Site Assessment	1
				2	Credit 2 D Site Development - Protect or Restore Habitat	1-2
1					Credit 3 D Open Space - v4.1	1
RP				3	Credit 4 D Rainwater Management - v4.1	2-3
2					Credit 5 D Heat Island Reduction	1-2
1					Credit 6 D Light Pollution Reduction	1
5				5	SS TOTAL	(10 Points)

Yes	75%	50%	25%	No	WATER EFFICIENCY	
Y					Prereq 1 D Outdoor Water Use Reduction	Required
Y					Prereq 2 D Indoor Water Use Reduction	Required
Y					Prereq 3 D Building-Level Water Metering	Required
1				1	Credit 1 D Outdoor Water Use Reduction	1-2
2				4	Credit 2 D Indoor Water Use Reduction	1-6
				2	Credit 3 D Optimize Process Water Use - v4.1	1-2
1					Credit 4 D Water Metering	1
4				7	WE TOTAL	(11 Points)

Yes	75%	50%	25%	No	ENERGY & ATMOSPHERE	
Y					Prereq 1 C Fundamental Commissioning and Verification	Required
Y					Prereq 2 D Minimum Energy Performance	Required
Y					Prereq 3 D Building-Level Energy Metering	Required
Y					Prereq 4 D Fundamental Refrigerant Management	Required
6					Credit 1 C Enhanced Commissioning	2-6
1				17	Credit 2 D Optimize Energy Performance	1-18
1					Credit 3 D Advanced Energy Metering	1
	1	1			Credit 4 C Grid Harmonization - v4.1	1-2
RP 5					Credit 5 D Renewable Energy - v4.1	1-5
1					Credit 6 D Enhanced Refrigerant Management	1

14	1	1		17	EA TOTAL	(33 Points)

	Yes	75%	50%	25%	No		
	Y						
	Y						
RP	1				4	Credit 1 C	Building Life-Cycle Impact Reduction - v4.1 2-5
EP	2					Credit 2 C	Building Product Disclosure and Optimization - Environmental Product Declarations - v4.1 1-2
	1		1			Credit 3 C	Building Product Disclosure and Optimization - Sourcing of Raw Materials - v4.1 1-2
EP	2					Credit 4 C	Building Product Disclosure and Optimization - Material Ingredients - v4.1 1-2
	1	1				Credit 5 C	Construction & Demolition Waste Management - v4.1 1-2
	7	1	1		4	MR TOTAL	(13 Points)

	Yes	75%	50%	25%	No		
	Y						
	Y						
RP	2					Credit 1 D	Enhanced IAQ Strategies - v4.1 1-2
	3					Credit 2 C	Low-Emitting Materials - v4.1 1-3
	1					Credit 3 C	Construction IAQ Management Plan 1
	2					Credit 4 C	IAQ Assessment - v4.1 1-2
					1	Credit 5 D	Thermal Comfort 1
	1		1			Credit 6 D	Interior Lighting 1-2
			2		1	Credit 7 D	Daylight - v4.1 1-3
	1					Credit 8 D	Quality Views 1
			1			Credit 9 D	Acoustic Performance - v4.1 1
	10		4		2	EQ TOTAL	(16 Points)

	Yes	75%	50%	25%	No		
	1					Credit	Innovation 1-5
	1					Innovation	Bird Collision Deterrence
	1					Exemplary	Environmental Product Declarations
	1					Exemplary	Material Ingredients
	1					Pilot	Carbon Sequestration Through Plantings, Certified Multi Attribute Materials, Green Training
	1					Pilot	Informing Design Using Triple Bottom Line Analysis
	1					Credit	LEED® Accredited Professional 1
	6					ID TOTAL	(6 Points)

	Yes	75%	50%	25%	No		
					1	Threshold	Regional Priority 1-4
	1					2 points	High Priority Site
	1					2 points	Surrounding Density and Diverse Uses
					1	1 point	Renewable Energy
					1	3 points	Building Life-Cycle Impact Reduction
					1	2 points	Rainwater Management
	1					1 point	Enhanced Indoor Air Quality Strategies
	3				3	RP TOTAL	(4 Points Maximum)

	Yes	75%	50%	25%	No		
	58	2	6		63	PROJECT TOTALS	(110 Points)

Certified: 40-49 Points, Silver: 50-59 Points, Gold: 60-79 Points, Platinum: 80 Points and above
Certification application phase: (D) = design submittal (C) = construction submittal

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Silver

		LEED NC v4/v4.1 Credit Matrix	Points Possible	100%	75%	50%	25%		Campus / Group	Responsible Party	DEADLINE	Progress	Status / Action Items	Cost Impact
Project: Wayne State University - School of Medicine Project Address: Detroit, MI Date: September 29, 2025														
Credit 1 D	Integrative Process	Beginning in pre-design and continuing throughout the design phases, identify and use opportunities to achieve synergies across disciplines and building systems described below. Use the analyses to inform the owner's project requirements (OPR), basis of design (BOD), design documents, and construction documents. ENERGY: Energy Related Systems Perform "simple box" energy modeling analysis before the completion of schematic design that explores reduced energy loads in the building and accomplishes related sustainability goals by questioning default assumptions. Assess 2 of the following in terms of project and human performance: basic envelope attributes, programmatic and operational parameters, lighting levels, thermal comfort ranges, plug and process load needs. and WATER: Water Related Systems Perform a preliminary water budget analysis before the completion of schematic design. Explores how to reduce potable water loads and accomplish related sustainability goals. Assess/estimate the project's potential nonpotable water supply sources and water demand volumes, include the following: fixture and fitting water demand, process water demand, supply sources.	1	1						OE, SD, HKS	100% CD	Early phase energy model and water budget analysis	Credit to be documented.	
Location & Transportation32														
Credit 1 D	LEED for Neighborhood Development	Locate the project in within the boundary of a development certified under LEED for Neighborhood Development (Stage 2 or Stage 3 under the Pilot or 2009	8-16	-				16				Not Applicable for Project		
Credit 2 D	Sensitive Land Protection	Option 1: Locate the development footprint on land that has been previously developed. Option 2: Locate the development footprint on land that has been previously developed or that does not meet the following criteria for sensitive land: Prime farmland, Floodplains, Habitat, Water bodies, Wetlands. (See v4 reference guide for more specific details.) Minor improvements within the wetland and water body buffers may be undertaken to enhance appreciation of them, provided such facilities are open to all building users. (See v4 reference guide for more specific details.)	1	1						HKS	100% CD	Site located on previously developed site.	Credit to be documented.	
Credit 3 D	High Priority Site *EP eligible	Option 1: Historic District (1 pt.) Locate the project on an infill location in a historic district. or Option 2: Priority Designation (1pt.) Locate the project on one of the following: • a site listed by the EPA National Priorities List; • a Federal Empowerment Zone site; • a Federal Enterprise Community site; • a Federal Renewal Community site; • a Department of the Treasury Community Development Financial Institutions Fund Qualified Low-Income Community (subset of the New Markets Tax Credit Program); • a site in a U.S. Department of Housing and Urban Development's Qualified Census Tract (QCT) or Difficult Development Area (DDA); or • a local equivalent program at the national level for projects outside the U.S. or	1-2	1				1		HKS	100% CD	Site located in Federal DDA area. 06/09/2025 - TEC to determine applicability of Brownfield remediation requirements. 06/17/2025 - Brownfield Criteria confirmed by TEC. 07/10/2025 - Brownfield remediation has not been performed, the project has pursued due-care requirements in lue of full remediation. Credit may be hard to achieve.	Credit to be documented.	

		Option 3: Brownfield Remediation (2pts.) Locate on a brownfield where soil or groundwater contamination has been identified, and where the local, state, or national authority (whichever has jurisdiction) requires its remediation. Perform remediation to the satisfaction of that authority.									Upload Brownfield remediation confirmation i.e. documentation from the local, state, or national government agency that includes the following elements: Declaration of the soil and/or groundwater contaminants existing on site Date of remediation and responsible parties Confirmation that the project team has remediated all contaminants on site to the			
Credit 4 D	Surrounding Density and Diverse Uses v4.1	Option 1: Surrounding Density. (2–3 pts.) Locate on a site whose surrounding existing density within a ¼-mile radius of the project boundary meets the values in Table 1. Use either the “separate residential and nonresidential densities” or the “combined density” values. and/or Option 2: Diverse Uses. (1–2 pts.) Construct or renovate a building or a space within a building such that the building’s main entrance is within a ½-mile walking distance of the main entrance of four to seven (1 pt.) or eight or more (2 pts.) existing and publicly available diverse uses (listed in Appendix 1). (Restrictions apply, see pg. 78, v4 Ref. Guide)	1-5	4				2		HKS	100% CD	Diverse uses to be documented, density may be difficult to achieve. 06/09/2025 - Walkscore is 85 - 4 points		
Credit 5 D	Access to Quality Transit *EP eligible	•Locate any functional entry within a ¼-mile walking distance of existing or planned bus, streetcar, or rideshare stops.	1-5					5				Credit is not achievable due to project location.		
Credit 6 D	Bicycle Facilities v4.1	Bicycle Network: •Design/locate such that a functional entry and/or bicycle storage is within a 200-yard distance from a bicycle network that connects 1 of the following: -at least 10 diverse uses (see Appendix 1). -school/employment center, if total floor area is 50% or more residential. -bus rapid transist, light/heavy rail station, commuter station, ferry terminal. *must be within a 3-mile bicycling distance of the project boundary. *Planned bicycle trails/lanes count if fully funded by the date of the certificate of occupancy and scheduled for completion within 1 year of that date. Bicycle Storage and Shower Rooms: • Provide short-term bicycle storage for at least 2.5% of all peak visitors, but no fewer than 4 spaces per building. • Provide long-term bicycle storage for at least 5% (Com.) or 15% (Res.) of all regular occupants, but no fewer than 4 spaces per building (Com.) or 1 space per residential unit (Res.), in addition to the short-term spaces. • (Commercial only) Provide 1 on-site shower w/ changing facility for first 100 regular occupants and 1 additional shower for every 150 regular occupants thereafter. *short-term storage w/in 200 ft. of main entrance, long-term storage w/in 300 ft. of and functional entry. Storage for occupants of non-project facilities do not count. Bicycle storage capacity may not be double-counted: storage that is fully allocated to the occupants of non-project facilities cannot also serve project occupants. Indoor storage is acceptable as long as it meets the walking distance requirements. On-site bicycle sharing stations within the project boundary may count for 50% of the long-term and short-term bicycle storage space. Zero lot line projects may count publicly available bicycle parking towards their short-term storage requirements if it meets the maximum allowable walking distance. Provide at least one on-site shower with changing facility for the first 100 regular building occupants and one additional shower for every 150 regular building occupants thereafter. Exclude patients and K-12 students from the regular building occupant count.	1	1					HKS	100% CD	Bicycle network to be documented, bicycle racks and showers to be provided. 04/28/2025 - Potential bike lanes on Canfield to improve pedestrian & cyclist experience. Showers to be confirmed. 06/16/2025 - 400 regular occupants to be confirmed. 06/23/2025 - Project occupancy is 362 regular occupants, 116 visitors peak (Total 478 persons) 06/30/2025 - Document indicating bike rack locations and logistics sent to WSU for review. 07/14/2025 - Bicycle racks approved.	Credit to be documented		

Credit 7 D	Reduced Parking Footprint v4.1 *EP eligible	Option 1. No Parking or Reduce Parking (1 point) Do not exceed the minimum local code requirements for parking capacity. Provide parking capacity that is a 30% reduction below the base ratios for parking spaces, by building type, found in Appendix 4. Table 1. Base Ratios for Parking. Alternatively, projects may demonstrate baseline and reduced parking capacity using calculations for the most appropriate land use found in the Institute of Transportation Engineers (ITE) Parking Generation Manual, 5th Edition or a comparable and current resource applied by a qualified transportation engineer or planner. Projects with no off-street parking meet the requirements. OR Option 2. Carshare (1 point) Provide dedicated parking for carshare vehicles. Provide carshare vehicle parking space(s) for at least 1% of total parking spaces, rounded up. If the project has fewer than 100 parking spaces, provide one carshare vehicle parking space. Establish an agreement between the project and carshare company guaranteeing that new and existing carshare vehicle space(s) will be dedicated for a minimum of two years from the certificate of building occupancy. Existing carshare vehicles located in nearby on- or off-street parking areas do not contribute to credit achievement. OR Option 3. Unbundling Parking (1 point) Sell parking separately from all property sales or leases. For owner-occupied projects, do not provide free or subsidized parking for employees. Implement a daily parking fee at a cost equal to or greater than the daily roundtrip cost of municipal public transit. For All Projects The credit calculations must include all existing and new off-street parking spaces that are leased or owned by the project, including parking that is outside the project boundary but is used by the project. On-street parking in public rights-of-way is excluded from these calculations.	1	1							SD / HKS	100% CD	Code requires approximately 500 spaces. LEED Peak Occupancy to be determined and parking requirements calculated. Potential bike lanes on Canfield to improve pedestrian & cyclist experience. 06/09/2025 - Potentially 30% reduction, 565 spaces baseline, 396 for 30% reduction, shared use agreement to be developed. Additional spaces to be utilized for covered bike storage. 06/11/2025 - Agreement approved for development.	Credit to be documented	
Credit 8 D	Electric Vehicles v4.1	Requirements Provide charging infrastructure for electric vehicles for on-site parking.	1					1					Credit not pursued. EVCS not provided in project.		
LT Totals:			8					25							

Sustainable Sites	10

Prereq 1 C	Construction Activity Pollution Prevention	Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the 2012 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) or local equivalent, whichever is more stringent. Projects must apply the CGP regardless of size. The plan must describe the measures implemented.	Req'd	Y						SD / GC	CA	SWPPP Plan to be developed.	Credit to be documented	
Credit 1 D	Site Assessment	Complete and document a site survey or assessment. Include the following: •Topography, Hydrology, Climate, Vegetation, Soils, Human Use, Human Health Effects •The survey or assessment should demonstrate the relationships between the site features and topics listed above and how these features influenced the project design; give the reasons for not addressing any of these topics. (See v4 reference guide for more specific details.)	1	1						SD / OE / HKS	100% CD`	Phase II Site Assesment completed, some contamination on site.	Complete Site Assessment Worksheet	

[illegible]

Prereq 1 D	Outdoor Water Use Reduction	Reduce outdoor water use through one of the following options. Nonvegetated surfaces, such as permeable or impermeable pavement, should be excluded from the landscape area calculations. Athletic fields and playgrounds (if vegetated) and food gardens may be included or excluded at the project team's discretion. <u>Option 1:</u> No Irrigation Required. Show that the landscape does not require a permanent irrigation system beyond a maximum 2-year establishment period. or <u>Option 2:</u> Reduced Irrigation. Reduce the project's landscape water requirement by at least 30% from the calculated baseline for the site's peak watering month.	Req'd	Y						SD	100% CD	No reclaimed available, 50% reduction targeted. Native plant species to be included.		
Prereq 2 D	Indoor Water Use Reduction	Building Water Use: - For the fixtures and fittings listed in table 1, as applicable to the project scope, reduce aggregate water consumption by 20% from the baseline. Base calculations on the volumes and flow rates shown in Table 1. - All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled. Appliance and Process Water Use: Install appliances, equipment, and processes within the project scope that meet the requirements listed in the tables on pg. 268 in the v4 Ref. Guide.	Req'd	Y						OE / HKS	100% CD	Low flow fixtures are included in the building.		
Prereq 3 D	Building-Level Water Metering	Install permanent water meters that measure the total potable water use for the building and associated grounds. Meter data must be compiled into monthly and annual summaries; meter readings can be manual or automated. Commit to sharing with USGBC the resulting whole-project water usage data for a five-year period beginning on the date the project accepts LEED certification or typical occupancy, whichever comes first. This commitment must carry forward for 5 years or until the building changes ownership or lessee.	Req'd	Y						WSU	100% CD		WSU to sign agreement letter.	

Credit 1 D	Outdoor Water Use Reduction	Option 1: No Irrigation Required. Show that the landscape does not require a permanent irrigation system beyond a maximum 2-year establishment period. or Option 2: Reduced Irrigation. Reduce the project's landscape water requirement by at least 50% from the calculated baseline for the site's peak watering month. Reductions must first be achieved through plant species selection and irrigation system efficiency as calculated in the Environmental Protection Agency (EPA) WaterSense Water Budget Tool. 50% (1 pt.) 100% (2 pts.) *Additional reductions beyond 30% may be achieved using any combination of efficiency, alternative water sources, and smart scheduling technologies.	1-2	1				1		TBD	100% Cons.	No reclaimed available, 50% reduction targeted. Native plant species to be included. 04/28/2025 - Greywater treatment and reuse may not be feasible, likely costly add to the project. 06/16/2025 - Irrigation design scope TBD. Meeting with Christman week of 7/7. 08/25/2025 - Irrigation pursued by WSU. Credit on track for 1 point.	09/15/2025 - Irrigation to be design build and completed towards the end of construction. Credit to be delayed to construction review.	
Credit 2 D	Indoor Water Use Reduction *EP eligible	Further reduce fixture and fitting water use from the calculated baseline in WE p Indoor Water Use Reduction. Additional potable water savings can be earned above the prerequisite level using alternative water sources. Include fixtures and fittings necessary to meet the needs of the occupants. Some of these fittings and fixtures may be outside the project boundary. 25% (1 pt.) 30% (2 pts.) 35% (3 pts.) 40% (4 pts.) 45% (5 pts.) 50% (6 pts.)	1-6	2				4		OE / HKS	100% CD	Incorporate WSU standards, mix of gang toilets and single occupancy, 2 points likely achievable.	Credit to be documented	
Credit 3 D	Optimize Process Water Use - v4.1	Option 3. Process Water Use (1-2 points except CS, 1-3 points CS) Demonstrate that the project is using minimum 20% recycled alternative water to meet process water demand for 1 point, or using minimum 30% recycled	1-2					2				Credit not achievable, No cooling towers in project.		
Credit 4 D	Water Metering	Install permanent water meters for two or more water subsystems listed: •Irrigation •Indoor plumbing fixtures •Domestic hot water •Boiler with aggregate projected annual water use of 100,000 gallons or more, or boiler of more than 500,000 BtuH. •Reclaimed water •Other process water *See pg. 311, v4 Ref. Guide for system and metering specifications.	1	1						SD / OE	100% CD	Irrigation meter to be included	Credit to be documented	
WE Totals:				4				7						

Energy & Atmosphere

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Prereq 1 C	Fundamental Commissioning and Verification	CxA MUST be engaged by the DD phase. A design review must be complete prior to mid CDs Complete the following Cx activities for MEP and renewable energy systems, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007. •Develop OPR and BOD •CxA must do the following: -Review the OPR, BOD, and project design. -Develop/implement a Cx plan. -Confirm incorporation of Cx requirements into construction documents. -Develop construction checklists. -Develop a system test procedure. -Verify system test execution. -Maintain an issues and benefits log throughout the Cx process. -Prepare final Cx process report. -Report findings/recommendations to owner throughout process.		Y						WSU / FSK	50% DD	RFP in development for CxA. OPR has been developed? Potential task for CxA. Potentially from an older project? 04/28/2025 - Cx interviews in progress. 05/12/2025 - Cx Has been onboarded 06/16/2025 - Cx Comments received, responses forthcoming.		

		•Design Review -CxA must have commissioning experience on 2 building projects with similar scope, from early design phase through 10 months of occupancy. -The CxA may be an employee of the owner, an independent consultant, an employee of the design or construction firm who is not part of project's team, or a disinterested subcontractor of the design team. •Operations and Maintenance Plan Review -sequence of operations for building -the building occupancy schedule; -equipment run-time schedules; -setpoints for all HVAC equipment; -set lighting levels throughout the building; -minimum outside air requirements; -changes in schedules or setpoints -systems narrative for mechanical and electrical systems and equipment; -preventive maintenance plan for equipment (in systems narrative); -commissioning program includes periodic commissioning requirements, ongoing commissioning tasks, and continuous tasks for critical facilities.	Req'd												
Prereq 2 D	Minimum Energy Performance	All designs must comply with the mandatory provisions of ANSI/ASHRAE/IESNA Standard 90.1-2010. <u>Option 1:</u> Designs must demonstrate a 5% improvement in overall building performance during a whole building energy simulation and meet the following criteria: •inclusion of all energy consumption and costs, •comparison against a baseline building, or <u>Option 2:</u> HVAC and service water heating requirements must comply with the ASHRAE 50% Advanced Energy Design Guide. or <u>Option 3:</u> (for projects less than 100,000sf) Compliance with sections 1, 2, 3.5, 3.9 and 3.10 of <i>Advanced Buildings Core Performance Guide</i> .	Req'd	Y						OE	100% CD	VE measures have removed more efficient building systems inhibiting LEED gold by may achieve base LEED certifications. 04/28/2025 - Energy Model update in progress.			
Prereq 3 D	Building Level Energy Metering	Install new or existing building-level energy meters, or submeters that can be aggregated to provide building-level data representing total building energy consumption: electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc. (Utility-owned meters are acceptable). Commit to sharing monthly energy consumption data with USGBC for a five year period starting when the project accepts LEED Certification or until the building changes ownership or lessee.	Req'd	Y						WSU	100% CD		WSU to sign agreement letter		
Prereq 4 D	Fundamental Refrigerant Management	Do not use (CFC)-based refrigerants in new heating, ventilating, air-conditioning, and refrigeration systems. When reusing existing HVAC&R equipment, complete a comprehensive CFC phase-out conversion before project completion.	Req'd	Y						OE	100% CD	Project to meet requirements.			
Credit 1 C	Enhanced Commissioning	•CxA must have commissioning experience on 2 building projects with similar scope, from early design through 10 months of occupancy. •The CxA may be an employee of the owner, an independent consultant, or a disinterested subcontractor of the design team (note difference from EA Prereq. 1) <u>Option 1:</u> Enhanced systems commissioning (3-4 pts.) •Path 1: Enhanced commissioning (3 pts.) Complete CxP activities for MEP and renewable energy systems in accordance with ASHRAE Guideline 0–2005 and ASHRAE Guideline 1.1–2007. (for detailed requirements see pg. 388, v4 Ref. Guide) or •Path 2: Enhanced and monitoring-based commissioning (4 pts.) -Achieve Path 1. -Develop monitoring procedures and identify measuring points to assess the performance of energy/water-consuming systems (see pg. 388, v4 Ref. Guide). -Update systems manual w/ modifications (describe reason for modification). and/or <u>Option 2:</u> Envelope Commissioning (2 pts.) •meet requirements in EA Prerequisite Fundamental Commissioning and Verification as they apply to the building's thermal envelope. •Complete CxP activities for the building's thermal envelope in accordance	2-6	6						FSK	CA	Enhanced commissioning to be incorporated to project requirements. 06/16/2025 - Cx Comments received, responses forthcoming. 06/30/2025 - Cx Process moving smoothly, check on OPR, Cx to coordinate OPR with WSU.			

		with ASHRAE Guideline 0–2005 and NIBS Guideline 3–2012. •See pg. 389, v4 Ref Guide for additional requirements.												
Credit 2 D	Optimize Energy Performance *EP eligible	Establish an energy performance target no later than schematic design phase. The target must be established as kBtu per square foot-year of source energy use. <u>Option 1:</u> Whole-building energy simulation (1-18 pts.). •Analyze efficiency measures during the design process and account for the results in design decision making. •analyze efficiency measures, focusing on load reduction and HVAC related strategies. Project potential energy savings and cost implications. •If pursuing the Integrative Process Credit, complete the basic energy analysis before conducting the energy simulation. •Demonstrate a percentage improvement from baseline. or <u>Option 2:</u> Prescriptive Compliance (1-6 pts.) •must use Option 2, EA prereq 2, Minimum Energy Performance •Comply with recommendations and standards in Chapter 4, Design Strategies and Recommendations by Climate Zone, for the appropriate <i>ASHRAE 50% Advanced Energy Design Guide</i> and climate zone. *For designs outside US consult ANSI/ASHRAE/IESNA Standard 90.1-2010.	1-18	1				17		OE	100% CD	Energy model performance to be determined. Current project design limits achievable points to one.	Credit to be documented	
Credit 3 D	Advanced Energy Metering	Install advanced energy metering for all whole-building energy sources used by the building and any individual energy end uses that represent 10% or more of the total annual consumption of the building. Meters must have the following: •Meters must be permanently installed, record at intervals of one hour or less, and transmit data to a remote location. •Electricity meters must record both consumption and demand. Whole-building electricity meters should record the power factor, if appropriate. •The data collection system must use a local area network, building automation system, wireless network, or comparable communication infrastructure. •The system must be able to store meter data for at least 36 months. •The data must be remotely accessible. •All meters in the system must be capable of reporting hourly, daily, monthly, and annual energy use.	1	1						OE	100% CD	Panels and meters to be confirmed if in project.	Credit to be documented	
Credit 4 C	Grid Harmonization - v4.1	To increase participation in demand response technologies and programs that make energy generation and distribution systems more affordable and more efficient, increase grid reliability, and reduce greenhouse gas emissions. Requirements Design building and equipment for participation in demand response programs through load shedding or shifting. On-site electricity generation does not meet the intent of this credit. Case 1. Demand Response Program Available and Participation (2 points) Participate in an existing demand response (DR) program and complete the following activities. Design a system with the capability for real-time, fully-automated DR based on external initiation by a DR Program Provider. Semi-automated DR may be utilized in practice. Enroll in a minimum one-year DR participation amount contractual commitment with a qualified DR program provider, with the intention of multiyear renewal, for at least 10% of the annual on-peak electricity demand. On-peak demand is determined under EA Prerequisite Minimum Energy Performance. The on-peak demand may vary based on the utility climate and pricing structures. Develop a comprehensive plan for meeting the contractual commitment during a Demand Response event. Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan. Include the DR program and any installed technologies in the building systems manual or include in the current facilities requirements and operations and	1-2		1	1						Not likely achievable. 04/30/2025 - https://www.dteenergy.com/us/en/residential/save-money-energy/get-started-with/demand-response.html 06/23/2025 - To be confirmed from team. 06/30/2025 - Generators are not an approved strategy for demand response program. The building will need to reduce cooling service to meet credit requirements. 07/28/2025 - Potentially enroll in program. Transfer switches included for the chillers. DR program for the building to be developed for 1	Credit to be documented 08/25/2025 - Osborne to review load reduction opportunities, potentially develop plan for building operations. 09/03/2025 - Demand Response controls potentially on a VE list. Case 1 may not be possible. Case 2 could be a more feasible option. Osborn is still working on load shedding capabilities. Side bar meeting needed for further discussion with DTE.	

		manual or include in the current facilities requirements and operations and maintenance plan if the project is not pursuing EA credit Enhanced Commissioning. Initiate at least one full test of the DR plan. OR Case 2. Demand Response Capable Building (1 point) Have infrastructure in place to take advantage of future demand response programs or dynamic, real-time pricing programs and complete the following activities: Install interval recording meters and have equipment capable of accepting an external signal. Develop a comprehensive plan for shedding at least 10% of the annual on-peak electricity demand. On-peak demand is determined under EA Prerequisite Minimum Energy Performance. Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan. Include the DR program and any installed technologies in the building systems manual or include in the current facilities requirements and operations and maintenance plan if the project is not pursuing EA credit Enhanced Commissioning. Contact local utility representatives to discuss participation in future DR programs. AND / OR Case 3. Load Flexibility and Management Strategies (1-2 points) Analyze the building's annual load shape and peak load based as calculated for EA prerequisite Minimum Energy Performance. Review the regional grid load profile using the metric of peak load or peak carbon emissions. The U.S. Environmental Protection Agency's (EPA) AVOIDed Emissions and geneRation Tool (AVERT) provides regional grid emissions data; local utilities may also										point.		
Credit 5 D	Renewable Energy v4.1 *EP eligible	Renewable Energy Choose one or more strategies for renewable energy procurement from the categories below. Points achieved in each category may be added for a total of 5 points. - Tier 1: On-site renewable energy generation - Tier 2: Off-site renewable energy produced by a generation asset(s) built within the last 5 years, or contracted to be operational within one year of building occupancy, and generated by either: - an asset(s) in the project's grid subregion - or - an asset(s) in a grid subregion with higher greenhouse gas emissions rates** . - Tier 3: Off-site renewable energy that is produced by a generation asset(s) built within the last 5 years or contracted to be operational within one year of building occupancy - Tier 4: Off-site renewable energy that is Green-e Energy certified or equivalent - Tier 5: Off-site renewable energy that is produced by a generation asset(s) that meet Green-e's certification criteria (or equivalent) for eligible renewables, has a mechanism to prevent double counting in place, and is third-party certified to an ecolabel standard. For all tiers, renewable energy must be contracted, owned or leased for a period of time between 1 and 15 years. Contract lengths less than 15 years are pro-rated linearly based on 1 and 15 year values in Table 1. Shorter contract lengths may require procurement of renewable energy in quantities that exceed the annual energy use of the building. For all tiers, the attributes (age, grid subregion, etc.) of the generation asset(s) are assessed at the beginning of the contract, and the generation asset(s) retain these attributes for the duration of the initial contract or lease term. All eligible renewable electricity generation used to comply with this credit shall be substantiated through Energy Attribute Certificates (EACs); the project owner must contract for renewable energy and demonstrate that the EACs are retained on behalf of the LEED project. EACs must be purchased from renewable energy projects located in the same country or region where the LEED project is located. Tier 1, Tier 2, and Tier 3 renewable energy may contribute to GHG reductions in EA credit Optimize Energy Performance. When claiming credit in EA credit Optimize Energy Performance, projects are required to calculate GHG emissions and avoided emissions using hourly electricity GHG emissions factors for the project's grid subregion. Points are awarded according to Table 1, based on the percentage of total site energy use.	1-3	5						OE / HKS	100% CD	04/28/2025 - DTE MiGreenPower program potentially to be incorporated into the project. https://solutions.dteenergy.com/dte/en/migreenpower/large-customer 04/30/2025 - WSU to inquire for details, not available online. 05/28/2025 - Meeting with DTE to discuss MiGreenPower program confirms Green-E certification and less than 5 year old asset. Reach out to LEED coach to confirm contract pro-rating. 06/11/2025 - RECs approved to be included in project through DTE MiGreenPower program. 5 points pursued.	Credit to be documented	\$\$\$

		Carbon Offsets Procure carbon offsets to offset annual building greenhouse gas emissions from energy use. Carbon offsets must be contracted for at least 15 years. Points are awarded according to Table 2, based on the percentage of total annual energy emissions offset by the purchase of carbon offsets.												
Credit 6 D	Enhanced Refrigerant Management	Option 1: Do not use refrigerants, or use only refrigerants (naturally occurring or synthetic) w/ an ODP of zero and a GWP of less than 50. (1 pt.) or Option 2: Calculation of Refrigerant Impact. Select refrigerants used in HVAC&R equipment to minimize or eliminate ODP and GWP. The combination of all new and existing base building and tenant HVAC&R equipment that serve the project must comply with formulas listed on pg. 422 of the v4 reference guide.	1	1						OE	100% CD	Project to meet requirements. R-454B to be used	Credit to be documented	
EA Totals:				14	1	1		17						

Materials & Resources

13

Prereq 1 D	Storage & Collection of Recyclables	Provide areas for the collection and storage of recyclable materials for the entire building: •Recyclables must include: mixed paper, corrugated cardboard, glass, plastics, and metals. •Must provide safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste (new for v4).	Req'd	Y						HKS / WSU	100% CD	Design to accommodate waste and recycling procedures in the building. 06/30/2025 - Bins to be located, WSU specs to be used	Credit to be documented	
Prereq 2 C	Construction & Demolition Waste Management Planning	•Identify at least 5 materials (structural and nonstructural) targeted for diversion. Approximate percentage of the overall project waste that these materials represent. •Specify whether materials will be separated or commingled. Describe where they will be taken and how the recycling facility will process the material. *Provide a final report detailing major waste streams, including disposal and diversion rates.	Req'd	Y						GC	CA	CDWP to be developed for the project.	08/25/2025 - Plan to be developed	
Credit 1 C	Building Life-Cycle Impact Reduction v4.1 *EP eligible	Demonstrate reduced environmental effects during initial project decision-making by reusing existing building resources or demonstrating a reduction in materials use through life-cycle assessment. Option 4: Whole-Building Life-Cycle Assessment (1-4 pts.) For new construction (buildings or portions of buildings), conduct a life-cycle assessment of the project's structure and enclosure and select one or more of the following paths below to earn up to 4 points: Path 1: Conduct a life cvcle assessment of the project's structure and	2-5	1				4		RE	100% CD	Determine if team will perform WBLCA for the design. 04/28/2025 - WBLCA in progress.	Credit to be documented	

		enclosure (1 point). Path 2: Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of 5% reduction, compared with a baseline building in at least three of the six impact categories listed below, one of which must be global warming potential (2 points). Path 3: Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of 10% reduction, compared with a baseline building, in at least three of the six impact categories listed below, one of which must be global warming potential (3 points). Path 4: Meet requirements of Path 3 and incorporate building reuse and/or salvage materials into the project's structure and enclosure for the proposed design. Demonstrate reductions compared with a baseline building of at least 20% reduction for global warming potential and demonstrate at least 10% reduction in two additional impact categories listed below (4 points). For Paths 2, 3 and 4 listed above, no impact category assessed as part of the life-cycle assessment may increase by more than 5% compared with the baseline building. Include a narrative of how the life cycle assessment was conducted and if applicable for paths 2, 3 and 4 what changes were made to proposed buildings in order to achieve the related impact reductions. The baseline and proposed buildings must be of comparable size, function, orientation, and operating energy performance as defined in EA Prerequisite Minimum Energy Performance. The service life of the baseline and proposed buildings must be the same and at least 60 years to fully account for maintenance and replacement. Use the same life-cycle assessment software tools and data sets to evaluate both the baseline building and the proposed building, and report all listed impact categories. Data sets must be compliant with ISO 14044.												
Credit 2 C	Building Product Disclosure and Optimization v4.1 -- Environmental Product Declarations (EPDs) *EP eligible	Option 1: EPD (1 pt.) Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the disclosure criteria listed on pg. 514 of the v4 Reference Guide. and/or Option 2: Multi-attribute optimization (1 pt.) 10%, by cost, of the total value of installed products must comply with credit requirements listed on pg. 516 of v4 Reference Guide. *products sourced within 100 miles of project site are valued at 200% of their base contributing costs.	1-2	2						HKS / GC	CA	Assess project products and materials for compliance.	Credit to be documented	
Credit 3 C	Building Product Disclosure and Optimization v4.1 -- Sourcing of Raw Materials *EP eligible	Use products sourced from at least three different manufacturers that meet at least one of the responsible sourcing and extraction criteria below for at least 20%, by cost, of the total value of permanently installed building products in the project (1 point). Use products sourced from at least five different manufacturers that meet at least one of the responsible sourcing and extraction criteria below for at least 40%, by cost, of the total value of permanently installed building products in the project (2 points). - Extended producer responsibility. - Bio-based materials - Wood products. - Materials reuse. - Recycled content - USGBC approved program.	1-2	1		1				HKS / GC	CA	Assess project products and materials for compliance. 100 mile materials: Steel, Concrete, etc.	Credit to be documented	
Credit 4 C	Building Product Disclosure and Optimization v4.1 -- Material Ingredients *new credit *EP eligible	Option 1: Material Ingredient Reporting (1 pt.) Use 20 different products from 5 different manufacturers that demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm). Must use one of the following rating programs: Manufacturer Inventory, HPD, Cradle to Cradle, USGBC approved program. and/or Option 2: Material Ingredient Optimization (1 pt.) Use permanently installed products from at least three different manufacturers that document their material ingredient optimization using the paths below.	1-2	2						HKS / GC	CA	Assess project products and materials for compliance.	Credit to be documented	

		Choose either 10 compliant products, or select products that constitute at least 10%, by cost, of the total value of permanently installed products in the project. - Material Ingredient Screening and Optimization Action Plan (value at 50% by cost or ½ product) - Advanced Inventory & Assessment (value at 100% by cost or 1 product): - Material Ingredient Optimization (value at 150% by cost or 1.5 products) - International Alternative Compliance Path – REACH Optimization (value at 100% of cost or 1 product) - USGBC approved program.													
Credit 5 C	Construction & Demolition Waste Management * EP eligible	Recycle and/or salvage nonhazardous construction and demolition materials. *Calculations can be by weight or volume but must be consistent throughout. (exclude ADC from calculations but include woodwaste converted to biofuel). *If unable to meet requirements using reuse and recycling methods, waste-to-energy may count as diversion method if facility meets EU requirements for waste management and emissions into air, soil, surface water, and groundwater. <u>Option 1:</u> Diversion (1-2 pts.) •Path 1: (1 pt.) Divert at least 50% of the total construction and demolition material; diverted materials must include at least three material streams. or •Path 2: (2 pt.) Divert at least 75% of the total construction and demolition material; diverted materials must include at least four material streams. or <u>Option 2:</u> Reduction of Total Waste Material (2 pts.) Do not generate more than 2.5 pounds of construction waste per square foot of the building's floor area.	1-2	1	1					GC	CA	Track waste and landfill diversion during construction. 75% diversion with 4 Streams. Christman confirms on site sorting pursued. 1 point is achievable, an additional point for 75% diversion is possible but not confirmed.	Credit to be documented		
MR Totals:				7	1	1		4							

Indoor Environmental Quality	16

Prereq 1 D	Minimum IAQ Performance	Case 1: Mechanically Ventilated Spaces <u>Option 1:</u> ASHRAE Standard 62.1–2010 Determine minimum outdoor air intake for mechanical ventilation systems using ASHRAE 62.1-2010, sections 4-7, or local equivalent, whichever is more stringent. <u>Option 2:</u> CEN Standards EN 15251–2007 and EN 13779–2007 Projects outside the US may use requirements of CEN Standards EN 15251-2007 and CEN Standard EN 13779-2007 (excluding sections 7.3,7.6,A.16, and A.17) *Monitoring (required for options 1 and 2): • for variable air volume systems, provide a direct outdoor airflow measurement device with and accuracy of +/-10%, alarm must indicate 15% variation between outdoor airflow value and outdoor airflow setpoint. •For constant volume systems install a current transducer on the supply fan, an airflow switch, or similar monitoring device. Case 2: Naturally Ventilated Spaces •Determine minimum outdoor air opening and space configurations for natural ventilation systems using ASHRAE 62.1-2010, or local equivalent, whichever is more stringent. •Confirm that natural ventilation is an effective strategy by following the flow diagram in the CIBSE Applications Manual AM10, March 2005, Figure 2.8, •Meet the requirements of ASHRAE Standard 62.1–2010, Section 4, or a local equivalent, whichever is more stringent. *Monitoring: Must comply with one of the following. •Provide exhaust airflow measurement device with accuracy of +/-10%, alarm must indicate 15% variation between outdoor airflow and exhaust airflow setpoint.	Req'd	Y						OE	100% CD	Design to meet credit requirements	Credit to be documented	

		•Automatic indication devices on ventilation openings. An alarm must indicate when one of the openings is closed. •Monitor CO2 in each thermal zone (See pg. 607, v4 Ref. Guide for specifications).												
Prereq 2 D	Environmental Tobacco Smoke (ETS) Control	•No smoking inside the building. •Smoking areas 25 ft from entries, air intakes, and operable windows. No smoking outside the property line in spaces used for business (document if code prohibits 25ft. smoking restriction). •Signage within 10 feet of all building entrances. Residential Only: Option 1: No smoking Option 2: Compartmentalization of Smoking Areas •No smoking in common areas. •Meet outdoor smoking area requirements from above. •Units must be compartmentalized (See pg. 624, v4 Ref. Guide for specifications).	Req'd	Y						WSU	100% CD	No smoking policy and signage to be provided. https://policies.wayne.edu/hr/00-03-smoke-free-campus	06/30/2025 - Need no-smoking signage from WSU	
Credit 1 D	Enhanced Indoor Air Quality Strategies v4.1 *EP eligible	Option 1: Enhanced IAQ Strategies (1 pt.) •Mechanically Ventilated Spaces: use strategies 1, 2 and 3 •Naturally Ventilated Spaces: use strategies 1 and 4 •Mixed Mode Systems: use all strategies below Strategies: 1. Entry Systems: Install permanent systems (grates, grilles, mats, etc.) at least 10 ft long at exterior entrances. 2. Interior Cross-Contamination Prevention: exhaust spaces where hazardous gases or chemicals are present using EQ Prereq., Minimum IAQ Performance, or a minimum of 0.50 cfm per square foot. Provide self-closing doors and deck-to-deck partitions or a hard-lid ceiling. 3. Filtration: Outdoor air ventilation systems for occupied spaces must have particle filters or air-cleaning devices must have a MERV of 13 or higher (ASHRAE Standard 52.2-2007) or Class F7 filters (CEN Standard EN 779-2002). 4. Natural Ventilation Design Calculations: System design for occupied spaces complies with CIBSE Applications Manual AM10, March 2005, Section 2.4. 5. Mixed Mode Design Calculations: System design for occupied spaces complies with CIBSE Applications Manual 13–2000. Option 2: Additional Enhanced IAQ Strategies (1 pt.) •Mechanically Ventilated Spaces: select 1 strategy, either 1,2,3 or 4. •Naturally Ventilated Spaces: Select 1 strategy, either 1,4 or 5. •Mixed-mode system: Select 1 strategy, either 1,2,4 or 5. Strategies: 1.Exterior Contamination Prevention: Verify that outdoor air contaminants are below thresholds listed in Table 1 pg. 647 v4 Reference Guide. 2.Increased Ventilation: Increase rates by at least 30% above the minimum rates as determined in EQ Prereq. Minimum IOQ Performance. 3.Carbon dioxide monitoring: Monitor CO2 concentrations (specifications on pg. 647 v4 Reference Guide). Calculate CO2setpoints using ASHRAE 62.1–2010, Appx. C. 4.Additional Source Control and Monitoring: Install monitoring systems for contaminants besides CO2 with sensors designed to detect the specific contaminant, alarm must indicate any unusual or unsafe conditions. 5.Natural Ventilation, Room-By-Room Calculations: Follow CIBSE AM10, Section 4, Design Calculations, to predict that room-by-room airflows will provide effective natural ventilation.	1-2	2						OE / HKS	100% CD	Project design to accommodate credit requirements. CO2 monitoring to be pursued for part 2.	Credit to be documented	
Credit 2 C	Low-Emitting Materials v4.1 *EP eligible	Use materials on the building interior (everything within the waterproofing membrane) that meet the low-emitting criteria below. Points are awarded according to Table 1: 2 product categories1 point 3 product categories2 point 4 product categories3 point 5 product categories3 points + EP Reach 90% threshold in at least 3 categoriesEP	1-3	3						HKS / GC	CA	Assess project products and materials for compliance.	Credit to be Documented	

		- Paints and Coatings At least 75% of all paints and coatings, by volume or surface area, meet the VOC emissions evaluation AND 100% meet the VOC content evaluation. - Adhesives and Sealants At least 75% of all adhesives and sealants, by volume or surface area, meet the VOC emissions evaluation AND 100% meet the VOC content evaluation. - Flooring At least 90% of all flooring, by cost or surface area, meets the VOC emissions evaluation OR inherently nonemitting sources criteria, OR salvaged and reused materials criteria.The flooring product category includes all types of hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, and other floor coverings. - Wall panels At least 75% of all wall panels, by cost or surface area, meet the VOC emissions evaluation, OR inherently nonemitting sources criteria, OR salvaged and reused materials criteria.The wall panels product category includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. - Ceilings At least 90% of all ceilings, by cost or surface area, meet the VOC emissions evaluation, OR inherently nonemitting sources criteria, OR salvaged and reused materials criteria.The ceilings product category includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights. - Insulation At least 75% of all insulation, by cost or surface area, meets the VOC emissions evaluation.The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation. - Furniture At least 75% of all furniture in the project scope of work, by cost, meets the furniture emissions evaluation, OR inherently nonemitting sources criteria, OR salvaged and reused materials criteria. - Composite Wood At least 75% of all composite wood, by cost or surface area, meets the Formaldehyde emissions evaluation OR salvaged and reused materials criteria.												
Credit 3 C	Construction IAQ Management Plan	•Meet/exceed recommended control measures outlined in SMACNA IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3. •Protect absorptive materials from moisture damage. •Do not operate permanently installed air-handling equipment during construction unless filtration media (for filtration specifications see pg. 677, v4 Reference Guide). •Prohibit the use of tobacco products inside the building and within 25 feet of the building entrance during construction.	1	1						GC	100% CD	CIAQ plan to be developed.	08/25/2025 - Policy to be provided	
Credit 4 C	Indoor Air Quality Control Assessment - v4.1	Option 1: Flush-Out (1 pt.) Path 1 (before occupancy): Install new filtration media and deliver total air volume of 14,000 cubic feet of outdoor air per sf of gross floor area while maintaining an internal temp. 60°F ≤ and ≤ 80°F and relative humidity no higher than 60%. or Path 2 (during occupancy): Deliver 3,500 cubic feet of outdoor air per sf of gross floor area with temp. 60°F ≤ and ≤ 80°F and relative humidity no higher than 60%. When occupied, space must be ventilated at a minimum rate of 0.30 cfm per square foot of outdoor air or the design minimum outdoor air rate determined in EQ Prerequisite Minimum IOQ Performance, whichever is greater. During flush-out period, ventilation begins three hours before occupancy and continues during occupancy. Continue until a total of 14,000 cubic feet per square foot of outdoor air has been delivered to the space. or Option 2: Air Testing (2 pts.) Between construction and occupancy, conduct baseline IAQ testing consistent with methods in Table 1 (pg. 686, v4 Ref. Guide) for all occupied spaces. Laboratories that conduct the tests for formaldehyde and VOC's must be accredited under ISO/IEC 17025. Document results. (additional requirements pg. 686, v4 Ref. Guide).	1-2	2						WSU / GC	100% CD	Building flush-out and/or air testing to be determined. Third party vendor for air testing 07/02/2025 - Flush out and air testing desired by WSU, full points pursued. 07/14/2025 - Air Handlers by Day: AHU 1- 60 days, Strategy for time of year to perform flush-out, more mild temperatures is advantageous. Substantial Completion February 2028, WSU potentially to have their own air testing.	Discussion with WSU on strategy to be scheduled, need potential testing cost vs. cost of heating outside air. 09/03/2025 - OEHS discussion needed, HKS to setup meeting with Jason H. Review air testing requirements.	
Credit 5	Thermal Comfort v4.1	Option 1: ASHRAE Standard 55-2017	1									Potential Desktop fans in open workspaces?		

D		HVAC systems/building envelope to meet the requirements of ASHRAE Standard 55–2017, or a local equivalent *natatoriums comply with ASHRAE HVAC Applications Handbook, 2011, Chapter 5. or Option 2: ISO and CEN Standards HVAC/building envelope must meet applicable thermal comfort requirements of ISO 7730:2005 or CEN Standard EN 17772-2017, Section A2. *Thermal Comfort Controls: Provide controls for 50% of individual occupant spaces. Provide group controls for shared multi-occupant spaces, and for any individual spaces without controls. Controls must allow occupants to adjust at least one of the following: air temp., radiant temp., air speed, and humidity.										WSU to determine strategy. 04/30/2025 - 364 Individually Occupied Spaces in the building per LEED Regularly Occupied Spaces matrix. 06/16/2025 - 150 fans needed to meet the requirements, fan spec to be determined. 06/30/2025 - Fans to be budget friendly option for LEED points, potential challenges with maintaining and keeping fans in the building. TBD 07/02/2025 - Fans not desired for the project work spaces. Credit not pursued.		
Credit 6 D	Interior Lighting v4.1	Option 1: Lighting Control (1 pt.) •Individual Spaces: Provide individual lighting controls that enable occupants to adjust lighting to suit individual preferences, must have 3 levels: on, off, and midlevel(30%-70% of max level). •Multi-occupant Spaces: -multizone controls with 3 lighting levels or (on, off, midlevel). -lighting for any presentation/projection wall controlled separately. -switches/manual controls located in the same space as controlled luminaires. Operator must have line of sight to controlled luminaires. and/or Option 2: Lighting Quality (1 pt.) •Choose 4: B. For the entire project, use light sources with a CRI of 80 or higher. Exceptions include lamps or fixtures specifically designed to provide colored lighting for effect, site lighting, or other special use. C. For 75% of the total connected lighting load, use light sources that have a rated life (or L70 for LED sources) of at least 24,000 hours (at 3-hour per start, if applicable). E. For 90% of the regularly occupied floor area, meet the following thresholds for area-weighted average surface reflectance: 85% for ceilings, 60% for walls, and 25% for floors. F. If furniture is included in the scope of work, select furniture finishes to meet the following thresholds for area-weighted average surface reflectance: 45% for work surfaces, and 50% for movable partitions.	1-2	1		1				HKS / OE	100% CD	Design to meet credit requirements for options B,C,E,F	Credit to be documented.	
Credit 7	Daylight v4.1	Option 1: Simulation: Spatial Daylight Autonomy (2-3 pts.) DA<0.55% or 0.55% to 75%	1-3			2		1		OE /	100%	Team to determine if credit requirements can be	09/15/2025 - Add service to be approved by	

D		•SDA300/50% of a least 55% or /5% 40% (1 pt) 55% (2 pts.) 75% (3 pts.) and • ASE1000/250 of less than 10% for occ. floor area that is daylight. *Calculation grid no more than 2ft. at workplane 30in. above FF. Use hourly time-step analysis for nearest weather station. Include permanent interior obstructions. or Option 2: Simulation: Illuminance Calculations (1–3 points) through computer modeling, demonstrate illuminance levels between 300 lux - 3000 lux for 9am and 3pm on a clear sky day at equinox. 55% (1 pts.) 75% (2 pts.) 90% (3 pts.) Calculate illuminance intensity for sun and sky for clear-sky conditions: •use meteorological year data for closest weather station. •Select a day within 15 days of September 21 and a day within 15 days of March 21 that represent the clearest sky condition. •Use average of the hourly value for the two selected days. *Include permanent interior obstructions. Exclude movable furniture, moveable partitions, blinds and shades. or Option 3: Measurement (1-3 points) Achieve illuminance levels between 300 lux - 3,000 lux for a % of floor area: 55% (1 pt) 75% (2 pts.) 90% (3 pts.) *Measure illuminance levels with furniture, fixtures, and equipment in place. •Use appropriate work plane height between 9am and 3pm. •one measurement during reg. occ. month, and a second as indicated in Table 4 (pg. 725, v4 Ref. Guide). •For spaces larger than 150 square feet, use a 10-foot square grid. •For spaces 150 square feet or smaller, use a max. 3-foot square grid.							HKS	CD	met in design. Would need to be an add service for OE. 06/25/2025 - HKS thinks 2-points are possible but it would be very close due to the interior lab spaces.	WSU.		
Credit 8 D	Quality Views - 4.1 *EP eligible	•direct line of sight via vision glazing to the outdoors for 75% of occupied floor area. •75% of reg. occ. floor area must have two of the following: -lines of sight to vision glazing in different directions 90 degrees apart; -include 2: (1) flora, fauna, sky; (2) movement; (3) objects w/in 25 ft away; -unobstructed views w/in 3 times the head height of vision glazing; -views w/ view factor of 3 or greater. *Include permanent interior obstructions in calculations (excludes moveable furniture and partitions). *Views into interior atria may meet up to 30% of the required area.	1	1						HKS	100% CD	Design to meet credit requirements	Credit to be documented	
Credit 9 D	Acoustic Performance v4.1	•HVAC Background Noise: -max noise from HVAC systems per 2015 ASHRAE Handbook, Chap. 48, Table 1; AHRI Standard 885-2008, Table 15; or a local equivalent. Calc. or Measure. Use meter that conforms to ANSI S1.4, or local equivalent. -Comply with design criteria for HVAC noise levels resulting from the sound transmission paths listed in ASHRAE 2015 Applications Handbook, Table 6; or a local equivalent. •Sound Transmission: -Meet the composite sound transmission class (STCC) ratings or noise	1			1				TBD	100% CD	TBD if project can meet credit requirements. To be held as a potential buffer point for the project. Would require additional equipment to meet LEED requirements. Soundscape has provided an add service	09/15/2025 - Add service to be approved by WSU.	\$\$

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SECTION 018116.16

CONSTRUCTION REQUIREMENTS FOR VOCs

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Volatile Organic Compound (VOC) limits for adhesives, sealants, paints and coatings.
- B. Related Sections:
 - 1. Refer to Division 01 Section for Health and Environmental Performance Requirements.

1.2 DEFINITIONS

- A. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1-2010 or current version, for the emissions testing and requirements of products and materials.
- B. Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method v1.1 definition.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for interior applied adhesives, sealants, paints and coatings indicating VOC content in grams/Liter (g/L).
 - 1. Include Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and General Emissions Requirements indicated in this Section.

PART 2 - PRODUCTS

2.1 VOLATILE ORGANIC COMPOUND (VOCs) LIMITS

- A. General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method, version indicated, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of Total VOCs (TVOC) after 14 days measured as specified in the CDPH Standard Method CATEGORIES as follows:
 - 1. 0.5mg/m³ or less,
 - 2. Between 0.5 and 5.0 mg/m³ or,
 - 3. 5.0 mg/m³ or more.

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2.2 PAINTS AND COATINGS

- A. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits

1. Air Quality Resources and Management: Use only paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

2.

Product Type	Allowable VOC Content (g/L)
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes - Sanding Sealer	275
Clear wood finishes - Lacquer	275
Colorant - Architectural Coatings, excluding IM coatings	50
Colorant - Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete - Curing compounds	100
Concrete - Curing compounds for roadways & bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings - Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings - Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings - High temperature IM coatings	420
Industrial maintenance coatings - Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings - Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100

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Reactive penetrating sealers	350
Recycled coatings	150
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac - Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings - repair	340
Swimming pool coatings - other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

2.3 ADHESIVES AND SEALANTS

- A. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Air Quality and Resources Management: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on October 6, 2017:

2.

Architectural Applications	Allowable VOC Content (g/L)
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510

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CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	250
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Sealants:	
Architectural sealant	250
Marine deck sealant	760
Nonmember roof sealant	300
Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other:	
Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250

- a. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes general administrative and procedural requirements for the commissioning process to supplement other Division 01 commissioning process activity Sections and other Sections in Divisions 21, 22, 23 and 26 that specify testing of components, systems and assemblies.

- B. Related Sections include the following:

1. Division 01 Section "Facilities Exterior Enclosure Commissioning" for commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.
2. Division 21 Section "Commissioning of Fire Suppression" for commissioning process activities for fire-suppression systems, assemblies, equipment, and components.
3. Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.
4. Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.
5. Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.

1.3 DESCRIPTION

- A. Commissioning is a systematic process of confirming that all building systems perform interactively according to the Owner's Program Requirements and the Basis of Design and continuing through construction, acceptance and the warranty period with actual verification of performance.

- B. Commissioning during design is intended to achieve the following specific objectives:

1. Verify the Owner's Program Requirements and Basis of Design are clearly documented and they meet the Owner's goals and objectives.
2. Provide Design Review during AE design efforts.
3. Verify commissioning for the construction phase is adequately reflected in the bid documents.

- C. Commissioning during the construction phase of this project is intended to achieve the following specific objectives:

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1. Provide direction for the commissioning process during construction, particularly providing resolution to issues and providing details not developed during design (ex. scheduling, participation of various parties, lines of reporting and approvals, coordination, etc.)
 2. Verify that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
 3. Verify and document proper performance of equipment and systems.
 4. Verify that O&M documentation left on site is complete.
 5. Verify that the Owner's operating personnel are adequately trained.
- D. The Commissioning process does not take away from or reduce the responsibility of the system designers to design a workable system nor the installing contractors to provide a finished and fully functioning product.
- E. The CxA directs and coordinates the commissioning activities and reports to the Owner. All members in the construction process work together to fulfill their contracted responsibilities and meet the objectives of the Owner's Project Requirement's as detailed in the Contract Documents.
- F. The CxA works with the CM/GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CM/GC and Owner for scheduling commissioning activities. Meanwhile, the CxA will integrate these activities into the master construction schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
- G. The following narrative provides a brief overview of the commissioning tasks during construction and the general order in which they occur.
1. Commissioning during construction begins with a Commissioning Kick-Off Meeting – Construction Team conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
 2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to the CxA through the submittal process, including detailed start-up procedures.
 4. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with Prefunctional checklists being completed before functional testing begins.
 5. The contractors, under their own direction, document and perform startup and initial checkout. The CxA documents that startup was completed according to the approved plans, when contracted. This may include the CxA witnessing start-up of selected equipment, if contracted.
 6. The CxA verifies installation integrity thru the use of checklists.
 7. The CxA develops specific equipment and system functional performance test procedures. The contractors review the procedures.
 8. The procedures are executed by the contractors, under the direction of, and documented by the CxA.
 9. Items of non-compliance in material, installation or setup are corrected at the contractor's expense and the system retested.
 10. The CxA reviews the O&M documentation for completeness.

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11. Commissioning is completed before Substantial Completion, whenever possible.
12. The CxA reviews and pre-approves the training plan provided by the contractors.
13. The contractors coordinate and provide training via qualified instructors.
14. Training occurs.
15. The Owner verifies that training has occurred and provides a written statement that training has occurred.
16. Deferred testing is conducted, as specified or required.

1.4 DEFINITIONS

- A. Acceptance: A formal action, to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.
- B. Acceptance Phase: Phase of commissioning after start-up and initial checkout when functional performance tests, O&M documentation review and training occurs.
- C. Architect/Engineer (AE): the prime Consultant (Architect) and Subconsultants who comprise the design team, generally the HVAC Mechanical Designer/Engineer, the Electrical Designer/Engineer and various other Subconsultants.
- D. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the contract documents.
- E. Basis of Design (BOD): A document that records concepts, calculations, decisions and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. Also known as the Design Criteria.
- F. Checklists: Verification checklists that are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements.
- G. Commissioning Authority (CxA): An entity identified by the Owner who plans, schedules and coordinates the commissioning team to implement the Commissioning Process. The Owner has engaged **Horizon Engineering Associates, LLP** as the CxA under a separate contract.
- H. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- I. Commissioning Process: A quality-focused process for enhancing the delivery of a project and includes verifying and documenting that the facility and its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner's Project Requirements.
- J. Commissioning Process Progress Report: A written document that details activities completed as part of the commissioning process and significant findings from those activities that is continuously updated during the course of a project.

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- K. Commissioning Report: A document recording the results of the commissioning process, including the record documents, performance of the commissioned systems and documents all sign-offs.
- L. Commissioning Specifications: The contract document that details the objective, scope and implementation of the construction and acceptance phases of the commissioning process as developed in the Commissioning Plan.
- M. Commissioning Team: A team comprised of the CxA, Owner, AE, Construction Manager/General Contractor, Contractors, maintenance and operations personnel, and occupants. Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action.
- N. Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.)
- O. Contractor: The CM or subcontractors authorized representatives.
- P. Construction Manager (CM): The prime contractor for this project. Generally, refers to all the CM's subcontractors as well. Also referred to as the Contractor, in some contexts.
- Q. Data Logging: The monitoring and recording of flow, current, status, pressure, etc. of equipment using 'stand-alone' data recorders separate from the control system or the trending capacities of control systems.
- R. Deferred Performance Tests (DPTs): Performance tests that are performed, at the discretion of the CxA, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.
- S. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the Owner's Project Requirements).
- T. Equipment Manufacturer: The multiple companies that will manufacturer equipment and products for the commissioned systems and who will participate as required in the commissioning activities.
- U. Factory Testing: Testing of equipment on-site or at the factory, by factory personnel, with or without Owner's representative present.
- V. Functional Performance Test: The testing of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, etc. The systems are run through all the control system's sequence of operation and components are verified to be responding as the sequences state. The commissioning authority develops the functional test procedures in a sequential written

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form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor.

- W. General Contractor: The prime contractor for this project. Generally refers to all the GC's subcontractors as well. Also referred to as the Contractor, in some contexts.
- X. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- Y. Issues Log: A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the commissioning team during the course of the commissioning process.
- Z. Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').
- AA. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.
- BB. Non-Compliance: See Deficiency.
- CC. Non-Conformance: See Deficiency.
- DD. Owner's Project Requirements (OPR): A written document that details functional requirements of the Project and the expectations of how the Project will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information. (Also formerly known as the Design Intent Document.)
- EE. Owner's Representative or Project Manager (Owner): The contracting and managing authority for the Owner who oversees the design and/or construction of the project.
- FF. Over-written Value: Writing over a sensor value in the control system to see the response of a system.
- GG. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of a project or other scheduling issues, in order to minimize the total construction time.
- HH. Re-Commissioning Management Manual: A single manual that contains information required for recommissioning the projects' building systems.
- II. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- JJ. Seasonal Performance Test: Performance tests that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.
- KK. Simulated Condition: Condition that is created for the purpose of testing the response of a system (eg. Raising/lowering the set-point of a thermostat to see the response in a VAV box).

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- LL. Simulated Signal: Disconnecting a sensor and using a signal generator to simulate a sensor value for the purpose of testing a full range of conditions.
- MM. Startup: The initial starting or activating of dynamic equipment, including completing construction checklists.
- NN. Systems Manual: A systems focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the occupancy and operations phase.
- OO. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean “as-built” systems, subsystems, and equipment.
- PP. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.
- QQ. Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents.
- RR. Training Plan: A written document that details the expectations, schedule, budget and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users, and occupants.
- SS. Trending: Monitoring over a period of time.
- TT. Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner’s Project Requirements.
- UU. Warranty Period: Warranty period for the entire project, including equipment components. Warranty begins at Substantial Completion and extends typically for at least one year, unless specifically noted otherwise in the Contract Documents.

1.5 SUBMITTALS

- A. The CxA will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The CxA will notify the Contractor, Owner or AE as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.
- B. The CxA will review the submittals once. The CxA will receive a copy of the final approved submittals.

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer’s calibration procedures and intervals. Recalibrate test instruments

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immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Commissioning Kick-Off Meeting – Construction Team: Contractors will attend a meeting of the Commissioning Team, chaired by the CxA, to review the scope of commissioning process activities and the Commissioning Plan with discussions on milestones, activities, and assignments of responsibilities. The flow and type of documents and the amount of submittal data given to the CxA will be determined. Meeting minutes will then be distributed to all parties by the CxA.
- B. Commissioning Meetings: Contractors will attend coordination meetings with the Commissioning Team, chaired by the CxA, to review progress on the Commissioning Plan, construction deficiencies, scheduling conflicts, and to discuss strategies and processes for upcoming commissioning process activities.
- C. Miscellaneous Construction Meetings: The CxA attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in the commissioning process.
- D. Pre-testing Meetings: Contractors will attend pretest meetings with the Commissioning Team, chaired by the CxA, to review startup reports, pre-test inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.
- E. Testing: Contractors will coordinate with testing personnel and agencies for timing and access for CxA to witness test.
- F. Manufacturers' Inspection and Startup Services: Contractors will coordinate services of manufacturers' inspection and startup services.
- G. Testing, Adjusting and Balancing: Contractors will coordinate with plan and schedule for testing, adjusting and balancing for timing and access for CxA to witness process.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from the vendor) required for testing shall be included in the base bid price to

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the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.

- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturers shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. Data logging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.
- E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 – EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. Submittals: See Section 1.5 – SUBMITTALS for requirements.
- B. Checklists
 - 1. The CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems.
- C. **Red-lined Drawings:** The Contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings. Preliminary red-lined drawings must be available to the Commissioning Team for use prior to start of the Functional Performance Testing. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings. The contracted party, as defined in the Contract Documents will create the as-built drawings.
- D. **Operation and Maintenance Data:** Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems. The CxA will review the O&M literature once for conformance to project requirements. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.
- E. **Demonstration and Training:** Contractor will provide demonstration and training as required by the specifications. A complete training plan and schedule must be submitted by the Contractor to the CxA four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session.

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3.2 OWNER'S RESPONSIBILITIES

- A. Provide the OPR documentation to the CxA and Contractors for use in developing the Commissioning Plan; testing plans and checklists.
- B. Provide the Basis of Design documents, prepared by the architect and approved by the Owner, for use in developing the Commissioning Plan; testing plans and checklists.
- C. Assign operation and maintenance personnel and schedule them to participate in Commissioning Team activities including, but not limited to, the following:
 - 1. Commissioning meetings.
 - 2. Construction phase coordination meetings.
 - 3. Piping and ductwork testing and flushing verification meetings.
 - 4. Procedures meeting for testing, adjusting and balancing.
 - 5. Testing and demonstration of systems, subsystems and equipment.
 - 6. Training in operation and maintenance of systems, subsystems and equipment.
 - 7. Final review and acceptance meetings
- D. Provide utility services required for the commissioning process.
- E. Facilitate the coordination of the commissioning work between the CxA, the Contractor and the Architect and Engineers to ensure that the commissioning activities are incorporated into the master schedule.
- F. Review and approve the commissioning plan.
- G. Coordinate any seasonal or deferred testing.
- H. Ensure that any seasonal, deferred testing and/or deficiency issues are addressed.

3.3 DESIGN PROFESSIONAL'S RESPONSIBILITIES

- A. Attend the Commissioning Kick-Off Meeting – Design Team, Commissioning Kick-Off Meeting – Construction Team and selected team meetings.
- B. Perform submittal review, construction observation, as-built drawing preparation, other items as contracted.
- C. Provide the Basis of Design Document. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
- D. Participate in the resolution of system deficiencies identified during the commissioning, according to the contract documents.
- E. Construction Record documents and specifications.
- F. Ensure that the CxA's submittals comments are incorporated into the Design Professional's submittal comments prior to sending to CM or GC for distribution.
- G. Facility operating procedures for normal, abnormal, and emergency modes of operation.
- H. Participate in resolution of design non-conformance and design deficiencies identified during the warranty-period commissioning process.
- I. Provide a written description and rationale for all energy and water saving features and strategies with operating instructions and caveats about their function and maintenance relative to energy use.

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- J. Provide written guidelines for establishing and tracking benchmarks for whole building energy use and equipment efficiencies of cooling, heating and service hot water equipment.
- K. *Provide a written list of diagnostic tools, with use descriptions, to assist facility staff.*

3.4 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following brief overview:
 - 1. Facilitate the coordination of commissioning and incorporate commissioning activities into the overall project.
 - 2. Provide copies of all applicable submittals as required in Division 01 including all changes thereto.
 - 3. Provide detailed startup procedures.
 - 4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, perform corrective actions.
 - 5. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 - 6. Attend commissioning team meetings held on a scheduled basis.
 - 7. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA. Furnish a copy of the O&M literature to the CxA forty five (45) days after final equipment submittals.
 - 8. In each purchase order or subcontract written, include requirements for submittal data, O&M literature, commissioning tasks and training.
 - 9. Integrate and coordinate commissioning process activities with construction schedule.
 - 10. Review and accept construction checklists provided by the CxA.
 - 11. Review and accept commissioning process test procedures provided by the CxA.
 - 12. Complete commissioning process test procedures.
 - 13. Submit training plan for approval, coordinate training and provide qualified instructors for training of Owner personnel.
 - 14. Assist the CxA as necessary in the seasonal testing, deferred testing and deficiency resolution.
 - 15. Ensure that subcontractors correct deficiencies and make necessary adjustments to submittals, O&M manuals and red-lined drawings for applicable issues identified in any seasonal testing.
 - 16. Provide written as-built controls drawings and sequences of operation for all equipment.
 - 17. Provide a written list of time-of-day schedules and a schedule frequency to review them for relevance and efficiency.
 - 18. Provide written recommendations for recalibration frequency of sensors and actuators by type and use.
 - 19. Provide a written list of all user adjustable set-points and reset schedules with a brief discussion of the purpose of each and the range of reasonable adjustments with energy implications.
 - 20. Provide a written schedule frequency to review the various set-points and reset schedules to ensure they are current relevant and efficient values.

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21. Provide a written list of diagnostic tools with use descriptions to assist facility staff.

3.5 EQUIPMENT SUPPLIERS RESPONSIBILITIES

A. Roles and Responsibilities

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
2. Assist in equipment testing per agreements with subcontractors.
3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

3.6 COMMISSIONING AUTHORITY RESPONSIBILITIES

A. Roles and Responsibilities

1. The CxA is not responsible for the design concept, the design criteria, compliance with codes, design or general construction scheduling, cost estimating or construction management.
2. The CxA may assist with problem solving and non-conformance items or deficiencies, but the CxA is not the Design Engineer / Engineer of Record, and the commissioning process does not preclude the design engineer / Engineer of Record of responsibilities for system evaluations, adequacy of systems to meet the OPR, capacities of systems, quality control checks, or any of the other elements and recommended final acceptance of systems to the Owner.
3. The primary role of the CxA is to coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultants with all necessary parties, frequently updated timelines and schedules and technical expertise.

B. Commissioning Plan

1. The CxA shall develop a Commissioning Plan at the start of the project. The Commissioning Plan shall outline the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
2. The Commissioning Plan shall be a "living document" in which information is added to or modified by the Commissioning Team during the course of the Project.
3. At the end of the Project, the CxA shall provide the Owner with the Final Commissioning Plan for the Owner's use.

C. Document Review

1. Review the Owner's Project Requirements and Basis of Design developed by the design professionals.
2. Perform a focused review of the drawings and specification during the Design Development and near the end of the Construction Document Phase, if contracted.

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3. Develop full commissioning specifications for all systems and equipment to be commissioned. The commissioning specifications will be subject to approval of the design team and included in the final construction specifications.
4. Review submittals applicable to systems being commissioned for compliance for commissioning needs, concurrent with the AE's reviews.

D. Cx Team Meetings

1. Commissioning during construction will begin with a 'Commissioning Kick-Off Meeting – for Construction Team' conducted by the CxA where the commissioning process is reviewed with all of the commissioning team members.
2. Additional meetings will be required throughout construction, and will be scheduled by the CxA on a weekly basis with necessary parties of the commissioning team attending, in order to plan, scope, coordinate, and schedule future activities and resolve problems.

E. Coordination and Scheduling

1. Coordinate and direct commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications, and consultations with all necessary parties.
2. Coordinate commissioning work with the CM/GC to ensure that commissioning activities are being scheduled into the master project schedule.

F. Commissioning Progress

1. Perform site visits, as necessary, to observe component and system installations.
2. Attend selected planning and jobsite meetings to obtain information on construction progress.
3. Review construction meeting minutes for revisions/substitutions relating to the commissioning process.

G. Pipe Testing, Flushing and Cleaning

1. Review and approve the pipe testing, flushing and cleaning plan submitted by the Contractor.
2. Witness all or part of the pipe testing, flushing and cleaning and be sufficiently confident that proper procedures are being followed.
3. Document via the online Commissioning Issues Log any deficiencies in the procedures or results.

H. Pre-Functional Checks

1. Verify proper installation of components, equipment, systems and assemblies. Sampling procedures may NOT be employed on systems and equipment.

I. Equipment and System Startup and Verification

1. Review and approve component, equipment, system and assembly startup plan developed and submitted by the Contractor.
2. Approve system startup by reviewing startup reports, if contracted; and by selected site observation.

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3. Review the Testing, Adjusting and Balancing execution plan for the project, which shall be submitted by the TAB subcontractor.
4. Verify and document the accuracy of the air and water systems balancing by spot testing the air and water reported field values with TAB subcontractors and by reviewing completed reports.

J. Functional Performance Testing

1. With assistance from the Contractor, write Functional Performance Testing procedures for all components, equipment or systems to be commissioned.
2. With the assistance of the Contractors, coordinate Functional Performance Testing. Witness and approve Functional Performance Testing performed by the Contractors.
3. With the assistance of the Contractors, coordinate retesting as necessary until satisfactory performance is achieved.
4. Witness seasonal or deferred Functional Performance Testing as necessary.

K. Issue/Deficiency Logs

1. The CxA shall prepare a formal, ongoing, online record of deficiencies, problems and concerns – and their resolution – raised by members of the Commissioning Team during the Commissioning Process.
2. Issues will be recorded on an online Commissioning Issues Log for the AE, CM/GC and Contractors to resolve to the satisfaction of the Owner. Issues will be added by the CxA. Team members are required to post their own responses to issues pertaining to their work. Team members are required to respond to issues added to the list within five (5) working days of being added by the CxA.
3. Issues will be revisited one (1) time to verify that the proper corrections have been made. The Owner reserves the right to deduct from the Contractors' contract costs associated with additional revisits required for outstanding issues.
4. When issues are resolved, they will be closed on the Issues Log by the CxA.

L. Operation and Maintenance Data

1. The CxA shall review of the documentation submitted by the Contractor as required by the Specifications for completeness and accuracy. This commissioning review supplements, but does not replace, the Architect/Engineer's review.
2. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

M. Training

1. The CM/GC and Contractors will provide all documentation and qualified training personnel for training.
2. The CxA will verify through the Contractor's plan and schedule, training agendas, and select observations that proper training procedures were followed on all commissioned systems.
3. See appropriate section below pertaining to training.

N. Systems Manual Requirements

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1. Index of Systems Manual with notation as to content storage location if not in actual manual.
2. Executive Summary
3. A list of recommended operational record keeping procedures at the facility level, including sample forms, trend logs, or others, and a rationale for each.
4. Maintenance procedures, schedules and recommendations.
5. Ongoing Optimization
6. Other Attachments

O. Post Occupancy Review

1. The CxA will return to the site within the 12-month warranty period to address the following: review current building operations with facility staff and address outstanding issues related to the Owner's Project Requirements; Interview facility staff and identify problems or concerns with operating the building; Identify problems covered under warranty or under the original construction contract.
2. The CxA will make suggestions for improvements in the content of the O&M Manuals. Any required changes shall be made by the contractor responsible for that section.
3. The CxA shall assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

P. Commissioning Final Report

1. The CxA shall provide a final report following the completion of all Functional Performance Testing. The report is to outline compliance and non-compliance to the construction documents, as well as identify concerns relative to future performance

3.7 GENERAL TESTING REQUIREMENTS

- A. Pre-Functional checklists are important to ensure that the equipment and systems are installed and operational. They ensure that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full Pre-Functional checkout. The Pre-Functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system. The Commissioning Authority shall complete the Pre-Functional checks in the field, with assistance from the installing Contractors (where necessary).
- B. The installing contractors, under the direction of the CxA, shall perform Functional Performance Testing of systems and sub-system performance after Pre-Functional checks have been completed and all outstanding issues resolved.
- C. The installing contractor will perform tests specified in Division 1 commissioning process activity Sections and other sections specifying testing procedures according to approved testing procedures.
 1. Verify and test performance using actual conditions whenever possible.
 2. Simulate conditions by imposing an artificial load when it is not practical to test under actual conditions. Set and document simulated conditions and methods of simulation. After test, return settings to normal operating conditions.
 3. Alter set points when simulating conditions is not practical.

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D. The CxA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractors for review and comment.

E. Deficiencies/Non-Conformance

1. The CxA will record the results of the functional test on the test form. All deficiencies or non-conformance items shall be noted and reported to the Owner and Contractors on a standardized form.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
4. As tests progress and a deficiency is identified, the CxA discusses the issue with the executing contractor.
5. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it, the CxA documents the deficiency and the contractor's response and intentions or corrections. The CxA and contractor then proceed to another test or sequence. Once the contractor corrects the deficiency, the test is rescheduled and repeated in anticipation of correct operation or function. If a deficiency is identified, the cost of retesting will be as per section 3.7.
6. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible, the CxA documents the deficiency and the contractor's response. The deficiency is then forwarded to parties assumed to be responsible for the deficiency. Resolutions are made at the lowest management level possible. Other parties are brought into the discussion as needed. Final interpretive authority is with the AE. Final acceptance authority is with the Owner and CxA. The CxA will then document the resolution process. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency. The CxA then reschedules the test as stated in the section above. Costs of retesting are as stated below in the applicable section.

F. Cost of Retesting

1. The cost for the contractor to retest a Pre-Functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM/GC.
2. For a deficiency identified, not related to any Pre-Functional checklist or start-up fault, the following shall apply: The CxA will direct the retesting of the equipment once at no "charge" to the CM/GC for their time. However, the CxA's and owner's time for a second retest will be charged to the CM/GC, who may choose to recover costs from the responsible contractor or subcontractor. Before retesting occurs, the CM/GC will inspect the deficiency and respond to the CA that the issue has been addressed.
3. The time for the CxA and owner to direct any retesting required because a specific Pre-Functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the CM/GC, who may choose to recover costs from the party responsible for misinformation or deficiency.
4. The contractor shall respond in writing to the CxA and owner at least as often as commissioning meetings are being scheduled concerning the status of each

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apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

5. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the CM/GC, contractors or subcontractors.

G. Failure due to Manufacturer Defect

1. If 10% or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM/GC, CxA or Owner. In such case, the Contractor shall provide the Owner with the following.
2. Within one week of notification from the CM/GC or Owner, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM/GC or Owner within two weeks of the original notice.
3. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
4. The CM/GC, CxA or Owner will determine whether a replacement of all identical units or a repair is acceptable.
5. Two examples of the proposed solution will be installed by the Contractor and the Contractor will be allowed to test the installations for up to one week, upon which the CxA or owner will decide whether to accept the solution.
6. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

H. Approval

1. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA. The CxA recommends acceptance of each test to the Owner using a standard form.

I. Deferred Testing

1. Unforeseen Deferred Testing – If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Owner. These tests will be conducted in the same manner as the seasonal tests, as soon as possible. Services of necessary parties will be negotiated.
2. Seasonal Testing - During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate contractors, with facilities staff and the CxA witnessing. Any final adjustments to the O&M

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manuals and record documents due to seasonal testing will be made by the contractor.

3.8 SYSTEMS TO BE COMMISSIONED

- A. Refer to individuals sections listed in Section 1.2 – SUMMARY for specific systems to be commissioned.

3.9 OPERATION AND MAINTENANCE MANUALS

- A. The specific content and format requirements for the standard O&M manuals are detailed in Division 01. Special requirements for the controls contractor and TAB contractor are found in Division 23.
- B. AE Contribution – The AE will include in the beginning of the O&M manuals a separate section describing the systems including the Basis of Design prepared by the AE. They will also provide Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include (ex. chillers/hot water system(s), condenser water system, supply air systems, exhaust systems, etc.). These shall show major pieces of equipment such as (ex. pumps, chillers, heat exchangers, control valves, expansion tanks, coils, service valves, etc.).
- C. CxA Review and Approval - Prior to substantial completion, the CxA shall review the O&M manuals, documentation and record documents for systems that were commissioned to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the CM/GC, Owner or AE, as requested. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the CM/GC, Owner or AE. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the AE's review of the O&M manuals according to the AE's contract.

3.10 TRAINING OF OWNER PERSONNEL

- A. The CM/GC and contractors shall be responsible for training coordination, scheduling and ultimately for ensuring that training is completed.
- B. The CxA shall oversee the training of Owner's personnel for commissioned equipment and systems.
 - 1. The CxA shall interview the Owner's staff to determine the special needs and areas where training will be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned equipment. The CxA shall communicate the results to the CM/GC and contractors. Who will in turn communicate to the subcontractors and vendors who also have training responsibilities.
 - 2. In addition to these general requirements, the specific training requirements of Owner personnel by contractors, subcontractors and vendors is specified in the individual sections listed in Section 1.2 – SUMMARY.
 - 3. Each Sub and vendor responsible for training will submit a written training plan to the CM/GC and/or contractors for review and approval prior to training. The CM/GC and/or contractors will submit one comprehensive training plan to the CxA and Owner.
 - 4. The plan will be reviewed by the CxA and Owner. Comments pertaining to its deficiencies will be forwarded to the CM/GC and Contractors. The training plan

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will be rewritten until approved by the CxA and Owner. The final approved training plan will cover the following elements:

- a. Equipment (included in training)
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Qualified instructor for each subject
 - i. Instructor qualifications
 - j. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
5. For the primary HVAC equipment, the Controls Subcontractor shall provide a discussion of the control of the equipment during the mechanical or electrical training conducted by each subcontractor or vendor.
 6. Training documentation shall include the following items:
 - a. Copy of the training plan, including schedule, syllabus, and agenda.
 - b. Copy of the Owner's Program Requirements.
 - c. Copy of the Basis of Design.
 - d. Compiled operations manuals.
 - e. Compiled maintenance manuals.
 - f. Completed manufacturer training manuals.
 - g. Red-lined drawings.
 - i. Other pertinent documents.
 7. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CxA recommends approval of the training to the Owner using a standard form. The owner signs the approval form/letter template.
 8. At one of the training sessions, the CxA presents a presentation discussing the use of the blank functional test forms for re-commissioning equipment.
 9. Video taping of the training sessions in DVD format will be provided by the CM/GC, with tapes cataloged by the CM/GC and added to the O&M manuals, if required by Division 1 specifications.
 10. The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be one to two hours in length and include a review of mechanical systems using the simplified system schematics (one-line drawings).

3.11 REPORTING

- A. The CxA will provide regular reports to the Owner, on a pre-determined frequency in accordance with the project schedule. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through, memos, progress reports, etc.
- B. The CxA will keep all documentation and log all commissioning-related issues that require current or future attention including deficiencies. An agreed-upon form will track the status of documentation and testing for each piece of equipment and system.

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3.12 COMMISSIONING DOCUMENTATION

A. The CxA oversees and maintains the development of commissioning documentation. The commissioning documentation shall be kept in three ring binders, and organized by system and sub-system when practical. All pages shall be numbered, and a table of contents page(s) shall be provided. The commissioning documentation shall include, but not be limited to, the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.
9. Approved final test and balance report for the building being commissioned.
10. All accepted shop drawings of systems equipment. Shop drawings shall be full size sheets folded as required to fit in binders.
11. All pre-functional performance test checklists, signed by personnel performing and/or witnessing test, organized by system and sub-system.
12. All verification and functional performance test checklists/results, signed by personnel performing and/or witnessing test, organized by system and sub-system. This information may be used for calibrating the original energy simulation model. The revised model will be used to create the baseline for energy use in the building.

END OF SECTION

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COMMISSIONING OF THE BUILDING ENCLOSURE

SECTION 01 9119

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Owner's Project Requirements and Basis of Design documentation are included for information only.
- C. Division 01 General Requirements for general requirements for commissioning including definition, commissioning team membership and responsibilities.
- D. Division 03 through 08 sections for building exterior enclosure commissioning requirements specific to the work of each section.

1.2 SUMMARY

- A. This section includes exterior enclosure commissioning procedures, including substructure, superstructure, exterior enclosure, and roofing construction that protects conditioned and semi-conditioned interior spaces from unconditioned spaces and the exterior environment.
- B. The materials, components, systems, and assemblies that comprise the above and below-grade building exterior enclosure will be evaluated and tested as outlined in this Section, as well as in accordance with each of the technical Sections associated with the design and construction of the building exterior enclosure. The purpose of Building Exterior Enclosure Commissioning is to provide a process for independent, third-party verification that the installed performance of the building exterior enclosure meets or exceeds the minimum performance requirements set forth by the contract documents for this project.

1.3 DEFINITIONS

- A. Refer to Division 01 Section "General Requirements" for definitions.

1.4 SUBMITTALS

- A. The Contractor is to provide all submittals related to the Building Enclosure as indicated in Section 1.1.D above to the Commissioning Authority in addition to submitting them to the Architect-of-Record. These submittals are in addition to those specified in Division 01 General Commissioning Requirements. Submittals subject to review include the following and may include additional submittals as required to properly perform the commissioning activities:

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1. Product Data: provide submittals for all enclosure related products in Divisions 03 through 08 of the project specification.
2. Shop Drawings: the Commissioning Authority shall review shop drawings for the construction of key building enclosure components where shop drawing submittals are required by the project specifications.
3. Coordination Drawings: provide cross references on any and all shop drawings indicating that drawings have been checked and cross-referenced by the Contractor to ensure that adjacent elements (i.e. wall elements and fenestration elements) and the dimensions and construction tolerances indicated will allow all work at interfaces to be constructible.
4. Preconstruction Test Reports: all preconstruction air and water leakage performance test results, including all failed tests, recording the noted deficiency and the required repair, and provide a copy of all remediation processes and QC/QA processes that will be put in place to address the deficiency on future work product.
5. Mock-Ups: where Visual or Performance mock-ups are specified, all submittals including shop drawings, testing procedures, and test results shall be provided to the Commissioning Authority for review.
6. Field Quality Control Reports: provide a copy of the test reports for all field water and air penetration and other appropriate building exterior enclosure tests completed by Owner's testing agency.
7. Special Inspections Reports for all special inspections indicated by the Architect/Engineer-of-Record in the specifications.

1.5 PERFORMANCE REQUIREMENTS

- A. Construction will comply with all performance requirements set forth in the individual specifications for enclosure components. Where multiple systems from separate specification sections comprise a single system, such as the air barrier, the moisture barrier, and the thermal barrier, the Contractor shall ensure coordination among the various trades in order to provide continuity across the entirety of the enclosure.
- B. Preconstruction Testing of Mockups: See requirements in the individual specification sections in Divisions 03 through 08.

1.6 QUALITY ASSURANCE

- A. Quality Assurance and Control: Specific commissioning quality assurance and control requirements for individual construction activities are specified in the individual specification sections in Divisions 03 through 08. Specified commissioning tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with the Contract Document requirements.

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PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITIES

- A. Attend Commissioning meetings.
- B. Provide schedule of field quality control tests and inspections required by the Contract Documents to Commissioning Authority.
 - 1. Update schedule, as it pertains to the Building Exterior Enclosure, weekly throughout the construction period.
- C. Cooperate with the Commissioning Authority personnel, provide access to work, and provide an adequate schedule for the work for commissioning tasks.
- D. Furnish copies of all shop drawings, manufacturer's literature, installation instructions, maintenance information, schedules, warranties or other information as requested.
- E. Provide qualified personnel for assistance to complete the commissioning tests, including air and water leakage testing for elements of the building exterior enclosure.
- F. Submit a copy of the General Contractor's project and site-specific Quality Assurance program to be implemented for construction for review by the Architect of Record, the Owner, Owner representatives and the Commissioning Authority, prior to beginning of construction.
- G. Participate and ensure all subcontractors utilized for work on this contract participate in meetings prior to beginning construction with the various members of the design and construction teams, including, but not limited to, the Owner, Owner's representatives, Architect of Record, Commissioning Authority, Mechanical Engineer, suppliers, and manufacturer technical representatives. The subcontractors that must attend this meeting include all subcontractors that will be involved in the construction of the building exterior enclosure, including, but not limited to, the roofing, cladding, air barrier system, glazing systems, and exterior sheathing contractors. This meeting will be to discuss construction sequencing and the coordination of trades and the General Contractor's project and site-specific Quality Assurance program to be implemented that will be completed during construction of the building exterior enclosure.
- H. Facilitate all field installation and performance testing by Owner's testing agency of building exterior enclosure materials or systems, as required in the individual specification sections in Divisions 03 through 08.

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- I. The Contractor is to complete and participate in the construction of on-site performance mock-ups to verify constructability, including elements of the building exterior enclosure, as identified in individual sections of the specifications in Divisions 03 through 08, including but not limited to wall-to-window interfaces, roof-to-wall interfaces, sill conditions, and material transitions, and provide personnel to be present and have a representative present from each trade and/or subcontractor associated with installing the system during air and water leakage performance testing on the mock-up, as indicated within the individual sections within Divisions 2 through 9. Personnel from each trade that will be completing the work in the field are to be utilized to construct each required mock-up. Provide a written protocol, timeline for repair of any deficiencies noted during the performance testing and/or a written report from the third-party agency performing the tests indicating what repairs were required. If a systemic problem is identified during testing, provide repair and remediation protocol for any systemic failures identified by the Commissioning Authority. Include a timeline for repair of all affected elements. Repaired elements shall not be covered up without review by the Commissioning Authority.
- J. The Contractor shall provide the following information to Commissioning Authority for inclusion in the Commissioning Plan:
 1. Submittals and other required documents and reports.
 2. Identification of installed exterior enclosure components, assemblies, systems, and equipment, including design changes that occurred during the construction phase.
 3. Certificate of completion, certifying that exterior enclosure assemblies, systems, equipment, and associated controls are complete and ready for testing.
 4. Test and inspection reports and certificates.
 5. Corrective action documents.

3.2 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

- A. The Building Exterior Enclosure Commissioning process will be managed by the Commissioning Authority, retained by the Owner, and will include, by reference, all requirements set forth by the Architect-of-Record for pre-construction laboratory and field performance testing of the materials, components, systems, and assemblies that comprise the building exterior enclosure. In that context, it should be understood by all parties to this project that:
 1. Full and complete compliance with the building exterior enclosure performance requirements set forth by the Architect-of-Record in the Basis-of-Design (BOD) for this project will be required to achieve successful "commissioning" of the building exterior enclosure.
 2. The requirements of this Section shall in no way relieve the Owner, Contractor, Architect-of-Record, and other parties to this project of their respective contractual obligations to the Owner for meeting the specified performance levels in the design and construction of this project.
 3. The commissioning requirements of the general contractor and sub-contractor or trade responsible for the final detailing and construction of the building exterior enclosure are

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included in Parts 1 and 3 of each of the technical specification Sections as they relate to the design and construction of the building exterior enclosure for this project (Divisions 03 through 08).

- B. The Commissioning Authority will provide written summaries of selected inspections of the work in progress during the construction of the building exterior enclosure. These reports will include, but may not be limited to, photographs, sketches and diagrams as required illustrating conditions observed in the field, especially deficiencies noted, together with proposed solutions for those conditions where appropriate for further review and acceptance by the Architect-of-Record and owner for the project. Any changes to the contract documents arising out of the Building Exterior Enclosure Commissioning process must be submitted, reviewed, and accepted in writing by the Architect-of-Record and Owner. The Architect shall submit required details/schematics and material specifications to the Contractor for pricing prior to implementation of any changes on the project. The Contractor shall be responsible for coordinating and managing the commissioning responsibilities of each of the subcontractors responsible for the building exterior enclosure.
- C. The Commissioning Authority will:
1. Perform a focused review of the drawings and specification related to Building Exterior Enclosure during the Design Phase.
 2. Review enclosure related submittals including product data and shop drawings.
 3. Witness Field Quality Control testing of key building enclosure components as outlined in the specifications in Divisions 03 through 08.
 4. Perform field observation of initial and on-going installation of enclosure components.
 5. Compile test data, inspection reports, and certificates and include them in the commissioning report.
 6. Promptly notify Architect and Contractor of irregularities or deficiencies in work that are observed during performance of services.
 7. Lead and conduct Building Enclosure Commissioning Meetings at regular intervals and document the meeting results.
 8. Draft and update the Building Enclosure Commissioning Plan throughout the project detailing the responsibilities and deliverables related to the commissioning process, including the preparation of a Test Matrix for all enclosure related Field Quality Control tests that are to be performed and witnessed.
 9. Attend a pre-occupancy meeting with the building's facility personnel to review maintenance procedures and review the status of the open items in the deficiency log.
 10. Work with the A/E Team and a representative of the Owner in securing remedy of defects that become apparent during the warranty period.
 11. Issue a Final Commissioning report summarizing the activities and findings of the commissioning process.

3.3 VERIFICATION

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- A. Field Quality Control testing, as required in the individual enclosure specification sections and as added by the Owner, will be used to help verify that building exterior enclosure systems, subsystems, and construction have been completed according to the Contract Documents.
- B. The Commissioning Authority will witness and document selected Field Quality Control tests and verify that the required Field Quality Control testing of the enclosure components and systems has been completed, that discrepancies have been corrected, and that the corrective work has been approved.
- C. If it is determined as a result from testing that a system is not constructed according to the Contract Documents, the Owner will decide whether modifications are required to bring the performance of the system to a level where the failure or deficiency is eliminated and shall be implemented or if the test results will be accepted as submitted. If corrective work is performed, the Owner will decide if tests shall be repeated and a revised report is to be submitted.
- D. Testing Reports: The Commissioning Authority shall provide reports including measured data, a description of the building exterior enclosure systems at the time of testing, diagnostics, and any recommendation for needed remediation.
- E. Deferred Testing: If tests cannot be completed because of a deficiency outside the scope of the Building Exterior Enclosure, the deficiency shall be documented by the Contractor and reported to Owner. Deficiencies shall be resolved and corrected by Contractor and tests rescheduled.

3.4 SYSTEMS TO BE COMMISSIONED

- A. The systems and elements to be commissioned include, but are not limited to the following where they exist on the project:
 - 1. Below-grade construction, waterproofing, drainage
 - 2. Floors, slab-on-grade
 - 3. Plaza deck waterproofing
 - 4. Fenestration systems including curtain walls, window walls, windows, storefronts, and glazed openings
 - 5. Skylights /Sloped glazing
 - 6. Shading devices
 - 7. Exterior doors and louvers
 - 8. Exterior wall cladding systems (inclusive of masonry, stone, EIFS, concrete, precast concrete, metal, insulation, formed metal, rain screen systems, etc.) with associated sheathing, insulation, and support systems
 - 9. Air barriers, thermal barriers, vapor barriers and moisture barriers integral to the exterior envelope
 - 10. Flashings (end dams, drip edges, flexible flashing, and metal flashings)
 - 11. Sealant joints, expansion joints and control joints related to the exterior envelope

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12. Roofing systems with associated flashing, trims, penetrations, curbs, etc.)
13. Interface conditions between each of the above listed elements.
14. Other special building exterior enclosure systems, equipment, and controls

END OF SECTION

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SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes selective removal and subsequent offsite disposal of portions of existing building indicated on drawings and as required to accommodate new construction.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner's designated storage area.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Locations of temporary partitions and means of egress.
 - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

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- C. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for demolitions similar to this Project and has a record of successful in-service performance
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with applicable regulations, codes and ordinances.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Proposed Dust-Control and Noise-Control Measures: Written statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- F. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.6 PROJECT CONDITIONS

- A. Occupied Buildings:
 - 1. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
 - 2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- B. Owner assumes no responsibility for condition of areas to be selectively demolished. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
- C. Hazardous Materials: If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

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- D. Storage or sale of removed items or materials on-site will not be permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

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3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Occupied Buildings: Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
 - 1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - 1. Arrange with Owner to shut off indicated utilities.
 - 2. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 3. Protect existing site improvements, appurtenances, and landscaping to remain.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furnishings, and equipment that have not been removed.
- C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

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1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
- E. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
 3. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents before starting flame-cutting operations.
 6. Maintain portable fire-suppression devices during flame-cutting operations.
 7. Maintain adequate ventilation when using cutting torches.

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8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 11. Dispose of demolished items and materials promptly.
 12. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- C. Removed and Salvaged Items: Comply with the following:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.6 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
1. Completely fill holes and depressions in existing concrete or masonry that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

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3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 SELECTIVE DEMOLITION SCHEDULE

- A. Refer to the drawings.

END OF SECTION

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SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Footings.
- B. Foundation walls.
- C. Concrete formwork.
- D. Concrete for composite floor construction.
- E. Floors and slabs on grade.
- F. Concrete foundation walls and column footings.
- G. Concrete reinforcement.
- H. Site retaining walls, seat walls, and stormwater planters/curbs
- I. Waterstops.
- J. Concrete curing process and procedures.
- K. Curing compounds, sealers and hardeners.
- L. Under-slab vapor barriers.

1.2 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing" for steel framing and post-installed concrete anchors.
- B. Section 053100 - Steel Decking for metal decks.
- C. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- D. Section 36329 - Drilled Concrete Piers and Shafts for drilled piers.

1.3 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
- C. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- D. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- E. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- F. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- G. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

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- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.
- L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

1.4 DEFINITIONS

- A. Action Submittals: Mandatory submittals by the Sub-Contractor which require action on the part of the General Contractor, Construction Manager and Design Professional.
 - 1. General Contractor and Construction Manager: Review, Stamp and Forward to the Design Professional.
 - 2. Design Professional: Review, Stamp and Return to the General Contractor or Construction Manager.
- B. Informational Submittals: Mandatory submittals by the Sub-Contractor to the General Contractor, Construction Manager and Design Professional which are not returned but kept by each for their project record.
- C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag cement, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. General:
 - 1. Review of submittals is of a general nature only, and the responsibility for conformance with intent of drawings shall remain with the Contractor. Review does not imply or state that the fabricator has correctly interpreted the construction documents.
 - 2. All submissions shall be in accordance with the submission schedule developed and agreed between the Architect and Contractor at the commencement of the project. Submission shall include dates of order and delivery of materials to the shop and the site.
 - 3. Shop drawing schedule shall allow adequate time for reviews. Reinforcing steel shall not be fabricated or placed before the shop drawings have been reviewed by the Architect and returned.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For each type of product indicated.
 - 2. ICC-ES Reports for mechanical couplers.
 - 3. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions,.
- D. LEED Submittals:

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1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, provide documentation indicating percentages by weight of post-industrial and post-consumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - b. For each concrete mixture containing fly ash, slag cement, micro silica, or other portland cement replacements, provide additional statement indicating cost of product of cementitious content only.
 2. Design Mixtures for Credit ID 1.1: Provide concrete design mixtures for each concrete mixture containing fly ash, slag cement, micro silica, or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
 - a. In addition to documents listed under item 1.4 C 2, an environmental assessment report for the concrete mixture shall be submitted. The environmental assessment shall compare the submitted concrete mixture to a conventional/typical reference concrete mixture that would otherwise be used to achieve the specified performance. The assessment at a minimum shall include information in the following environmental impact areas: consumption of energy, emissions, toxicity potential, risk potential, consumption of raw materials, and land use. The methodology used to conduct the analysis and assessment shall be in accordance with ISO 14040 and ISO 14044 (ecological part) and shall be third-party-validated by NSF International, or other accredited agency that provides third-party assessment services.
 3. Product Data for Credit MR 5.1 and Credit MR 5.2: For products sourced (1) extracted, harvested, or recovered and (2) manufactured within 100 miles of project site, provide documentation indicating cost, distance to extraction site, mode of transport, and source of information.
 - a. For product comprised of components sourced from different locations, include statement indicating (1) distance between project and extraction site and (2) weight contributing to regional extraction.
 - b. For products shipped by rail or water, compute the total travel distance of the project site using a weighted average determined through the following formula: $(\text{Distance by rail}/3) + (\text{Distance by inland waterway}/2) + (\text{Distance by sea}/15) + (\text{Distance by all other means}) \leq 100$ miles. If this total distance is within the 100 mile limit, provide the above documentation for each applicable product component.
 4. Environmental Product Declaration (EPD), in compliance with ISO 14025, third-party verified eco-label, for each concrete mix type or each concrete mix to be used. Where not yet available, supply an industry-wide EPD or other product declaration conforming to requirements of LEEDv4.1 MRc2: Building Product Disclosure and Optimization – Environmental Product Declarations, Option 1.
 - a. Provide a Type I or III product specific EPD for each concrete mix type or concrete mix component as available. If an EPD is not available, provide written notification that the EPD has not been secured.
 5. Health Product Declaration, publicly available manufacturer's inventory, Cradle-to-Cradle v3 Bronze or higher certification, or other USGBC-approved program for LEEDv4.1 MRc4: Building Product Disclosure and Optimization – Material Ingredient Reporting, Option 1, for each concrete mix type or each concrete mix qualifying as an individual product as defined by LEED.
- E. Design Mixtures: Each concrete mix design to be used on the project shall be reviewed and approved by the Testing Agency and Architect prior to concrete being delivered to site. Submit proposed mix designs for each class of concrete. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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1. For each concrete mixture, the following information shall be included: where the mix is to be used, all materials and admixtures including their source and proportions in the mix; Water content, water-to-cement ratio, slump, and aggregate grading; whether the mixture is appropriate for pumping; and total chloride content.
 2. Provide shrinkage test results for mixes with shrinkage criteria showing that mix meets performance criteria. The mix design number must match with the mix design number shown on the test data.
 3. Indicate compressive strength and method used to determine strength. The compressive strength of the concrete shall be proportioned per ACI. Include all calculations and tests required by ACI 318 Section 5.3 and 5.4. Laboratory test data must be submitted along calculations that show with each mix design meets the strength requirement. Mix design number must match the mix design number shown on the test data. Include all test results or past history back up data specific as part of the submittal. Test results within the past two years shall be used to indicate performance in accordance with past history.
 4. Indicate amounts of mixing water to be withheld for later addition at Project site.
 5. Each mix shall be stamped and signed by a Professional Engineer licensed in the State of Michigan.
 6. Cement and cement replacement quantities to be proportioned as needed to achieve specified structural concrete design requirements.
- F. Steel Reinforcement Shop Drawings: Placing drawings in accordance with SP 66 that detail fabrication, bending, and placement. Direct copies of the contract documents are not acceptable as a submission from the Contractor.
1. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include any welding to be done.
 2. Shop drawings shall make it clear where each bar is located. Beams, grade beams and walls shall be shown in elevation. On elevations show locations of sleeves and penetrations.
 3. Check architectural, structural, mechanical, and electrical and other contract documents for anchor bolt schedules and locations, anchors, inserts, conduits, sleeves, and any other items which are required to be cast in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
 4. Show all areas of congestion. Identify where reinforcing steel will interfere with the placement of embedded items such as anchor bolts, anchors, inserts, conduits, sleeves and any other items which are required to be cast in concrete.
- G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- H. Submit schedule of concrete placement operations before commencing Work.
- I. Show on one or more plans and/or elevations, locations of construction, contraction and expansion of joints, slab edges, curbs, equipment pads, depressions, sleeves and openings.
- 1.6 INFORMATION SUBMITTALS
- A. Samples: For waterstops, vapor retarder, formwork, as requested by Architect.
 - B. Welding certificates.
 - C. Welding Procedures for all reinforcement welding.
 - D. Mill Test Reports: Submit steel producer's certificates of mill analysis for each heat or melt of reinforcing steel, including steel source, description, heat number, yield point, ultimate tensile

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strength, elongation percent, bend test and the chemical composition of each heat as determined by ladle analysis, before delivery of steel to site. Where steel is required to be welded, mill reports shall be used to help verify the weldability of the steel.

- E. Qualification Data: For Installer, manufacturer, and testing agency. Submit qualification of Concrete Foreman, showing 5 years experience with this type of concrete installation.
- F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Normal weight aggregate (per ASTM C33). Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity. Include evaluation of reactivity and the following:
 - a. Abrasion Resistance: ASTM C131; Los Angeles Machine.
 - b. Cleanness Value: Test Method NO. C 227; coarse aggregate only.
 - c. Fineness: ASTM C117.
 - d. Organic Impurities: ASTM C40.
 - e. Potential Reactivity: ASTM C289.
 - f. Sand Equivalent: Test Method No. C 217.
 - g. Sieve Analysis: ASTM C136.
 - h. Soundness: ASTM C88.
 - i. Absorption for lightweight aggregate: Maximum 15%.
- G. Product Test Reports and Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials, per ASTM C150, ASTM C595, ASTM C618, ASTM C989, and/or ASTM C1240, as applicable.
 - 2. Admixtures. Where more than one admixture is used, include certification that admixtures are compatible. Per ASTM C494 for each type used; include chloride ion content.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Welding Electrodes.
 - 6. Deformed Bar Anchors
 - 7. Fiber reinforcement.
 - 8. Waterstops.
 - 9. Curing compounds.
 - 10. Floor and slab treatments.
 - 11. Non-shrink grout, per ASTM C1107.
 - 12. Bonding agents.
 - 13. Adhesives.
 - 14. Vapor retarders.
 - 15. Semirigid joint filler.
 - 16. Joint-filler strips.
 - 17. Post-installed concrete anchors.
 - 18. Repair materials.
- H. Submit a complete description of the system proposed for meeting the specified floor slab flatwork tolerances. Submit survey data from a minimum of two previous slab installations to demonstrate capability to satisfy specified tolerances.
- I. Field quality-control test and inspection reports.

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- J. Submit an affidavit identifying cementitious material used, including manufacturer's lot number, date of shipment by manufacturer, date of receipt by the concrete supplier, place of storage and date of use. If such information is not available, a sample of cementitious material used on the Project shall be taken for each day's pour and shall be tested as directed by the Architect.
 - K. Transit-Mix Delivery Slips:
 - 1. Keep record at the Site showing time and place of each pour of concrete, together with transit mix delivery slip certifying contents of the pour per ASTM C94. Include the time water was added to dry mix.
 - 2. Make the record available for inspection at the Site and to the Architect for his review upon request.
 - 3. Upon completion of this portion of the Work, deliver the record and the delivery slips to the Architect.
 - L. Complete minutes of preinstallation conference within (5) business days.
 - M. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
 - N. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- 1.7 QUALITY ASSURANCE
- A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
 - B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
 - C. Follow recommendations of ACI PRC-306 when concreting during cold weather.
 - D. Standards: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 2. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 3. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 4. ACI SP-66, "Detailing Manual"
 - 5. American Welding Society (AWS) D1.4, "Structural Welding Code – Reinforcing Steel"
 - 6. Michigan Building Code.
 - E. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
 - F. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
 - G. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete

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Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II. Shop and field testing and inspection of steelwork shall be performed by an inspector currently certified as an AWS Certified Welding Inspector.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II
 3. .Shop and field testing and inspection of steelwork shall be performed by an inspector currently certified as an AWS Certified Welding Inspector.
- H. Testing Agency: Shall be selected and paid for by the Owner, unless otherwise specified; re-testing paid for by the Contractor.
- I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to test concrete mixtures. When mixes, are proportioned by trial batch method, engage a Laboratory conforming to ASTM E329 and under direction of a Professional Engineer licensed in Michigan.
- J. Contractor's Quality Control Plan: Quality Control includes the functions performed by the Contractor to ensure that the material and workmanship of concrete construction meets the project specifications and applicable standards. The Contractor shall submit a Quality Control Plan that addresses all inspection issues, including testing and inspection per ACI. The verification testing and inspection carried out by the Testing Agency does not relieve the contractor of the responsibility for conducting their own quality control/inspection program to ensure the requirements of the Contract Documents have been met. The Contractor's Quality Control Plan will be reviewed by the Testing Agency.
- K. Quality Control Inspector Qualifications: Along with Quality Control Plan, Contractor shall submit written qualifications for all inspectors to be assigned Quality Control functions for concrete work.
- L. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- M. Mechanical Bar Couplers shall have a current ICC-ES Evaluation Report that indicates compliance with requirements of these specifications.
- N. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-- Reinforcing Steel."
1. Welders whose work fails to pass inspection shall be requalified before performing further welding.
 2. Firm specializing in furnishing and installing reinforcement shall have a minimum of 5 years experience on projects with requirements similar to this project and shall have sufficient production capacity.
 3. All welding shall be performed by operators who are qualified for the types of welds used. Each operator shall have been qualified within the preceding one year as prescribed by AWS. Welder qualification shall include passing the Charpy tests when specified for the electrode.
 4. Require welders to retake the qualification test if, as determined by the Architect, there is a reasonable doubt as to the proficiency of the welder. If the welder does not requalify, they

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- O. Deformed Bar Anchors or Weldable Rebar Studs shall have a current ICC-ES Evaluation Report that indicates compliance with requirements of these specifications shall not perform any welding on the project.
- P. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to test concrete mixtures. When mixes, are proportioned by trial batch method, engage a Laboratory conforming to ASTM E329 and under direction of a Professional Engineer licensed in the State of Michigan.
- Q. Prefabrication and Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Laboratory responsible for field quality control.
 - f. Admixture manufacturer (s).
 - g. Concrete pumping subcontractor.
 - 2. During meeting, review:
 - a. LEED Submittals
 - b. Special inspection and testing and inspecting agency procedures for field quality control
 - c. Concrete finishes and finishing
 - d. Cold- and hot-weather concreting procedures
 - e. Curing procedures
 - f. Construction contraction and isolation joints
 - g. Joint-filler strips and semirigid joint fillers
 - h. Vapor-retarder installation
 - i. Anchor rod and anchorage device installation tolerances
 - j. Steel reinforcement installation
 - k. Floor and slab flatness and levelness measurement
 - l. Concrete repair procedures
 - m. Concrete protection.
 - 3. The concrete contractor shall confirm that the proposed mix designs will enable him to properly place, pump, finish and achieve the required concrete quality specified.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement:
 - 1. Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
 - 2. Deliver reinforcing to Site properly bundled and tagged. Use tags that indicate bar size, lengths and marks corresponding to markings shown on shop drawings. Segregate so as to maintain identification after bundles are broken.
 - 3. Store reinforcement in a manner that will prevent excessive rusting or fouling with/ grease, oil, dirt, and other bond weakening materials.
 - 4. Do not use damaged, reworked, or deteriorated material.

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- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- C. Formwork: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
- D. Concrete Materials:
 - 1. Protect cement from moisture and rotate stock to ensure fresh materials.
 - 2. Protect aggregates as necessary to maintain saturated condition when batched.
 - 3. Storage methods should comply with ACI 301 4.1.4.

1.9 WARRANTY

- A. Slabs with Porosity Inhibiting Admixture (PIA) or Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for ten years.
 - 1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
- B. Moisture Emission-Reducing Curing and Sealing Compound, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 years.
 - 1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Insert additional paragraph, or adjust as required, for special architectural finishes.
- B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. High-density overlay, Class 1 or better.
 - 3. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - 4. Structural 1, B-B or better; mill oiled and edge sealed.
 - 5. B-B (Concrete Form), Class 1 or better; and edge sealed. Mill oil not allowed.
- C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

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- D. For exposed surfaces not otherwise specified use Special exterior Type Douglas Fir, Grade AB plywood, conforming to NBS PS-1, minimum 3/4 in. thick and constructed so that finished concrete will be straight, smooth, dense, free from honeycombs, bulges, or depressions. Keep joints between plywood sections to a minimum and make tight and strongly backed so that adjoining edges remain flush and true.
 - E. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
 - F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
 - G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
 - H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agents shall have a VOC content of 250 grams/liter or less.
 - I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface and permit neat and solid patching at every hole.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
 - J. Expansion Joint Filler:
 - 1. Fiber Type: Preformed asphalt impregnated fiber, ASTM D1751, 1/2 inch thick unless otherwise noted.
 - 2. Cork Type: Preformed cork expansion joint, ASTM D1752. Type II, 1/2 inch thick unless otherwise noted.
 - K. Expansion Joint Sealant: ASTM C920, Type M, Class 2 5; two part polyurethane traffic grade sealant, gray color.
 - 1. Horizontal Joints: Pourable, Grade P, Use T.
 - 2. Vertical Joints: Nonsag, Grade NS, Use NT.
- 2.3 REINFORCEMENT MATERIALS
- A. Recycled Content of Steel Products: Concrete reinforcement shall contain a minimum of 25% combined post-industrial and post-consumer recycled content where the percentage of recycled content is based on the weight of the component materials.
 - B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.

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- C. ASTM A706, deformed, where bars are welded, where #6 or larger bars are mechanically coupled, or where designated on drawings.
- D. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
 - 1. Form: Flat Sheets.
 - 2. WWR Style: As indicated on drawings.
- E. Plain-Steel Wire: ASTM A82, as drawn.
- F. Tie Wire: American Wire 16 gauge or heavier black annealed wire.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view or where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports, unless noted otherwise.
 - 2. Where supports are placed against ground or atop vapor barrier use precast concrete blocks not less than 3 inches square with two 16 gauge embedded wires.
 - 3. At Architectural Concrete and surfaces exposed to weather; CRSI Class 1 plastic protected.
- C. Mechanical Bar Couplers: Provide coupler capable of achieving Type 1- splice, unless otherwise noted on Drawings.
 - 1. Type 1: ICC-ES approved; capable of developing 125% of specified minimum yield strength of bar in tension or compression.
 - 2. Type 2: ICC-ES approved; capable of developing the lesser of 95% of the ultimate tensile strength or 160% of the specified minimum yield strength of the bar in tension or compression.
- D. Welding Electrodes: As required in AWS D1.4. As a minimum, use E90XX electrodes.
- E. Deformed Bar Anchors: Nelson, flux filled deformed bar anchors, type D2L, as manufactured by Nelson Stud Welding Division of TRW or approved equal.
 - 1. Alternate: SWR A706 Stud Weldable Rebar by Stud Welding Products, Inc.

2.5 REINFORCEMENT FABRICATION

- A. Fabricate reinforcing in accordance with ACI 301, 315 or CRSI "Manual of Standard Practice."
- B. Bending:
 - 1. Do not bend or kink reinforcing except as shown on the Drawings.
 - 2. Minimum bend diameters and hook extensions as shown on the drawings or per ACI.
 - 3. In case of fabrication errors do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
 - 4. Reinforcing bars are to be bent cold, do not preheat, unless approved by Architect.
 - 5. Do not rebend reinforcement that has previously been bent within 6 inches of new bend except as allowed in section 3.3.2.8 of ACI 301.

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C. Unacceptable Materials: Reinforcement with any of the following defects shall not be permitted in the Work and will be replaced without cost:

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bend or kinks not shown on the Drawings or final shop drawings.
3. Bars with reduced cross-section due to rusting or other cause.
4. Bars with dirt, mud, grease or form release agent.

2.6 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C150, Type II, unless noted otherwise.
 - a. Portland Cement: ASTM C150, Type V. As required for corrosion resistance.
2. Supplement Portland Cement with the following Supplementary Cementitious Materials (SCM):
 - a. Fly Ash: ASTM C618, Class C or F.
 - b. Slag Cement: ASTM C989, Grade 100 or 120.
 - c. Silica Fume: ASTM C1240. [MasterLife SF 100 (formerly Rheomac SF100) by BASF Corporation or approved equal.]
 - d. Metakaolin: ASTM C618. [MetaMax by BASF Kaolin, Part of BASF Corporation or approved equal.]
 - e. The SCM producer shall have a minimum of 5 years experience in the production of acceptable SCM and shall practice an effective quality control program to guard against contamination of the SCM.
3. Blended Hydraulic Cement: ASTM C595 or C1157, Type IS, portland blast-furnace slag IP, portland-pozzolan I (PM), pozzolan-modified portland I (SM), slag-modified portland cement.
4. Cementitious material used shall have at least 2 years of use with proposed aggregates without detrimental reaction.
5. Alkali content shall not exceed 0.6% when tested in accordance with ASTM C114.
6. The temperature of cement delivered to the plant shall not exceed 150 degrees F.
7. For Architectural Concrete: Silica Fume and Fly Ash not permitted unless reviewed and approved for color by Architect.

B. Silica Fume: ASTM C1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Provide Class 5S for architecturally exposed concrete

1. Coarse Aggregate:
 - a. Aggregate shall contain no thin or elongated pieces. Any piece having a major dimension more than 2-1/2 times the average thickness shall be considered thin or elongated.
 - b. If shrinkage controlled concrete, Coarse Aggregate shall be crushed limestone, granite, or accepted equal.
 - c. Alkali Silica Reactivity: Aggregate shall be considered non-reactive with documented satisfactory service record for a minimum of ten year period used in concrete with similar cementitious materials. In the absence of service record the aggregate shall be tested and will be considered non-reactive if it passes ASTM C1260 or ASTM C1293 per requirements of the Engineer of Record.
 - d. Aggregates shall consist mainly of calcium or magnesium carbonate, e.g., limestone or dolomite, and containing 40 percent or less quartz, chert or flint.

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- e. The maximum size used in a particular location shall be consistent with the form and dimensions of the section being placed, with the location and spacing of the reinforcing steel and with the method of vibration. The aggregate sizes shall be such as will produce dense, uniform concrete, free of rock pockets, honeycombs, or other irregularities.
 - f. Combined aggregate gradation for slabs and other designated concrete shall be 8% to 18% for large top size aggregates (1-1/2-inch) or 8% - 22% for smaller top size aggregates (1-inch or 3/4-inch) retained on each sieve below the top size and above the No. 100.
 - g. Recycled Crushed Concrete Aggregate: Crushed structural concrete is permitted for use as coarse aggregate when shown by testing to produce concrete of adequate strength and durability, and these are found acceptable to the Engineer of Record.
 - 2. Fine Aggregate: Uniformly graded, clean sand, free from excessive fines, organic materials or other deleterious materials. Free of materials with deleterious reactivity to alkali in cement.
 - 3. Combined Aggregate Gradation: Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large size aggregates (1 1/2 in.) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 in.) retained on each sieve below the top size and above the No. 100.
 - D. Water: ASTM C1602 clean, free from deleterious matter. Non-potable water is acceptable if meets the chemical content limits of ASTM C1602.
 - E. Recycled (Reclaimed) Aggregates:
 - 1. Use only in below grade work or concrete to be covered in its final condition. Do not use in integrally colored concrete.
 - 2. Maximum [20%] of total aggregates by weight.
 - 3. Where recycled aggregates are used, furnish recycled content documentation to meet LEED 4.1 & 4.2 per LEED requirements.
 - 4. Furnish regional material documentation to meet LEED 5.1 & 5.2 per LEED requirements.
 - 5. Use one source for each required type throughout the project.
 - 6. Testing per Greenbook Standard Specifications for Public Works Construction 2006 Edition.
- 2.7 ADMIXTURES
- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified:
 - 1. BASF SE Corporation
 - 2. Euclid Chemical Company
 - 3. Grace Construction Chemicals
 - 4. Sika AG Corporation
 - B. General: Only if accepted by the Owner's Representative in accordance with ACI 318/318R 3.6 if they comply with requirements of ASTM C494. Where more than one is used, admixtures shall be compatible. Use of admixtures shall be consistent throughout Work.
 - 1. Where specified herein do not use other admixtures without the written acceptance of the Architect.
 - 2. Prohibited Admixtures: Admixtures containing intentionally-added chlorides are not permitted. Do not use admixtures that will negatively impact the visual finish of concrete exposed to view.
 - 3. Limit VOC content per Section 01 81 13 to meet LEED Certification requirements.
 - C. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

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- D. Air Entrainment Admixture: ASTM C260/C260M.
- E. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- F. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- G. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- H. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- I. Accelerating Admixture: ASTM C494/C494M Type C.
- J. Retarding Admixture: ASTM C494/C494M Type B.
- K. Water Reducing Admixture: ASTM C494/C494M Type A.

2.8 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
 - 1. ASTM E 1745, Class A, not less than 15 mils thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape. Plastic Vapor Retarder shall have a water-vapor transmission rate no greater than .010 perms (grain/h xft² in x Hg) when tested in accordance with ASTM E96.
 - 2. Available Products:
 - a. Alumiseal Corporation; Zero Perm Vapor Barrier.
 - b. Fortifiber Corporation; Moistop Ultra A.
 - c. Raven Industries Inc.; Vapor Block 15.
 - d. Reef Industries, Inc.; Griffolyn Type 105
 - e. W.R. Meadows, Inc.; Plasmatic Core.
 - 3. Single-ply polyethylene is prohibited.
 - 4. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
 - 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
 - 3. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 - 4. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 8000 pounds per square inch.

2.9 BONDING AND JOINTING PRODUCTS

- A. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- B. Waterstops: Bentonite and butyl rubber.
 - 1. Configuration: As indicated on drawings.
 - 2. Products:
 - a. CETCO, a division of Minerals Technologies Inc; WATERSTOP RX:
www.mineralstech.com/#sle.
- C. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.
 - 1. Material: ASTM D1751, cellulose fiber.

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2.10 CURING MATERIALS

- A. Curing compounds shall have a VOC limit of 200 g/l.
- B. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- C. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- D. Low-Solids, Non-Membrane-Forming, Silicate Curing Compound: Water-based, reactive silicate liquid.
- E. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Clear, liquid sealer for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
 - 1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 - 2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 - 3. VOC Content: Less than 100 g/L.
- F. Curing Compound, Non-Dissipating: Liquid, membrane-forming, clear, nonyellowing acrylic; complying with ASTM C309.
 - 1. Vehicle: Water-based.
- G. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
 - 1. Vehicle: Water-based.
 - 2. VOC Content: OTC compliant.
- H. Moisture-Retaining Sheet: ASTM C171.
 - 1. Curing paper, regular.
 - 2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.
- I. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.
- J. Water: Potable, not detrimental to concrete.

2.11 CONCRETE MIXTURES, GENERAL

- A. Review: Do not begin concrete operations until proposed mix has been reviewed by architect.
- B. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. The mixes shall be submitted on mix design submittal form at the end of the specification.
 - 1. Procurement of concrete mix design is responsibility of Contractor.
 - 2. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 - 3. At the discretion of the Engineer of Record a manufacturer's laboratory may also be approved to perform trial batching. The Manufacturer's lab must be run under the direct supervision of a Professional Engineer and technicians performing the tests must be Both ACI Concrete Field

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Testing Technician Grade I and Laboratory Testing Technician grade I certified. The facilities must be adequate to properly perform the testing required.

- C. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 2. Proportion light-weight concrete according to ACI 211.2 and ACI 301.
- D. Mix design submittal shall include:
1. Project name
 2. Project component which pertains to submitted mix design
 3. Admixtures
 4. Historical break data from past projects on which the proposed mix was used
 5. General Contractor or Construction Manager review stamp
- E. Supplementary Cementitious Materials (SCM): Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent, or as noted otherwise within this specification, without exceeding the following limits:
1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 2. Fly Ash: [25] [60] percent.
 3. Ground granulated blast-furnace slag: [50] [70] percent.
 4. Combined Fly Ash and Ground Granulated Blast-Furnace Slag: [50] [80] percent, where neither component exceeds [50] percent.
 5. Silica Fume: [10] [15] percent.
 6. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: [50] [60] percent with fly ash or pozzolans not exceeding [25] percent and silica fume not exceeding [10] percent.
- F. Where concrete is exposed to deicing chemicals, limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- G. Limit water-soluble, chloride-ion content in hardened concrete to the limits specified in ACI 318.
- H. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability. See wiki commentary
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use accelerating or water-reducing and accelerating admixture in concrete, as required, for cold weather placement or when acceleration of setting time is required.
 4. Use high range water-reducing in all fiber concrete pumped concrete, self-consolidating concrete and any concrete with water/cementitious materials ratio below 0.50.
 5. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

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- I. Mix Adjustments: Provided that no additional expense to owner is involved, contractor may submit for architect's review requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.12 CONCRETE MIX DESIGN

A. Definition of Mix Properties:

1. Concrete strength (f'c) is the minimum compressive strength at 28 days (or 56 days where specified) , tested in accordance with ASTM C39.
2. Aggregate size is the largest of the coarse aggregate.
3. Slump shall be measured at the point of delivery in accordance with ASTM C143. Slump tolerance shall meet the requirements of ACI 117. Slump can be increased with use of a high-range water-reducer to improve workability of mix. After addition of high-range water-reducer, slump shall not exceed 9" at point of delivery.
4. Air content is by volume and may be plus or minus 1.5 percent at point of delivery.
5. Water/cementitious materials ratio is specified by weight.
6. Drying shrinkage limit is percentage change in length after 28 days of drying when tested as per ASTM C157 with 4 inches x 4 inches x 11 inches specimen moist cured 7 days prior to drying.

B. Foundations: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (f'c): 5000 psi at 56 days.
2. Maximum SCM Replacement ratio: 50percent.
3. Maximum Aggregate Size: 1-1/2 inch.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 2 percent.
6. Shrinkage Limit: 0.045 percent.

C. Slab-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (f'c): 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Maximum SCM Replacement ratio: 50 percent.
4. Maximum Aggregate Size: 1-1/2 inch.
5. Slump Limit: 4 inches, plus or minus 1 inch.
6. Air Content: 6 percent for concrete exposed to freeze/thaw cycles.

D. Normal Weight Concrete Fill in Decking: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (f'c): 4000 psi at 28days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Maximum SCM Replacement ratio: 50 percent.
4. Maximum Aggregate Size: 1 inch.
5. Slump Limit: 5 inches, plus or minus 1 inch before admixture(s)
 - a. Pumped Concrete Slump Limit: 9 inches maximum at truck, 7 1/2 inches maximum at hose delivery.
6. Shrinkage Limit: .040 percent at 28 days.

E. Fill Below Foundations: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (f'c): 500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50

F. Concrete Exposed to Freeze-Thaw Cycles: Proportion normal-weight concrete mixture as follows:

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1. Minimum Compressive Strength (f'c): 5000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Maximum SCM Replacement ratio: 15 percent.
4. Maximum Aggregate Size: 1 inch.
5. Slump Limit: 5 inches, plus or minus 1 inch.
6. Air Content: 6 percent.

2.13 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
 1. The batching plant shall be equipped with an electric metering device capable of determining moisture content of sand.
 2. Begin the mixing operation within thirty minutes after the cement has been intermingled with the aggregates.
 3. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes. Alternatively a retarding admixture may be used where results from testing can be provided for approval by the Engineer of Record.
- C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 EXECUTION

3.1 PREPARATION

- A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with

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manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.2 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Place concrete for floor slabs in accordance with ACI PRC-302.1.
- C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- D. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.4 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.5 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.
- B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
 - 1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15.
 - 2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15.
 - 3. Under Carpeting: F(F) of 25; F(L) of 20.
 - 4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25.
- C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.
- D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

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- E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.6 CONCRETE FINISHING

- A. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
 - 3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.
- C. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 - 3. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

3.7 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Surfaces Not in Contact with Forms:
 - 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 - 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - 3. Final Curing: Begin after initial curing but before surface is dry.

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3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Post-installed concrete anchors, per ICC-ES recommendations.
 - 5. Verification of use of required design mixture.
 - 6. Concrete placement, including conveying and depositing.
 - 7. Curing procedures and maintenance of curing temperature.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Water Content and W/cm: In accordance with AASHTO T318.
 - 5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 6. Compression Test Specimens: ASTM C31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 and 56 days, when specified.
 - a. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
 - b. Number of specimens in each set shall follow requirements of ACI 318 Section 5.
 - 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi, when the specified strength is 5000 psi or less; or by more than 10 percent of specified strength, when the specified strength is above 5000 psi.
 - 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

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10. Monthly charts and compressive strength, w/cm and air content will be sent to all parties on the pre-concrete conference distribution list.
 11. Non-compliant Test Reports: All test reports indicating non-compliance should be e-mailed or faxed immediately to all parties on the test report distribution list. Copies shall be distinguishable from the originals.
 12. Nondestructive Testing: Rebound hammer, ultrasonic, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
 - a. If test results indicate that compressive strength requirements have not been met, the Contractor shall justify that the load carrying capacity of the structure has not been reduced. Carry out tests of cores drilled from the area in question as directed by the Architect in accordance with ASTM C42 and ACI 318 Section 5.6.5.
 - b. If the compressive tests of the core specimens fail to show the compressive strength specified, the concrete shall be deemed defective and shall be replaced or adequately strengthened in a manner acceptable to the Architect. Perform load tests as outlined in ASTM C39, as directed by the Architect, on the questionable portion of the Work.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- F. Reinforcing Steel
1. Notify the testing agency and the Architect at least 48 hours before concrete is to be poured or reinforcing is covered up.
 2. Before any concrete is poured on any particular portion of the building, the reinforcing steel and form dimensions will be inspected by the Testing Agency. Any errors or discrepancies shall be corrected before concrete is placed.
 3. In addition to other required inspections, the following are subject to Special Inspection as per IBC Chapter 1704.4:
 - a. Placement of Reinforcing Steel
 - b. Welding of Reinforcing Steel
 4. A special inspector from the Testing Agency shall be present during all field bending of reinforcement.
 5. Installation of deformed bar anchors to be tested in accordance with Section 7.1 of AWS D1.1.
 6. Welding of Reinforcement: There shall be continuous inspection during all welding of reinforcement. All butt welds to be inspected using radiographic testing. At the Owners option recognized non-destructive tests such as resistance, Magnetic Particle Examination, and Liquid Penetrant Inspection may be used to inspect the welds.
 7. Comply with ICC-ES approvals with respect to special inspection required during installation.
 8. Testing and inspection of mechanical splices and reinforcing couplers to conform to manufacturer's recommendations and ICC-ES approval.
- G. Survey and Adjustment: Continuously observe formwork operations, record such observations on a daily basis, and submit reports of the results. Instrument check forms before and during concrete placement to assure no movement has taken place. Make appropriate corrections to reposition displaced forms.
1. Measure floor and slab flatness and levelness according to ASTM E1155 within 24 hours of finishing.

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2. Certify, by written report submitted on a weekly basis, for each level and story that the elevations, finish lines and building lines of the hardened concrete are within tolerances, as substantiated by transit survey also that all embeds and inserts have been installed within tolerance.

3.9 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.10 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.
- B. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

3.11 CONSTRUCTION SITE WASTE MANAGEMENT (CONCRETE)

- A. Segregate materials by types for recycling, such as wood, stone, metal, etc.
 1. Designate areas for materials that can be reused on site such as formwork, rebar cutoffs, and fill.
 2. Submit documentation for waste diversion calculations per Section 01 74 19 to meet LEED Certification requirements.
- B. Ready-Mix supplier to have gray water system to use recycled water in plant operations
Contractor to give preference to such a supplier, for exception contractor must demonstrate due diligence in trying to locate a ready-mix supplier with this type of facility.

END OF SECTION

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SECTION 034500

ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Plant precast reinforced architectural concrete units and supplementary items necessary for installation.
 - 1. Architectural precast concrete cladding units.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.

1.2 DEFINITIONS

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, approved by Architect.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

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2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.
 1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Design Mixtures: Manufacturer/fabricator's detailed ingredients list for each concrete mixture. Include compressive strength and water-absorption tests.
- C. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate details at building corners.
 1. Indicate separate face and backup mixture locations and thicknesses.
 2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 4. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 5. Indicate relationship of units to adjacent materials.
 6. Indicate joints, reveals, and extent and location of each surface finish.
 7. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- D. Concrete-Faced Unit Samples for Verification Purposes: Design reference samples for verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
- E. Pre-Production Sample Panels: After sample approval and before fabricating architectural precast units, produce sample units for review by Architect. Produce as many sample units as required, but not less than a minimum of two sample panels approximately 16 sq. ft. in area for review by Architect to verify selections made under Sample submittals. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 1. Locate panels as indicated or, if not indicated, as directed by Architect.
 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.

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4. Demolish and remove field sample units when directed by Architect.

- F. Range Samples: After sample panel approval and before fabricating architectural precast concrete units, produce a minimum of three sets of samples, approximately 16 sq. ft. (1.5 sq. m) in area, representing anticipated range of each color and texture on Project's units. Maintain one set of range samples at Project site and remaining sets at manufacturer's plant as color and texture approval reference.

1.5 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
1. Results that materials, including water, in concrete mix are free of ferrous or other material which will cause surface staining during curing operations or upon exposure to weather.
 2. Results that aggregates have a stain index of less than 20 according to ASTM C 641.
- C. Source Quality-Control Submittals:
1. Source Quality-Control Programs: For architectural precast manufacturer.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
1. Certification Program Participant: Participates in one of following:
 - a. PCI's plant certification program and designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.
 - b. APA's "Plant Certification Program for Production of Architectural Precast Concrete Products" and designated an APA-certified plant.
- B. Installer Qualifications:
1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

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- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products" unless more stringent requirements are indicated.
- F. Welding: Qualify procedures and personnel according to AWS qualification requirements and following:
 - 1. AWS D1.1/D.1.1M, "Structural Welding Code - Steel".
 - 2. AWS D1.4, "Structural Welding Code - Reinforcing Steel".

1.7 MOCKUPS

- A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 - 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 - 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 - 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver units in such quantities and at such times to limit unloading units temporarily on ground. Support units during shipment on nonstaining shock-absorbing material.
- B. Storage: Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping, or other physical damage.
- C. Handling: Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage. Lift and support units only at designated points shown on Shop Drawings.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- C. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 2. Other Loads: As indicated on Drawings.
- D. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
 2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
- E. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.
- F. Building Maintenance Equipment: Engineer units supporting building maintenance equipment to resist pull-out and horizontal shear forces transmitted from equipment.
- G. Vehicular Impact Loads: Engineer precast units acting as vehicular barriers for passenger cars to resist a single 6000 lb service load and 10,000 lb ultimate load applied horizontally in any direction to the unit, with anchorages or attachments capable of transferring this load to the structure. Engineer units assuming the load to act at a height of 18 in above the floor or ramp surface on an area not to exceed 1 sq ft.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

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2.4 Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.5 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes.
- B. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent surface or joint treatments of concrete.

2.6 REINFORCING MATERIALS

- A. Reinforcing Bars: One of both of the following as required:
 - 1. Reinforcing Bars: ASTM A 615 / A 615M, Grade 60, deformed.
 - 2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706 / A 706M, deformed.
- B. Steel Bar Mats: ASTM A 184 / A 184M, fabricated from ASTM A 615 / A 615M, Grade 60 or ASTM A 706 / A 706M, deformed bars, assembled with clips.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn or galvanized steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497 / A 497M, flat sheet.
- E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.7 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray for non-exposed backup concrete, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, mix gray, white, tan, or a combination to produce exposed finish color selected, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials: Not to be used in face mixture; allowed in back of unit mixture only
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 - 3. Metakaolin Admixture: ASTM C 618, Class N.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

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1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining. Uniformly or gap graded to match approved sample.
 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
- D. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, non-fading, and alkali resistant.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer/fabricator to be compatible with other required admixtures.
- G. Chemical Admixtures: Certified by manufacturer/fabricator to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.8 ANCHORS, CONNECTORS, AND MISCELLANEOUS MATERIALS

- A. General: Select anchors and connectors for type, grade, and class required to comply with performance requirements and produce connections suitable for environmental exposure.
1. Shop-Primed Finish: For steel items and connections exposed to interior and conditioned areas, prepare surfaces of non-galvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 or SSPC-Paint 25 according to SSPC-PA 1.
 2. Zinc-Coated Finish: For steel items and connections exposed to exterior and unconditioned areas, Zinc coated by hot-dip process in accordance with ASTM A123/A123M, after fabrication, or ASTM A153/A153M, as applicable.
 - a. Galvanizing Repair Paint: Touch up damaged galvanized surfaces in accordance with ASTM A780/A780M or SSPC-Paint 20.
- B. Carbon-Steel Shapes and Plates: ASTM A 36 / A 36M.
- C. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- D. Carbon-Steel Plate: ASTM A 283 / A 283M.
- E. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- F. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
- G. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- H. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A / ; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 / ; and flat, unhardened steel washers, ASTM F 844.

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- I. Welding Electrodes: Comply with AWS standards.
- J. Accessories: Cast-in structural steel anchors, inserts, plates, angles, clips, hangers, shims, bearing pads, and other similar accessories required to install units.

2.9 GROUT MATERIALS

- A. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107 of consistency suitable for application within a 30-minute working time.

2.10 CONCRETE MIXTURES

- A. Mix Designs: Prepare design mixtures for each type of precast concrete required.
 - 1. Limit use of fly ash and silica fume to 20 percent of Portland cement by weight; limit metakaolin and silica fume to 10 percent of Portland cement by weight. Not allowed in face of unit mix.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength: 5000 psi minimum at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 6 percent by weight or 14 percent by volume according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.11 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

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- B. Maintain molds to provide completed units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished Work.
 - 2. Edges and corners shall be uniformly chamfered or radius as indicated on the Drawings.

2.12 FABRICATION

- A. Fabrication Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified in this Section:
 - 1. PCI MNL 117.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. General: Fabricate units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with fabrication quality standard, product tolerances, and position tolerances for cast-in items.
- C. Connection Hardware:
 - 1. Fabricate cast-in anchors, inserts, plates, angles, and other anchorage hardware with sufficient anchorage and embedment to comply with delegated engineering.
 - 2. Accurately position for attachment of loose hardware, and secure in place during precasting operations.
 - 3. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 4. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- D. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete.
- E. Cast-in openings larger than 10 in in any dimension. Do not drill or cut openings without Architect's approval.
- F. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement:
 - 1. Clean reinforcement of loose rust and mill scale and other materials that reduce or destroy bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcement to maintain at least 3/4 in minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Place reinforcing steel to maintain at least 3/4 in minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 in when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

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5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by delegated engineering. Offset laps of adjoining widths to prevent continuous laps in either direction.
- G. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- H. Placing Concrete:
 1. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
 2. Place face mixture to a minimum thickness after consolidation of greater of 1 in or 1.5 times maximum aggregate size, but not less than minimum reinforcing cover specified.
 3. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in units.
 4. Place backup concrete mixture to ensure bond with face-mixture concrete.
 5. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
- I. Hot and Cold Weather Concrete Placement: Comply with PCI MNL or ACI 306.1 procedures for cold weather concrete placement and ACI 305R recommendations for hot weather concrete placement.
- J. Handling Units: Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
- K. Curing: Cure concrete, according to PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- L. Defective Units: Discard and replace units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's and Owner's approval.

2.13 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.14 CONCRETE-FACED UNIT FINISHES

- A. Finishes, General: Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample, sample panels, mockups and as follows:

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1. Finish Selections: As scheduled or as indicated in Design Selections; match approved sample units for aesthetic purposes.
 2. Textured-Surface Finish: Impart by form liners.
- B. Exposed Top, Bottom, and Sides Surfaces: Finish exposed surfaces to match face surface finish.
- C. Exposed Back Surfaces: Finish exposed back surfaces with smooth, steel-trowel finish.
- D. Unexposed Surfaces: Finish unexposed surfaces with float finish.

2.15 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner may employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing architectural precast concrete panels in accordance with PCI MNL 117.
- C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. Quality Control Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 2. Cores will be tested in an air-dry condition.
 3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 4. Test results will be made in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

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- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Acceptance of Building Structural Frame: Do not install units until supporting cast-in-place concrete building structural framing has attained minimum allowable design compressive strength, supporting structural steel framing, or other structure is complete.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. PCI MNL 127 Standards and Guidelines for the Erection of Precast Concrete Products.
 - 2. Respective manufacturer/fabricator's written installation instructions.
 - 3. Accepted submittals.
 - 4. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 ERECTION

- A. Erection: Install units level, plumb, in alignment, and square within specified allowable tolerances.
 - 1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 2. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of concrete.

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3. Unless otherwise indicated, maintain uniform joint widths of 3/4 in.
- B. Attachments, General: Connect units in position by bolting, welding, or grouting.
- C. Bolted Connections: Use lock washers, lock nuts, or other acceptable means to prevent loosening of bolted connections.
- D. Welding: Perform welding in compliance with AWS D1.1/D1.1M and AWS D1.4 with qualified welders.
 1. Protect units from damage by field welding or cutting operations, and provide noncombustible shields as required.
 2. Repair damaged galvanized steel surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces.
 3. Repair prime painted steel by cleaning and re-priming damaged painted surfaces.
- E. Grouting Connections:
 1. Grout connection block-outs after final adjustment.
 2. Retain grout in place until hard enough to support itself.
 3. Pack spaces with stiff grout material, tamping until voids are completely filled.
 4. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
 5. Keep grouted joints damp for not less than 24 hours after initial set.
 6. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.5 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
- B. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:
 1. Erection of architectural precast panels.
- C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

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- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS

- A. Repair exposed surfaces of units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Architect and Owner. Architect and Owner reserves right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired Work, when viewed in typical daylight illumination from a distance of 20 ft.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged units if repairs do not comply with requirements.

3.8 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Cleaning: After erection and completion of joint treatment, clean exposed surfaces of units to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to manufacturer/fabricator's written recommendations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

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SECTION 044200

EXTERIOR STONE CLADDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes exterior stone cladding system and supplementary items necessary to complete its installation, including but not limited to the following:
 - 1. Dimension stone panels, mechanically anchored on architectural precast concrete.
- B. Related Requirements:
 - 1. Refer to Division 1 Section Field Test for Air and Water Leakage.
 - 2. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
 - 3. Refer to Division 3 Section 034500 Architectural Precast Concrete for casting stone panels in architectural precast concrete units.
 - 4. Refer to Division 7 Section Joint Sealants for sealing joints in dimension stone cladding system with elastomeric sealants.

1.2 DEFINITIONS

- A. Definitions contained in ASTM C 119 apply to this Section.
- B. Dimension Stone Cladding Assembly: An exterior wall covering system consisting of dimension stone panels and trim together with anchors, backup structure, secondary weather barrier (sheathing), fasteners, and sealants used to secure the stone to the building structure and to produce a weather-resistant covering.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

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D. Coordination of Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's / Fabricator's technical literature for each variety of stone, stone accessory, and manufactured product.
1. Include manufacturer's / fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
1. Submit plans, elevations, sections, and details showing each stone panel, dimensions, stone retention system, joint size and treatment, finish, and any special cutouts for other trades.
 - a. Indicate false joints, reveals and copings.
 - b. Show direction of veining, grain, or other directional patterns.
 - c. Show large-scale details as required.
 2. Show locations and details of joints both within dimension stone cladding system and between dimension stone cladding system and other construction.
 3. Include details of sealant joints.
 4. Show locations and details of anchors and backup structure.
 5. Include large-scale shaded elevations and details of decorative surfaces and inscriptions.
- C. Stone Samples for Verification: Sets for each variety, color, and finish of stone required; not less than 12 in square.
1. Submit five sets consisting of at least five Samples, exhibiting extremes of the full range of color and other visual characteristics expected and will establish the standard by which stone will be judged.
 - a. One set of the accepted color and finish range samples shall be kept at the Project site for use by the Architect when reviewing the installed work.
 - b. One set of the accepted color and finish range samples shall be kept at the Architect's offices.

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- c. One set of the accepted color and finish range samples shall be kept at the quarry for use by the Architect when reviewing stone production.

D. Sealant Samples for Verification: For each type and color of joint sealant required.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Material Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
 - 1. Stone Test Reports: For each stone variety proposed for use on Project, provide test data indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous three years.
 - 2. For metal components, indicate chemical and physical properties of metal.
 - 3. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Division 07 Section "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.
- D. Preconstruction test reports.
- E. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- F. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For stone cladding to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.7 QUALITY ASSURANCE

- A. Manufacturer / Fabricator Qualifications: Manufacturer / Fabricator with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.
- B. Installer Qualifications:

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1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar in scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel, AWS D1.2/D1.2M, "Structural Welding Code - Aluminum or AWS D1.3, "Structural Welding Code - Sheet Steel."

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Stone Testing: If Material Test Reports are unavailable or unacceptable, Owner may engage a qualified independent testing agency to perform preconstruction testing.
1. Furnish test specimens that are representative of materials proposed for incorporation into the Work.
 2. Physical Property Tests: For each stone variety proposed for use on Project, tested for compliance with physical property requirements, other than abrasion resistance, according to referenced ASTM standards.
 3. Flexural Strength Tests: For each combination of stone variety, thickness, orientation of cut, and finish, proposed for use on Project, tested according to ASTM C 880/C 880M, in both wet and dry conditions.
 4. Anchorage Tests: For each combination of stone variety, orientation of cut, finish, and anchor type proposed for use on Project, tested according to ASTM C 1354/C 1354M.
- B. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates according to Division 7, Section "Joint Sealants."

1.9 MOCKUP

- A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 - b. Include window opening with stone returns and trim.
 - c. Include sealant-filled joint complying with requirements in Division 07 Section "Joint Sealants." Include stone to dissimilar material joints.
 - d. Include an area that has been damaged and repaired.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.

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4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.10 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
 1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
 2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
 - a. Stone damaged or broken in shipment shall be replaced with new material to match the original material.
- B. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.

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- C. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

1.12 FIELD CONDITIONS

- A. Protect dimension stone cladding during erection by doing the following:
 - 1. Cover tops of dimension stone cladding installation with non-staining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 in down both sides and hold securely in place.
 - 2. Prevent staining of stone from pointing mortar, sealants, and other sources. Immediately remove such materials without damaging stone.
 - 3. Protect base of walls from rain-splashed mud and pointing mortar splatter by coverings spread on ground and over wall surface.
 - 4. Protect sills, ledges, and projections from pointing mortar and sealant droppings.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace dimension stone cladding damaged by frost or freezing conditions. Comply with cold-weather construction and protection requirements for masonry contained in ACI 530.1/ASCE 6/TMS 602.
- C. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in ACI 530.1/ASCE 6/TMS 602.
- D. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F or when joint substrates are wet.
- E. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.13 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
 - 1. Coordinate concrete ledge heights and locations with stone materials and project finish grade elevations.
- B. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing regrets, and similar items to be used by dimension stone cladding Installer for anchoring, supporting, and flashing of dimension stone cladding assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.

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- C. Time delivery and installation of dimension stone cladding to avoid extended on-site storage and to coordinate with work adjacent to dimension stone cladding.

1.14 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturers standard form, signed by exterior stone cladding manufacturer and installer, agreeing to repair or replace exterior stone cladding system that fails in materials and workmanship at no additional cost.
1. Coverage: Defects include, but are not limited to, evidence of the following:
 - a. Abnormal deterioration or aging.
 - b. Structural failure.
 - c. Permanent deformation or loosening of parts by winds within design criteria.
 - d. Deterioration or discoloration of finishes.
 2. Warranty Period: 5 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
- C. If exploratory work is required to determine the cause of the defects, the cost of such work shall be borne by the Contractor if the work is found to be defective as judged by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance and physical properties.
1. For stone types that include same list of varieties and sources, provide same variety from same source for each.
 2. Quarry stone in manner to ensure that as-quarried block orientations yield finished stone with required characteristics.
 3. Provide matched blocks for each type, variety, color, and quality of stone. Extract blocks from a single bed of quarry stratum reserved for Project unless stones from randomly selected blocks are acceptable to Architect.

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- B. Source Limitations for Other Materials: Obtain each type of stone accessory, sealant, and other material from single manufacturer for each product.
- C. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. General: Design stone anchors and anchoring systems according to ASTM C 1242.
 - 1. Stone anchors shall withstand not less than two times the weight of the stone cladding in both compression and tension.
- C. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
 - 1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 - 2. Other Loads: As indicated on Drawings.
- D. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
 - 1. Deflection Due to Weight of Stone Cladding Assembly:
 - a. Deflection: As indicated on Drawings.
 - 2. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
 - 3. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
- E. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.
- F. Deflection of Assembly: Limit deflection in each assembly caused by the loads and thermal movements indicated, acting singly or in combination with one another, to not more than 1/720 of assembly's clear span or the following, whichever is smaller:
 - 1. Deflection Parallel to Wall Plane: 1/16 inch, measured in plane of wall.
 - 2. Deflection Perpendicular to Wall Plane: 1/4 inch, measured perpendicular to wall.
- G. Water Penetration under Static Pressure: Test in accordance with ASTM E 331 as follows:

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1. No evidence of water penetration when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).
- H. Maximum Water Leakage: No uncontrolled water penetrating assemblies. Water leakage does not include infiltration and condensation water controlled by flashing and gutters that is drained to exterior. Coordinate with other adjacent exterior wall components.
- I. Energy Performance:
 1. Air leakage for the system of not more than 0.06 cfm/sf (0.30 L/s/sm) at a minimum static-air-pressure differential of 6.24 lbf/sf (300 Pa) when tested in accordance with ASTM E 283.
- J. Thermal Movements: Provide dimension stone cladding system that allows for thermal movements resulting from ambient and surface temperatures changes by preventing displacement of stone, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- K. Safety Factors for Stone: Design dimension stone cladding assembly to withstand loads indicated without exceeding stone's allowable working stress determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:
 1. Safety Factor for Oolitic Limestone: 8.
 2. Safety Factor for Dolomitic Limestone: 6.
 3. Safety Factor for Concentrated Stresses: 4 for granite and 10 for stone varieties other than granite.
- L. Design stone anchors, including framing systems and connections to building structure, to withstand loads indicated without exceeding allowable working stresses established by the following:
 1. For Structural Steel: AISC 360.
 2. For Cold-Formed Steel: AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
 3. For Cold-Formed Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
 4. For Aluminum: AA ADM-1, "The Aluminum Design Manual."
 5. For Cast-in-Place and Postinstalled Fasteners in Concrete: One-fourth of tested capacity when installed in concrete with compressive strength indicated.
 6. For Postinstalled Fasteners in Masonry: One-sixth of tested capacity when installed in masonry units indicated.
- M. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system.
 1. Structural-steel fabrication and erection tolerances are specified in Division 05 Section "Structural Steel Framing."

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- N. Corrosion and Staining Control: Prevent galvanic and other forms of corrosion as well as staining by isolating metals and other materials from direct contact with incompatible materials. Materials shall not stain exposed surfaces of stone and joint materials.

2.4 LIMESTONE

- A. Material Standard: Comply with ASTM C568/C568M.
- B. Varieties and Sources: Subject to compliance with requirements, provide the following:
1. Stone Types and Finish Descriptions: As scheduled or as indicated in Design Selections.
- C. Cut:
1. Orientation of Veining: As indicated.
- D. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- E. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- F. Thickness: Not less than 2 in unless otherwise indicated; thickness as required for project conditions.

2.5 ANCHORS AND FASTENERS

- A. General:
1. Self-drilling, self-tapping TEK type fasteners are not allowed for wind or dead load connections.
 2. Dielectric insulators, in addition to metal coatings, shall be used when connecting dissimilar metals.
 3. Connections shall include locking devices which prevent movement due to dynamic or vibration loads, thermal or other cyclical conditions when appropriate.
- B. Anchors in Direct Contact with Stone: Fabricate anchors, including shelf angles, from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 304; temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A 276, Type 304.
- C. Shelf Angles for Limestone: Fabricate shelf angles from hot-dip galvanized steel, ASTM A 36/A 36M for materials and ASTM A 123/A 123M for galvanizing.
- D. Cast-in-Place Concrete Inserts Not in Direct Contact with Stone: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel, with capability to sustain, without failure, a load equal to 4 times the loads imposed as determined by testing per ASTM E 488, conducted by a qualified independent testing agency. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

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- E. Postinstalled Anchor Bolts for Concrete and Masonry: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.
 - 1. For stainless steel, use annealed stainless-steel bolts, nuts, and washers; for bolts, ASTM F 593; and for nuts, ASTM F 594, Alloy Group 1.
 - 2. For galvanized-steel shelf angles and backup structure, use carbon-steel bolts, nuts, and washers; for bolts, ASTM A 307, Grade A; for nuts, ASTM A 563, Grade A; and for washers, ASTM F 436; all hot-dip or mechanically zinc coated.
- G. Weld Plates for Installation in Concrete: Comply with Division 5 Section, "Metal Fabrications."

2.6 STONE ACCESSORIES

- A. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.
- B. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
- C. Concealed Sheet Metal Flashing: Fabricated from stainless steel and complying with Division 7 Section "Sheet Metal Flashing and Trim."
- D. Cementitious Dampproofing for Limestone: Cementitious formulation recommended by ILI and nonstaining to stone; compatible with joint sealants and noncorrosive to anchors and attachments.
- E. Weeps and Vents: Provide one of the following:
 - 1. Cellular Plastic Weep Hole/Vents: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard. Hold back 1/8 in from exterior face of stone.
 - a. Manufacturers and Products:
 - 1) Advanced Building Products, Inc.; Mortar Maze Weep Vents.
 - 2) Heckmann Building Products, Inc.; No. 85 Cell Vent.
 - 3) Hohmann & Barnard, Inc.; QV - Quadro-Vent.
 - 4) Wire-Bond; Cell Vent.
 - 2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.

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- a. Description: Compressed, 200 denier polyester with 90 percent open mesh and bonded with flame retardant adhesive.
 - b. Basis of Design: Mortar Net USA, Ltd.; Mortar Net Weep Vents.
- F. Sealants for Joints in Dimension Stone Cladding: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics that comply with applicable requirements in Division 7 Section "Joint Sealants" and do not stain stone.
- 1. Colors: Provide color of exposed sealants as scheduled or as indicated in Design Selections.
- G. Sealant for Filling Kerfs: Same sealant used for joints in dimension stone

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- 1. Review concrete ledge locations and elevations with stone materials and finish grade elevations.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
- 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF STONE CLADDING, GENERAL

- A. Before setting stone, clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

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- B. Coat limestone with dampproofing to extent indicated below:
 - 1. Stone at Grade: Beds, joints, and back surfaces to at least 12 in above finish-grade elevations.
 - 2. Stone Extending Below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 - 3. Stone with Sloped or Horizontal Profile: Back surfaces.
 - 4. Allow dampproofing to cure before setting dampproofed stone. Do not damage or remove dampproofing while handling and setting stone.
- C. Execute dimension stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.
 - 1. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.
- D. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.
- E. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure dimension stone cladding in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with uniform joints of widths indicated, and with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Maximum Shim Dimension: 1 inch.
- F. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
 - 1. Sealing expansion and other joints is specified in Section 079200 "Joint Sealants."
- G. Seal all joints at dissimilar materials with sealants as specified in Section 079200 "Joint Sealants".
- H. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water, to divert water to building exterior. Extend flashing 6 in at ends and turn up not less than 2 in to form end dams.
- I. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.
 - 1. Place weep holes in joints where moisture may accumulate, including at base of cavity walls and above shelf angles and flashing. Locate weep holes at intervals not exceeding 24 in. Use weeps and vents.
 - 2. Place vents in cavity walls at tops of cavities, below shelf angles and flashing, and at intervals not exceeding 20 ft vertically. Locate vents in joints at intervals not exceeding 60 in horizontally. Use weeps and vents.

3.5 INSTALLATION OF MECHANICALLY ANCHORED STONE CLADDING

- A. Set dimension stone cladding with mechanical anchors without mortar unless otherwise indicated.

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- B. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C 1242.
- C. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.
- D. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.

3.6 INSTALLATION OF JOINT-SEALANTS

- A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.7 INSTALLATION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of walls, do not exceed 1/4 in in 10 ft, 3/8 in in 20 feet, or 1/2 in in 40 feet or more. For external corners, corners and jambs within 20 ft of an entrance, expansion joints, and other conspicuous lines, do not exceed 1/8 in in 10 ft, 1/4 in in 20 ft, or 3/8 in in 40 ft or more.
- B. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 in in 10 ft, 1/4 in in 20 ft, or 3/8 in maximum.
- C. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/4 in in 20 ft or 1/2 in in 40 ft or more.
- D. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/4 in.
- E. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/8 in or a quarter of nominal joint width, whichever is less. For joints within 60 in of each other, do not vary more than 1/8 in or a quarter of nominal joint width, whichever is less from one to the other.
- F. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16 in difference between planes of adjacent units.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

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- B. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:
 - 1. Erection of stone panels.
- C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 ADJUSTING AND CLEANING

- A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and dimension stone cladding that does not match approved samples and mockups.
 - 1. Damaged stone may be repaired if Architect approves methods and results.
- B. Replace damaged or defective work in a manner that results in dimension stone cladding's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean dimension stone cladding as work progresses. Remove excess sealant and smears as sealant is installed.
- D. Final Cleaning: Clean dimension stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION

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SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Structural steel framing members.
- B. Base plates, shear stud connectors and expansion joint plates.
- C. Bolts, washers, and other steel accessories.
- D. Shop and Field Welding.
- E. Grouting under base plates.
- F. Galvanizing.
- G. Prime Painting.
- H. Structural Slide Bearing Assemblies.
- I. Thermal Isolation Assemblies.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
- C. Division 03 Section "Cast-in-Place Concrete" for post-installed concrete anchors.
- D. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
- E. Division 05 Section "Steel Decking" for field installation of shear studs through deck.
- F. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
- G. Division 05 Section "Metal Stairs."
- H. Division 07 Section "Applied Fireproofing."
- I. Division 09 Section "Exterior Painting" and Division 09 Section "Interior Painting" and Division 09 Section "High-Performance Coatings" for surface-preparation and priming requirements.
 - 1. High-Performance Coatings include tile-like coatings for use on exterior and interior substrates.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by American Institute of Steel Construction (AISC) 303, "Code of Standard Practice for Steel Buildings and Bridges."

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- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.
 - C. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
 - D. Heavy Sections: Rolled and built-up sections as follows and subjected to special notch toughness, fabrication, welding and inspection requirements as defined in this specification:
 - 1. Shapes included in ASTM A6 with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.
 - 4. Welded built-up members with plates thicker than 1-1/2 inches if part of the Seismic Load Resisting System.
 - E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.
 - F. Delegated Design: For structural systems which have been designated as Delegated Design, Deferred Submittal, or design-build components per the drawings and/or project specification, the Contractor is required to submit documents (stamped and signed by a licensed engineer in the state where the project is located) for all such components to the Building Official, upon request and Structural Engineer of Record (SEOR) for approval. Delegated design items shall not be installed until the submittal items have been approved by the Building Official, upon request, and the SEOR.
 - G. Action Submittals: Mandatory submittals by the Sub-Contractor which require action on the part of the General Contractor, Construction Manager and Design Professional.
 - 1. General Contractor and Construction Manager: Review, Stamp and Forward to the Design Professional.
 - 2. Design Professional: Review, Stamp and Return to the General Contractor or Construction Manager.
 - H. Informational Submittals: Mandatory submittals by the Sub-Contractor to the General Contractor, Construction Manager and Design Professional which are not returned but kept by each for their project record.
- 1.4 REFERENCE STANDARDS
- A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2025).
 - B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).
 - C. AISC 325 - Steel Construction Manual; 2023.
 - D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
 - E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

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- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- H. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance; 2024.
- I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.
- J. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- K. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series; 2017a.
- L. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.
- M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- O. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

1.5 PERFORMANCE REQUIREMENTS

A. General:

1. The Contractor is responsible for the design of connections when they are not fully defined on the Contract Documents.
2. The Engineer shall be licensed in the state in which the project is located. At the commencement of the project submit a letter signed and sealed by the Engineer that will supervise the steel connection design attesting to this responsibility.
3. At the end of the steel shop drawing submission phase submit a letter, signed and sealed by the Engineer supervising the steel connection design, attesting to the completion of the work.
4. Submit calculations of all connections. Calculations and details shall be clearly keyed to the appropriate members on the construction documents. Calculations shall bear the seal of the Engineer supervising design of the steel connections.
5. When connection calculations are resubmitted, the Contractor shall cloud and identify all changes made due to additions, deletions, and corrections to the calculation. Calculations will be returned as "Not Reviewed" if changes are not identified.
6. Contractor shall not proceed with steel erection until these requirements are fulfilled.
7. The Contractor shall not submit any piece drawing for review until all connections used on that drawing have been reviewed by the Engineer. Drawings submitted with connections that have not previously been submitted for review will be rejected as incomplete.

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- B. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by the structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
1. Select and complete connections using schematic details indicated and AISC 360.
 2. Use LRFD; data are given at factored-load level.
 3. Design composite floor beams for 75% of the uniform load carrying capacity published in table in the AISC Code or the reaction indicated on the framing plans, whichever is greater. No connection shall have a capacity less than 6000 pounds.
 4. Design roof beams for 50% of the uniform load carrying capacity published in table in the AISC Code or the reaction indicated on the framing plans, whichever is greater. No connection shall have a capacity less than 6000 pounds.

1.6 ACTION SUBMITTALS

A. General:

1. Review of submittals if of a general nature only, and responsibility for conformance with the intent of the Contract Documents shall remain with the Contractor. Review does not imply nor state that fabricator has correctly interpreted the Contract Drawings.
2. All submissions shall be in accordance with the submission schedule developed and agreed between the Architect and Contractor at the commencement of the project. Submission shall include dates of order and delivery of materials to the shop and the site.
3. Shop drawing schedule shall allow adequate time for reviews. Submittal shall include all related pieces in an assembled or area. The Contractor shall allow adequate time in shop drawing preparation stage for the dimensioning process and coordination with the Architectural Drawings and those of other disciplines. Submit a schedule for steel shop and erection drawings.

B. Product Data: For each type of product indicated.

C. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of post-industrial and post-consumer recycled content. Include statement indicating costs for each product having recycled content, materials cost only.
2. Product Data for Credit MR 5.1 and Credit MR 5.2. For products and materials that meet or can contribute to the requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to project, cost for each regional material, and fraction by weight that is considered regional.
 - a. For product comprised of components sourced from different locations, include statement indicating (1) distance between project and extraction site and (2) weight contributing to regional extraction.
 - b. For products shipped by rail or water, compute the total travel distance of the project site using a weighted average determined through the following formula: $(\text{Distance by rail}/3) + (\text{Distance by inland waterway}/2) + (\text{Distance by sea}/15) + (\text{Distance by all other means}) \leq 100$ miles. If this total distance is within the 100 mile limit, provide the above documentation for each applicable product component.
3. Environmental Product Declaration (EPD), in compliance with ISO 14025, third-party verified eco-label, for each structural steel product or component. Where not yet available, supply an industry-wide EPD or other product declaration conforming to requirements of LEEDv4.1 MRc2: Building Product Disclosure and Optimization – Environmental Product Declarations, Option 1.

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- a. Provide a Type I or III product specific EPD for each structural steel component as available. If an EPD is not available, provide written notification that the EPD has not been secured.
 4. Health Product Declaration, publicly available manufacturer's inventory, Cradle-to-Cradle v3 Bronze or higher certification, or other USGBC-approved program for LEEDv4.1 MRc4: Building Product Disclosure and Optimization – Material Ingredient Reporting, Option 1, for each concrete mix type or each concrete mix qualifying as an individual product as defined by LEED.
- D. Shop Drawings: Show fabrication of structural-steel components, including anchor rod setting plans, details of layout and connections, fabrication of all members, and element and erection plans. Direct copies of the Contract Documents are not acceptable as a submission from the Contractor.
1. Submit shop drawings to Architect for review and obtain Architect's acceptance prior to start of fabrication. Where shop drawings are resubmitted, the Contractor shall cloud and identify all changes made due to additions, deletions, and corrections to the shop drawing. Shop drawings resubmitted without each change being clouded and identified will be returned for resubmission.
 2. Ensure that language used in the following subparagraph is consistent with submittal stamp used in project.
 3. Only shop drawings marked "No Exceptions Taken" or "Make Corrections Noted, Resubmittal Not Required" may be used by the Contractor in the work. Shop drawings marked "Rejected" or "Revise and Resubmit, Not Accepted for Reasons Given" shall be corrected and completed as required and resubmitted and approved before they are used in the work.
 4. Include layout, member size, and weights, materials used, and beam marks as well as orientation and relation of members to appropriate grid lines and setting elevations for column bases. Reference shop drawings to specific location and detail number on the Structural Drawings.
 5. Include layout, member size, and weights, materials used, and beam marks as well as orientation and relation of members to appropriate grid lines and setting elevations for column bases. Reference shop drawings to specific location and detail number on the Structural Drawings.
 6. Include details of cuts, connections, splices, camber, holes, openings, doubler plates, stiffeners and other pertinent data, including bolt hole sizes, connection materials, and welded joint designations.
 7. Include embedment drawings.
 8. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Identify WPS applicable to each shop weld.
 9. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
 10. Indicate surface preparation and finishes.
 11. Submit plans of all levels locating the edge of slab at perimeter and at interior openings.
 12. Where items such as anchor bolts and inserts are scheduled to be set into concrete or masonry provide setting drawings, templates, instructions and directions for their installation. Coordinate delivery with other work to avoid delay of job progress.
- E. 3-D Detailing Model Review:
1. The Contractor shall provide, and regularly update, a 3-D detailing model, referred to here as Design Model. Design Model shall be in a SDS2 Reader compatible format, to be used for preliminary review of steelwork and for coordination with other disciplines. The Design Model

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will be reviewed by the design team, ahead of piece drawing submittals, to reduce the number of re-submittals, and expedite drawing submittal review.

2. At the commencement of the detailing process, and before any piece drawings are submitted, the Contractor shall make available the lead detailer for a period of no less than 3 days, to work at the Engineers office to coordinate the Design Model and discuss the detailing process.
 3. Before any piece drawing submittal, the Contractor shall provide an update to the Design Model together with a report listing all the beams to be submitted, together with their connection codes. The Engineer shall provide comments on the submitted pieces for the Detailer to incorporate before the corresponding piece drawings are submitted. Any piece drawings submitted without previously being reviewed in the Design Model will be rejected.
 4. The Engineers preliminary review of the Design Model is for general conformance only, and the Contractor shall still submit for review all erection plans and piece drawings as required by these specifications.
 5. The Design Model shall contain at least the following:
 - a. Entities that fully define each steel element and the extent of detailing of each element, including all information that would be included in a standard structural steel shop drawing.
 - b. All steel elements identified in the Contract Documents as well as any other elements required for strength and stability of the completed erected structure.
- F. Erection Procedures:
1. Submit procedures, methods, sequences of erection, temporary shoring and guying, and equipment proposed for erecting structural steel. Erection procedures are submitted for record only and therefore will not be returned to the Contractor.
- G. Jacking and Tensioning Procedures:
1. Submit procedures, methods, sequences of jacking and tensioning, instrumentation, and monitoring devices to be used in the project.
- H. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," and AISC 341 Appendix W for each welded joint whether prequalified or qualified by testing, including items listed below. All submitted Procedures shall be reviewed by the Testing Agency prior to use on the project for conformance with the requirements of AWS D1.1. The Procedures will be submitted to the Engineer for record only.
1. All weld joints shall be qualified for this project by test even if they are pre-qualified. This qualification will be with the same electrodes, processes and procedures that will be used on this project.
 2. Power source (constant current or constant voltage).
 3. Electrode and flux manufacturer and trade name.
 4. Tolerances or the acceptable range of values, applicable to the various welding parameters.
 5. Where backgouging is required provide back gouging criteria (e.g. smoothness, grinding, gouge shape, inspection by the welder, etc.).
 6. For multi-pass welds define sequence and layering of passes.
 7. Welding Procedure Qualification Record (WPQR) Tests: For WPSs that are not pre-qualified per AWS D1.1, submit the supporting WPQR tests results conducted in accordance with AWS D1.1 along with the corresponding WPS.
 8. When the required effective throat thickness of flare groove welds is larger than allowed by Table J2.2 of AISC "Steel Construction Manual", submit data establishing by qualification the consistent production of such larger effective throat thickness. Qualification of effective throat thickness shall be as required by the AISC specification.

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9. For complete penetration butt or groove welds, include test records for the following only at locations specified on the drawings: toughness, (Charpy tests for weld metal), heat affected zone.
 - I. Weld Shrinkage and Distortion Procedures: Submit weld shrinkage and distortion procedures for all welded connections where distortion due to weld shrinkage may cause damage to the steel material. The welding sequence and procedures are to minimize the effect of weld shrinkage, residual stresses, and to maintain erection tolerances. These procedures shall be reviewed by Testing Agency, and then used by Testing Agency to verify conformance. As a minimum, procedures shall be submitted for the following connections:
 1. Welding of continuity plates and doubler plates into the WF columns.
 2. Field welding and bolting of special-moment-frame beam-to-column connection (include beam flange welds, rib welds, connection plate bolting and weld).
 3. Welding ASTM A913 columns to base plates.
- 1.7 INFORMATION SUBMITTALS
- A. Qualification Data: For qualified
 1. Installer
 2. Fabricator
 3. Professional engineer
 4. Testing agency
 - B. Welding certificates.
 - C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
 - D. Mill test reports for structural steel, including chemical and physical properties, regardless of thickness or use. Reports shall comply with ASTM A6.
 1. Submit a mill report for each heat of steel used, and certified fastener reports for all fasteners, including nuts, washers and direct tension indicators prior to the start of fabrication. For unsatisfactory mill test report, retest steel.
 2. Include Charpy test results for heavy sections and for materials where Charpy values are specified. Testing required per AISC Section A3.1c for sections with over 2" flanges with net tension and have CJP welds.
 3. Mill test reports shall include ladle analysis and tensile elongation and bend tests.
 4. Mill reports shall be traceable to individual pieces of steel used.
 - E. Contractor Certificate of Compliance for Materials: Submit a Certificate of Compliance letter stating that the Contractor has reviewed the submitted manufacturer's test reports and certifications, and that the materials being furnished for the project are in conformance with the applicable standards and project documents. The Certificate of Compliance letter shall be submitted along with the manufacturer's test reports and certifications for structural steel, fasteners, welding filler metals, and shear studs.
 - F. Product Test Reports and Certifications: Submit manufacturer's test reports and certifications as listed below. Test Reports and Certifications are submitted for record only and therefore will not be returned to the Contractor. A copy of the test reports and certifications shall be sent to the owner's

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Quality Assurance Agency. The Contractor Certificate of Compliance letter shall accompany the Manufacturer's Certifications.

1. Bolts, nuts, and washers including mechanical properties and chemical analysis. Certifications for high strength bolts shall conform to certification requirements contained in ASTM A325, A490, F1852, F959, F2280.
 2. Direct-tension indicators.
 3. Tension-control, high-strength bolt-nut-washer assemblies.
 4. Shear stud connectors. Shear studs, as supplied, shall meet the requirements of AWS D1.1, Sections 7.2 and 7.3.
 5. Shop primers.
 6. Non-shrink grout.
 7. Welding electrodes, fluxes and shielded gas products. Certifications shall satisfy the applicable AWS A5 and project requirements.
 8. Spray-on fireproofing. Submit certificate issued by paint manufacturer ensuring compatibility between the primer and the spray-on fireproofing.
- G. Source quality-control reports.
- H. Field quality control and special inspection reports.
- I. Survey of existing conditions.
- J. Submit fabricators identification mark system to Testing Agency prior to fabrication.
- K. Environmental Management System (EMS): Submit evidence of an EMS for the steel manufacturers providing material for work of this section. For each steel manufacturing facility, submit copy of registration as per ISO 14001.
- L. Chain-of-custody certification: Submit manufacturer's certification that no open hearth furnaces were utilized in the production of structural steel to be incorporated into the Work. Submit evidence of energy efficiency for steel manufacturers providing material for work of this section. Acceptable certification includes:
1. Bill of Lading indicating source of manufactured steel as North American facility; or,
 2. Manufacturer's certification that structural steel complies with CO2 limitations for crude steel production. Indicate method for calculating CO2 emissions; or,
 3. Manufacturer's certification that structural steel complies with energy efficiency requirements for steel production. Include description of energy efficient processes utilized; or,
 4. Participation in CO2 Breakthrough Program: Manufacturer's certification of participation in CO2 Breakthrough Program.
- 1.8 QUALITY ASSURANCE
- A. Comply with AISC Chapter N minimum quality control and quality assurance requirements.
- B. Comply with applicable provisions of the current edition of the following specifications and documents, except where more stringent requirements are shown or specified:
1. AISC 303 "Code of Standard Practice for Structural Steel Buildings and Bridges."
 2. AISC 360, "Specification for Structural Steel Buildings."
 3. AISC "Steel Construction Manual."
 4. AISC 341 and AISC 341s1, "Seismic Provisions for Structural Steel Buildings" with supplements.

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5. AISC 358, "Pre-qualified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications."
 6. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts." with supplements.
 7. American Welding Society (AWS) D1.1 and D1.8.
 8. Michigan Building Code, current edition.
- C. Testing Agency: Shop and field testing and inspection of steelwork specified in this document or requested by the Owner will be performed by an independent agency engaged by the Owner.
1. The Testing Agency shall be furnished with the following:
 - a. One complete set of fabrication and erection drawings.
 - b. Material bills, cutting lists, order sheets and mill test reports.
 - c. Information regarding time, place of rolling and shipment of materials to shop.
 - d. If requested, representative sample pieces for testing.
 - e. Full and ample means and assistance for testing materials.
 - f. Access and facilities, including scaffolding, temporary work platforms, etc., for testing and inspection at all places where materials or components are stored, fabricated or erected in the mill, shop or field.
 - g. Complete set of welding procedures.
 - h. Welder qualifications.
 - i. AISC fabricator certification documents, QA/QC manual and most recent AISC audit.
 - j. Reports for all Contractor tests and inspections.
 2. In addition to the work specified elsewhere in the Contract Documents, the Testing Agency shall review the following for compliance with project specifications:
 - a. Fastener Installation Procedures.
 - b. WPSs and WPQRs.
 - c. Manufacturer's Test Reports and Certifications.
 - d. Welder qualification.
- D. All work shall be performed by qualified operators experienced in their field of work and as otherwise required by these specifications.
- E. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- F. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE. The erector shall have a minimum of 5 years experience in similar types of erection. Erector shall be able to furnish evidence of ability, facilities, proficiency of personnel, and completed projects with similar structural systems.
- G. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, P3 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- H. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1 for each process, position and joint configuration. Each operator shall have been qualified as prescribed by AWS and shall be approved by the Detroit building department. Qualification performed more than six months prior to the start of the welding by the welder is acceptable, provided written

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documentation is submitted showing that the welder has continued to use the applicable welding process on an ongoing basis since the test was conducted, with no lapse in service exceeding six months.

1. Welder Certificates shall be submitted to Testing Agency prior to welding.
2. Require welders to retake the qualification test if, as determined by the Architect or Testing Agency, there is a reasonable doubt as to the proficiency of the welder. If the welder does not requalify, he shall not perform any welding on the project.
3. In addition to AWS D1.1 requirements on welder Qualification, qualify welders making welds with restricted access (such as welding the bottom flanges of girders to column flanges through cope or access holes in the girder webs) by using a mock-up assembly identical to the actual conditions of producing weldments in the field, using the approved WPS.
4. Welder qualification shall include passing the bend test and Charpy tests when Charpy values are specified for the electrode.

1.9 QUALITY CONTROL

- A. Contractor's Quality Control Plan: Quality Control includes the functions performed by the Contractor to ensure that the material and workmanship of structural steel construction meets the project specifications and applicable standards. The Contractor shall submit a Quality Control Plan that addresses all inspection issues, including fabrication/erection testing and inspection per AWS D1.1 and AISC 341 Appendix Q. The verification testing and inspection carried out by the Testing Agency does not relieve the contractor of the responsibility for conducting their own quality control/inspection program to ensure the requirements of the Contract Documents have been met. The Contractor's Quality Control Plan will be reviewed by the Testing Agency.
- B. Quality Control Inspector Qualifications: Along with Quality Control Plan, Contractor shall submit written qualifications for all inspectors to be assigned Quality Control functions for structural steel work, including general inspection, bolting inspection, welding inspection, and non-destructive testing. Qualifications for welding inspectors shall show evidence of ability to monitor all WPS variables, check weld sizes, and visually detect weld defects.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Do not handle structural steelwork until paint has thoroughly dried. Care shall be exercised to avoid abrasions and other damage.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration. Material shall be kept free from dirt, grease, and other foreign matter.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed, to the acceptance of the Architect, and at no additional cost to the Owner. Materials showing evidence of damage will be rejected and shall be immediately removed from the site.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

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1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.
- D. Requirements for storage and handling of electrodes shall be per AWS D1.1. Additional requirements include:
1. Long term storage of weld consumables shall be indoors, where moisture or dew does not collect, and in undamaged manufacturer's shipping bags, boxes, and containers.
 2. Open Flux Cored Arc Welding (FCAW) electrodes shall be completely covered during hours of non-use (i.e., weekends, nights of nonuse, days of nonuse, etc.). Where rain or dew could be expected to collect (i.e., open floors of erection site, open shop bays, etc.), electrodes shall also be covered.

1.11 COORDINATION

- A. Surveys: Contractor shall conduct field surveys and field verification as required to incorporate existing conditions from previous works, such as foundations and existing buildings, to the work before shop drawings are produced.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions for installation.
- C. Notify the Owner's Representative in sufficient time prior to shop or field fabrication or erection to permit testing and inspection without delaying work.
- D. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

1.12 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Prior to performing fabrication or erection work, there shall be a pre-fabrication and pre-erection meeting to review welding procedures, bolting procedures, and inspection requirements for all welding and bolting operations. The meeting shall include the following individuals: Owner's Representative, Testing Agency, Special Inspector, Steel Fabricator, Erector personnel supervising the shop, field, and quality control work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus post-industrial recycled content is not less than the following:
 1. W-Shapes: 70 percent.
 2. Channels, Angles: 70 percent.
 3. Plate and Bar: 25 percent.

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4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.
- B. Steel Angles and Plates: ASTM A36/A36M, as noted on Contract Drawings.
- C. Steel W Shapes and Tees: ASTM A992/A992M, typical, and ASTM A572, Grade 50 as noted on Contract Drawings.
- D. Channels, Angles, M, S-Shapes: ASTM A36, as noted on Contract Drawings.
- E. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A588, Grade 50.
- F. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, welded structural tubing.
- G. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A847, structural tubing.
- H. Steel Pipe: ASTM A53, Type E or S, Grade B.
 1. Weight Class: As noted on Drawings.
 2. Finish: Black except where indicated to be galvanized.
- I. Heavy Sections: Heavy sections as defined in this specification shall have toughness properties meeting a Charpy V-Notch (CVN) value of 20 ft-lb at 70 degrees F. Testing shall be conducted in accordance with the current AISC specification.

2.2 WELDING MATERIALS

- A. Welding Material: Filler metal requirements shall conform to AWS D1.1 and AISC "Specification for Structural Steel Buildings".
 1. Minimum classified tensile strength of 70 ksi (E70).
 2. Use low hydrogen electrodes as defined by AWS D1.1, unless noted otherwise.
- B. For all CJP welds used on Heavy Structural Sections that are not part of the Seismic Load Resisting System the filler metal shall have a Charpy V-Notch (CVN) toughness of at least 20 ft-lb at 70 degrees F.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts unless noted otherwise; ASTM A563, Grade C, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish. ASTM F1852 Twist-Off Type Torque Control Bolts are a suitable alternative to ASTM A325 bolts.
 1. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with plain finish. Use on all A325 bolts where noted 'slip-critical' or 'fully pre-tensioned' on Structural Drawings.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
 1. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with plain finish. Use on all A325 bolts where noted 'slip-critical' or 'fully pre-tensioned' on Structural Drawings.

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- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain, or Mechanically deposited zinc coating, as noted on drawings.
- E. Unfinished Bolts and Nuts (Machine Bolts) and Threaded Rods: ASTM A307, Grade A, low carbon steel bolts and nuts; ASTM F436, Type 1, hardened carbon-steel washers.
- F. Shear Studs: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B and conform to requirements of AWS D1.1 Section 7.
- G. Unheaded Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable per section S1 and CVN toughness of at least 20 ft-lbs at 65 degrees F per section S4.
 - 1. Configuration: as indicated on drawings.
 - 2. Nuts: ASTM A563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A36 carbon steel.
 - 4. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 5. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C as indicated.
- H. Headed Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable per section S1 and CVN toughness of at least 20 ft-lbs at 65 degrees F per section S4, straight.
 - 1. Nuts: ASTM A563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A36 carbon steel.
 - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 4. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C as indicated.
- I. Threaded Rods: ASTM A 36/A 36M typically or A 572/A 572M, Grade 50 as indicated.
 - 1. Threaded Rod = threaded over entire length
 - 2. Tie Rod = threaded only at connector ends.
 - 3. Nuts: ASTM A563 heavy-hex carbon steel.
 - 4. Washers: ASTM F436, Type 1, hardened carbon steel.
- J. Finish: Plain or Hot-dip zinc coating, ASTM A 153/A 153M, Class C as indicated.
- K. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amscot Structural Products Corp.
 - b. Fluorocarbon Company Limited.
 - c. R.J. Watson Bridge & Structural Engineered Systems.
 - d. Seismic Energy Products, L.P.
 - 2. Mating Surfaces: PTFE and mirror-finished stainless steel
 - 3. Coefficient of Friction: Not more than 0
 - 4. Design Load: Not less than 5,000 psi (34 MPa).

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5. Total Movement Capability: 1 inches (25 mm).
- L. Thermal Isolation Assemblies: Composite material manufactured using fiberglass reinforced laminate to prevent thermal bridging in load bearing structural connections complete with isolation bushings and washers.
 1. Basis of Design Product: Subject to compliance with requirements, provide thermal insulation material (TIM) by:
 - a. Fabreeka International, Inc.
 - b. P.O. box 210
 - c. 1023 Turnpike Street
 - d. Stoughton, MA 02072
 - e. (800) 322-7352
 2. Coefficient of Thermal Conductivity equal to or less than 1.8 BTU/Hr/ft²/In/°F
 3. Tensile Strength equal to or greater than 9,400 psi
 4. Flexural Strength equal to or greater than 22,300 psi
 5. Compressive Strength equal to or greater than 38,900 psi
 6. Compressive Modulus equal to or greater than 1,400,000 psi
 7. Thickness: 1 inch
- 2.4 PRIMER
 - A. Comply with Division 09 Section "Painting" and "High-Performance Coatings."
 - B. Primer Paint shall comply with all applicable SSPC requirements and shall be compatible with finish paints and spray-on fireproofing specified elsewhere.
 1. Steel not indicated to be galvanized: SSPC-Paint 25, Type II: Zinc Oxide, Alkyd, & Linseed Oil slow drying primer suitable for interior, normally dry and exterior, normally dry exposures. Requires Hand Tool Cleaning.
 - C. Galvanize miscellaneous framing and supports where exposed to the elements such as the Building Exterior as well as interior locations which are humid or corrosive.
 1. Galvanizing Repair Paint: SSPC-Paint 20 or ASTM A780.
 - D. Preparation and Coating over Galvanized Steel:
 1. Preparation: All galvanized metal receiving additional coats shall be tested by use of a copper sulfate test. This includes using a 10% solution of copper sulfate dissolved in water and applied to the galvanized surface. The reaction time between the copper sulfate and zinc should result in turning the galvanized area black within 15 seconds or less. If the reaction takes longer than 15 seconds, further cleaning is required as follows:
 - a. Preparation for TNEMEC paints: Apply Oakite CrysCoat 747 or 747 LTS as recommended by manufacturer. Allow to dry and air chuck entire prepared area removing excess materials.
 - b. Preparation for Wasser paints: Apply Great Lakes Clean and Etch or Oakite 747 as recommended by manufacturer followed by a thorough rinse.
 2. Primer:
 - a. TNEMEC: One (1) coat TNEMEC Series N 27 S.T. Typoxy @ 2.0 to 4.0 mil DFT.
 - b. Wasser: One (1) coat of Wasser MC-CR @ 3.0-4.0 mils DFT.
 3. For warranty purposes, the Contractor shall insure that the intermediate and finish coats specified in Division 9 "Painting" and the applied primer specified above are from the same manufacturer.

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2.5 GROUT

- A. Grout shall have a minimum 2400 psi compressive strength in 48 hours and 6000 psi compressive strength at 28 days.
- B. Metallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 CONNECTION DESIGN

- A. Contractor shall design all steel connections not fully defined in the Contract Documents. Design shall be performed by a qualified professional engineer.
- B. Connection Types:
 - 1. High-strength bolts assemblies.
 - 2. Unfinished bolts assemblies.
 - 3. Welded assemblies.
- C. When the type of connection is shown on the Drawings use that type of connection unless otherwise approved in writing by the SEOR.
- D. Use a connection other than unfinished bolts where required by code and in the following locations:
 - 1. All beam and column connections and splices unless otherwise noted on Drawings.
 - 2. All connections indicated as such.
 - 3. Connections that are a part of the lateral force resisting system.
 - 4. Connections for supports of running machinery or of other live loads which produce impact.
 - 5. Connections carrying cooling tower loads.
 - 6. Beams supporting columns or posts.
 - 7. Connections for cantilevers.
 - 8. Full and partial moment connections.
- E. Design Criteria:
 - 1. Design connections for the loads and according to the requirements in the Contract Documents and the applicable building regulations.
 - 2. Bolts shall be at least $\frac{3}{4}$ inches in diameter.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303 and AISC 360.
 - 1. Camber structural-steel members where indicated. Fabricate beams and girders with natural camber upward, unless noted otherwise on the drawings. Camber stated in the drawings is the required camber after erection.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly. Members shall be fabricated for delivery in a sequence that will expedite erection and minimize field handling of structural steel.

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5. Splice members only where indicated on Structural Drawings or where accepted by the SEOR.
 6. All hollow members exposed to weather shall be sealed with continuous welds, incorporating structural welds where shown or required, or provide weep holes where water may accumulate.
 7. Grind burrs, sharp arrises and ragged edges that would prevent solid seating of the connected parts.
 8. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Tolerances:
1. Except as noted as follows, maintain fabrication tolerances of structural steel within the tolerances specified on the drawings and AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. An unguided torch may be used provided the cut is within 1/8 inch of the required line.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
1. Use standard holes unless otherwise indicated as oversized, short-slotted, or long-slotted on the Drawings. Holes shall be drilled or punched at right angles to the surface of the metal. Making or enlarging holes by burning is prohibited.
 2. Flame cut holes for fasteners are not acceptable.
 3. Holes in column baseplates shall be no more than 1/2 inch larger than the nominal bolt size. Holes in column baseplates shall be within the limits of table 14-2 of AISC "Steel Construction Manual."
 4. For the following conditions holes shall be drilled (not punched), even where punching is allowed by referenced standards: a) material having a thickness in excess of 7/8 inch or the hole diameter; b) column base plates; c) holes less than 6-inches from an edge that requires a CJP weld; d) where holes are subjected to welding shrinkage stresses.
- E. Bending Steel Plate:
1. Bend plates perpendicular to the rolling direction.
 2. Grind flame cut plate edges transverse to the bend line.
 3. Grind out nicks in plate edges transverse to the bend line.
 4. Round sharp corners on plate edges transverse to the bend line.
- F. Heat Straightening: Will be permissible by the use of properly controlled heat, skilled personnel, proper equipment and in accordance with documents prepared by the fabricator and accepted. Reject materials that contain kinks or sharp angles. Material straightened prior to fabrication shall be rejected where it shows signs of distress or defects.
- G. Planing and Milling: Accurately finish ends of columns and other members transmitting bearing loads. Mill bearing surfaces to true planes. Mill ends of columns perpendicular to centerline axis connection mid-depth points at ends of member. Cut and fit column and bearing stiffeners in manner to provide bearing over entire cross section.
1. Column Base Plates:
 - a. For 2-inch through 4-inch thickness: Straighten by pressing.
 - b. Over 4-inch thickness: Plane top for column bearing; plane bottom when bearing on steel.

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- H. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning" and SSPC-SP 2, "Hand Tool Cleaning."
 - I. Shear Studs: Prepare steel surfaces as recommended by manufacturer of shear studs. Use automatic end welding of headed-stud shear studs according to AWS D1.1/D1.1M and manufacturer's written instructions.
 - J. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Provide holes, slots and openings together with necessary reinforcing as shown on the Drawings required for securing work of other trades to the work specified here. Where openings are shown on the Drawings no change shall be permitted without prior approval. Openings shall be done in the shop.
 - 2. Cut, drill, or punch holes perpendicular to steel surfaces.
 - 3. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 4. Weld threaded nuts to framing and other specialty items indicated to receive other work.
 - K. The Contractor shall cooperate fully with requests from inspection and testing personnel for access to the connections and joints to be inspected and tested. This includes beam and column turning in shop, weld backing removal when nondestructive examination indicates rejectable conditions, and access to platforms or scaffolding as required to perform the work safely.
 - L. Any technique not covered by this Section shall be submitted to the Engineer of Record for approval.
- 2.8 SHOP CONNECTIONS
- A. General Bolting:
 - 1. Product containers must be marked with lot numbers and traceability information so that correspondence with mill reports can be established. Manufacturer's symbol and grade markings shall appear on all bolts, nuts, through-hardened washers and direct tension indicators.
 - 2. Bolts shall be of a length that will extend to a point at least flush with the surface of the nuts, though not more than a length equal to the height of the nut, beyond the nuts unless otherwise noted.
 - 3. Bolts shall be installed with threads excluded from the shear plane.
 - 4. Washers shall be used on all bolts. Use beveled washers where bolts bear on sloping surface.
 - 5. Circular and slotted holes shall be as per Specification for Structural Joints Using ASTM A325 or A490 Bo
 - 6. Where bolt holes are subject to welding shrinkage stresses the holes shall be drilled.
 - B. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified. Contact surfaces of bolted parts shall as a minimum comply with the Class A requirements.
 - 1. Joint Type: Snug tightened unless noted Pre-tensioned or Slip-Critical on the Drawings.
 - 2. Direct tension indicator (load indicating washers or "Tension-Set" bolts) method shall be used at slip-critical connections. "Turn-of-Nut" methods are not an acceptable alternative.

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3. When connection has bolts and welds, fully tighten bolts prior to welding with the exception that in moment connections the flange welds shall be completed prior to final tightening of high strength bolts.
4. When already tensioned bolts have had their tension relaxed, replace the bolt and tension indicator and re-tighten.
- C. Unfinished Bolts (Machine Bolts): Machine bolts shall be brought to a snug tight condition. Mutilate bolt threads for unfinished bolts to prevent the nuts from backing off.
- D. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Shop welds shall be inspected in the shop before the work is painted or shipped.
 2. Weld sizes where shown shall be assumed to be effective weld sizes.
 3. All groove or butt welds shall be full penetration unless noted otherwise on the Drawings.
 4. Where structural steel members are to remain exposed in the finished work, welds exposed to view shall be uniformly made and ground smooth.
 5. Weld tabs shall be in accordance with AWS D1.1. In addition, weld tabs shall extend beyond the edge of the joint a distance equal to the plate thickness but not less than 1-inch except at access holes in beam/girder webs and at continuity plate clips. Weld tabs shall be oriented parallel to the joint preparation and to the weld direction. Weld dams are not allowed.
 6. Remove weld tabs and backup plates and grind surfaces smooth as required for inspection or testing. Where tabs or backup bars interfere with architectural treatment or are exposed to view in the final structure, remove and grind smooth. Backup bars and run-off tabs at Heavy Structural Sections shall be removed.
 7. Splices of members in tension, all members of moment frames and all members of braced frames that are made from heavy steel sections shall be made in conformance with Section J1.5 of AISC 360.
 8. Weld variables shall be consistent with the recommendations of the electrode manufacturer.
 9. Do not weld into column flange-to-web intersection as defined the AISC "k" and "k1" distances except for the doubler plate to column welds. Continuity plate welds shall stay clear of this area as noted on the drawings.
 10. Sequence the work as necessary to accommodate testing.
 11. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
 12. Welding Procedures:
 - a. Weld only in accordance with the Welding Procedure Specifications. WPS shall be readily available to all welders, inspectors, and supervisors during the production process.
 - b. Consider toughness and notch sensitivity of steel in formation of the welding procedures to prevent brittle and premature fracture during fabrication and erection. Toughness requirements are to match those of the parent metal.
 - c. Weld in a manner to minimize accumulation and concentration of through-thickness strains due to weld shrinkage. Sequence welds in a manner to reduce residual stresses (caused by welding) to a minimum value. Welding procedures shall incorporate measures necessary to eliminate cracking.
 - d. Do not mix different electrodes in the same weld joint unless the interactions have been shown not to cause problems.
 - e. Stringer passes only, no weaving or wash passes. Manipulation of the electrode for vertical welds (oscillation) shall be kept to a maximum movement of 4 to 5 electrode diameters.
 - f. Welding shall not begin until joint elements are bolted or tacked in intimate contact and adjusted to dimensions shown in the Drawings, with proper allowance for any weld shrinkage.

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- g. All tack welds shall be of the same quality as final welds. Preheat of tack welds is only necessary at the immediate area where the tack is placed. Preheat temperature is the same as for welding. Tack welds must be placed where they will be consumed in the weld or be ground out to a depth of 1/8" but not rewelded unless the gouge is greater than 1/8". If rewelding is necessary, it shall then be considered a new weld with all relevant weld inspections.

13. Refer to the Structural Drawings for additional requirements.

2.9 SHOP PRIMING

- A. Shop prime all steel surfaces whether or not completely concealed by interior finishes unless noted otherwise and excepting the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded and areas within 4 inches on each side of field welds.
 - 3. Top surfaces of beams to receive metal deck.
 - 4. Surfaces to be high strength bolted except surfaces painted with Type B Primer. Areas with high-strength bolts exposed to the weather shall receive a primer coat compatible with slip-critical type connections.
 - 5. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 6. Galvanized surfaces.
 - 7. Machined surfaces.
 - 8. Welded shear studs.
- B. Steel members not otherwise painted shall be painted when subjected to condensation from piping, are in shower or steam rooms, are exposed to chemical fumes or are exposed to other conditions of potentially aggressive corrosion.
- C. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the applicable SSPC specification requirements for each primer. As a minimum, all surfaces shall be prepared according to the following specifications and standards:
 - 1. SSPC-SP1 "Solvent Cleaning"
 - a. Typical except for "Architecturally Exposed Structural Steel."
 - 2. SSPC-SP 2, "Hand Tool Cleaning"
 - a. Typical except for "Architecturally Exposed Structural Steel."
 - 3. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - a. Required for "Architecturally Exposed Structural Steel."
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 2 mils for interior primer and 3 mils for exterior primer. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- E. All steel exposed to the weather in the final structure shall be galvanized or painted.
- F. The following surfaces shall be temporarily protected by a thin coating of varnish or lacquer:
 - 1. Unpainted area around field welds.

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2. Steel around high-strength bolts.
 3. Machined surfaces.
- G. Use special care if steel is fabricated, cleaned, and painted in damp weather to remove moisture from mill scale cracks.

2.10 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123 and to bolts, nuts, and washers according to ASTM A153. Galvanize all items noted on Drawings to be galvanized and fasteners that connect galvanized components, except that ASTM A490 bolts shall not be hot dip galvanized.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
 3. Roughen faying surfaces of slip-critical high-strength bolted connections to achieve Class C surface accordance with the RCSC Specifications.
- B. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Testing Agency to perform shop tests and inspections as defined by AWS, AISC and these specifications. Testing Agency shall summarize their finding in inspection and testing reports. Reports shall identify any findings that are not in compliance with requirements of the project specifications.
1. Provide Testing Agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. See Part 1 of this specification for additional testing and inspection requirements. As a minimum the inspector will make all tests and inspections as required by the Michigan Building Code and the International Building Code, latest edition. Testing Agency will make all the tests and inspections indicated in the Contract Documents.
- C. Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
1. Owner's Representative reserves right, at any time before final acceptance, to reject material not complying with requirements.
 2. Any tests that may be necessary to reconfirm any noncompliance of original work, and as may be necessary to show compliance of corrected work, shall be at Contractor's expense.
- D. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the Inspector can refer back to the person making the connection.
- E. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

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1. High Strength Bolted Connections: High strength bolts specified as Snug-Tight (ST) need not be inspected for bolt tension.
 2. High Strength Bolted Connections: For bolts specified as Pre-Tensioned or Slip-Critical, the special inspector shall observe the preinstallation testing and calibration procedures when such procedures are required by the installation method or by project plans or specifications; determine that all plies of connected materials have been drawn together and properly snugged and monitor the installation of bolts to verify that the selected procedure for installation is properly used to tighten bolts.
 - a. Periodic monitoring: Monitoring of bolt installation for pre-tensioning is permitted to be performed on a periodic basis (10% or a minimum of 2 bolts per connection) when using the turn-of-nut method with matchmarking techniques, the direct tension indicator method or the alternate design fastener (twist-off bolt) method.
 - b. Continuous monitoring: Monitoring of bolt installation for pretensioning using the calibrated wrench method or the turn-of-nut method without matchmarking shall be performed on a continuous basis.
 3. Direct Tension Indicators: Observe all Direct Tension Indicators to see if proper tightness was achieved.
 4. Standard Bolted Connections: Testing Agency shall inspect the installation of A307 bolts to verify that 10% of all bolts or a minimum of 2 bolts per connection are installed properly and tightened to a Snug-Tight (ST) condition.
- F. Welded Connections:
1. Testing Agency shall be present during all welding operations. In addition to visual inspection, all shop-welded connections will be tested and inspected according to AWS D1.1 and this specification using the following inspection procedures:
 - a. Liquid Penetrant Inspection (PT): ASTM E165.
 - b. Magnetic Particle Inspection (MT): ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection (UT): ASTM E164.
 - d. Radiographic Inspection (RT): ASTM E94.
 2. Visual Inspection of Welding: Testing Agency shall visually inspect all shop and field welding of structural steel accordance with the governing building code and AWS D1.1. Visual inspection of welds shall include but not be limited to the following:
 - a. Verify: Welding Procedure Specification (WPS) sheet has been provided and has been reviewed with each welder making the weld, welder qualification and identification, fit-up meets tolerances of WPS and mark joint prior to welding, welding consumables are per the Contract Documents and the WPS, amperage and voltage at the arc with hand-held meters, meters on welding equipment are functioning and accurate.
 - b. Observe preheat and interpass temperatures, weld pass sequence and size of weld bead.
 - c. Multi-pass shop and field welds shall be continuously inspected.
 - d. Visually inspect welds of heavy structural sections, or plates of 1-1/2 inch minimum thickness, at least 72 hours after completion of welding for the presence of cracks.
 - e. Visually inspect areas where backing bars and welds tabs are removed for conformance with the surface roughness criteria of the specifications.
 - f. Verify that the effective throat thickness of flare groove welds is consistently obtained when flush to bar or section. This verification shall be based on test sections where necessary.
 3. Nondestructive Testing Requirements: Testing Agency shall perform non-destructive testing of shop and field welding in accordance with the project specifications, governing building code, and AWS D1.1. Extent of non-destructive testing shall be as follows:
 - a. Complete Joint Penetration (CJP) welds: UT 100% CJP welds greater than 5/16-inch. MT 25% all CJP welds.
 - b. Partial Penetration Joint (PPJ) welds: UT 100% of PJP welds greater than 5/16-inch. UT 100% PJP in column splices.

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- c. Fillet Welds: Fillet welds of gusset plates to beams, columns and base plates - MT 10% of the following fillet welds and reduce to 5% if no significant cracks are found in the first 50 tested: a) gusset plate fillet welds to beam and columns; b) base plate fillet welds.
- d. Column Web Material at Continuity Plate: MT the WF column webs 3-inches above and below the weld terminations at the first 50 continuity plates and doubler plates installed. Test shall be conducted when weld has cooled to ambient temperature. If no web cracks are found, then no more testing required. This test shall also be conducted for all locations where the Contractor has welded into the "no weld" zone shown on the Drawings for continuity plates.
- e. Access holes at splices in Heavy Structural Sections – MT or PT 100%.
- G. In addition to visual inspection, shop-welded shear studs will be tested and inspected according to requirements in AWS D1.1 and the governing building code for stud welding and as follows:
 - 1. The type and capacity of the welding equipment shall be in accordance with the manufacturer's recommendations and shall be checked and approved.
 - 2. At the beginning of each day's work, a minimum of 2 test stud welds shall be made, with the equipment to be used, to metal which is the same as the actual work piece. The test studs shall be subjected to a 90-degree bend test by striking them with a heavy hammer. After the above test, the weld section shall not exhibit any tearing or cracking.
 - 3. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 4. Tests will be conducted on additional shear studs if weld fracture occurs on shear studs already tested, according to requirements in AWS D1.1.
- H. Inspection Records:
 - 1. The inspector will maintain a daily record of the work that has been inspected and its disposition. One copy of each report will be submitted to the Owner on a weekly basis. Test reports will be made on the form suggested in the AWS D1.1 "Structural Welding Code."
 - 2. Make systematic record of all shop welds, including:
 - a. Date of inspection.
 - b. Location and type of weld.
 - c. Identification marks of welders.
 - d. List of defective welds.
 - e. Manner of correction of defects.
- I. Factory Finishing:
 - 1. Toxicity:
 - a. Solvent coating systems are not permitted.
 - b. Electroplated coating systems are not permitted.
 - 2. Anti-Corrosive Paint: Comply with "Green Seal Standard for Anti-Corrosive Paints" (GC-03)]

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Discrepancies: In the event of discrepancy, immediately notify the Owner's Representative in writing. Do not proceed with construction in the region of the discrepancy until all such discrepancies have been resolved.

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3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. The Contract Drawings indicate the completed structure. The Contractor is fully responsible for all temporary measures necessary for erection, except where specific sequences and requirements are specified on the Drawings.
- B. Furnish templates for exact locations of items to be embedded in concrete and any setting instructions required for installation.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360. Check plumbness after erection of each tier.
- B. Dimensions shown on drawings are based on an assumed design temperature of 70 degree F. Fabrication and erection procedures shall take into account the ambient temperature range at the time of the respective operations.
- C. Care shall be taken to protect work already installed from damages resulting from structural steel erection.
- D. Items installed before concrete is placed shall be properly braced to prevent distortion by pressure of concrete. Watch and maintain bracing during concrete operations.
- E. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates. Remove any templates used for the setting of anchor bolts.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. If used, do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- F. Maintain erection tolerances of structural steel within AISC 303.
- G. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- H. Splice members only where indicated.

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- I. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- J. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- K. Post-Installed Bolts and Anchors:
 - 1. Install in accordance with the manufacturer's recommendations.
 - 2. Use washers on all bolts.
 - 3. Use care to avoid cutting or damaging reinforcing bars.
 - 4. When exposed to view in the final structure, bolts shall be of a length that will extend entirely through but not more than 1/4-inch beyond the nuts unless otherwise shown on the Drawings.
- L. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts. Where a hole is required to be enlarged by more than 3/32-inch ream to and use next larger bolt size.
- M. Shear Studs: Prepare steel surfaces as recommended by manufacturer of shear studs. Use automatic end welding of headed-stud shear studs according to AWS D1.1 and manufacturer's written instructions.
- N. Temporary Shoring and Bracing:
 - 1. The Contract Drawings indicate the completed structure. The Contractor is fully responsible for all temporary measures necessary for erection, except where specific sequences and requirements are specified on the Drawings. See the Drawings for erection sequence notes and minimum requirements.
 - 2. Contractor is responsible for identifying need for temporary construction and for the design, installation and use of all temporary bracing and supports necessary to stabilize the framing until complete.
 - 3. Provide temporary works as necessary to erect the structure and achieve proper alignment as erection proceeds. In addition, provide temporary bracing and shoring to brace the incomplete structure against loads such as wind and seismic forces comparable in intensity to the design loads for the completed structure.
 - 4. Make all necessary provisions for temporary bracing and for completion of erection where structural members are temporarily left out for erection at a later time.
- O. Temporary Tower Crane:
 - 1. The Contract Drawings indicate the completed structure. The Contractor is fully responsible for all temporary measures necessary for vertical and lateral support of the tower crane.
 - 2. Contractor shall refer to Drawings for specific sequences and requirements related to the temporary crane erection, vertical support locations, and tie-back diaphragm locations. Any deviations from the Drawings shall be submitted to the Engineer of Record for approval.
 - 3. The Contractor is responsible for designing all temporary structural elements necessary to allow the installation of the tower crane. This includes responsibility to assess the adequacy of the permanent structure in the temporary condition with may be affected by the installation and operation of the tower crane.
 - 4. The Contractor is responsible for identifying and providing for all openings at the façade, floor and roof, to allow the installation of the tower cranes and temporary works. Opening locations shall be submitted to the Engineer of Record for approval.
 - 5. The Contractor shall engage an Engineer registered in Michigan to determine crane load requirements, assess the final structure, and propose any temporary modifications as needed.

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These loads and calculations shall be submitted to the Engineer of Record for review prior to the start of the fabrication detailing process. The submittal at a minimum shall include:

- a. A basis of design that identifies:
 - 1) Stages of construction to be considered.
 - 2) Gravity, wind, and seismic loading design criteria.
 - 3) Make and model of tower crane and loads imposed by tower crane during operation, at rest, and due to wind and seismic forces.
 - 4) Load combinations, including combinations due to crane loads and wind/seismic loads acting concurrently.
 - 5) Drift limits.
- b. A three-dimensional structural frame analysis, in an industry standard software package, that accounts for the following:
 - 1) Staged construction and load in general.
 - 2) Vertical and lateral loads imposed on the structure by the crane in combination with appropriate gravity, wind, and seismic loads.
- c. Design calculations for new and existing structural elements and their associated connections impacted by forces due to the tower crane. Structural elements shown on the Contract Drawings and their associated connections shall be evaluated under temporary loads and reinforced or redesigned if required to resist temporary loads.
6. Contractor shall notify Engineer of Record of locations where changes to the structure in the final condition are required in order to support the temporary tower crane. Changes to the permanent structure are subject to review and approval by the Engineer of Record.
7. Shop Drawings for temporary works located within the building envelope shall be submitted to the Engineer of Record for review and approval. Temporary works Shop Drawings shall show fabrication of structural-steel components, including details of layout and connections, fabrication of all members, and element and erection plans, and erection sequence. Shop Drawings shall identify temporary works members to remain in the permanent structure. Review of Shop Drawings by the Engineer of Record is of a general nature only.

3.4 FIELD CONNECTIONS

- A. Field connection requirements shall be as a minimum equal to those specified in Part 2 of this document.
- B. Erection bolts for welded connection shall be tightened securely and left in place, unless noted otherwise.
- C. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened unless noted Pre-tensioned or Slip-Critical on the Drawings.
- D. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or weld tabs where indicated, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
 4. Weld in manner to prevent warping or distortion of finished product. Use jigs which will not restrain piece from moving during welding or cooling after welding. Sequence weld passes at a joint to prevent excessive heat build-up or cause shrinkage cracks to form.
 5. Auxiliary Member Connections and Temporary Welds shall be per AWS provided that preheating may be omitted on ASTM A36 steel for single pass fillet welds with low hydrogen

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electrodes under the following conditions: Air temperature is 60° F. or over, steel is dry, and welds to structural base material are more than 1" away from corners or ends of plates.

6. Preheat and post-heat procedures for welded joints shall be utilized to prevent rapid cooling of welds, particularly in cold weather. Procedures are Contractor's responsibility.
- E. Shear Studs: The shear studs shall be automatically end welded in accordance with AWS D1.1 and the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plate.
 1. There should be no porosity or evidence of lack of fusion between the welded end of the stud and the plate.
 2. Shear studs through metal deck shall be welded through the deck within 1 day of laying the deck.
- F. Bearing Pads: Install bearing pads in accordance with manufacturer's recommendations.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Construction Manager/Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Field quality control shall, as a minimum, conform to the requirements specified under Source Quality Control in Part 2.
- C. Erection Tolerances: Unless otherwise noted, level and plumb individual members of the structure within a tolerance of 1:500, but not to exceed 1/2" for full height of columns. Make exterior columns and columns adjacent to elevator beams accurate within tolerance of 1:1000, but not to exceed 1/2" for full column height. Make level and plumb based on the mean operating temperature of the structure, allowing for the difference in temperature at time of erection and the mean temperature of the structure when completed and in service. Base measurements relating to tolerances on the theoretical centerline of the columns.
 1. Columns: Gaps exceeding 1/8 inch between milled ends not permitted. Shim acceptable gaps with non-tapered mild steel shim stock.
- D. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- E. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 1. The Inspector shall observe all Direct Tension Indicators to see if proper tightness is achieved.
- F. Welded Connections: Field welds will be visually inspected according to AWS D1.1, the governing building code, and Part 2 of this document, by the Testing Agency.
 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

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- c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 - G. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
 - H. Defective Work:
 - 1. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents. Work deemed defective will be removed from the site at the Contractor's expense.
 - 2. Any special tests not specifically covered by this specification that are proposed by the Contractor as a result of failure to comply with this Section shall be at the Contractor's expense. The Contractor shall be responsible for any consequential costs or delays.
 - 3. The results of those tests will be accepted, at the discretion of the Architect, as proof of adequate materials or workmanship.
- 3.6 REPAIRS AND PROTECTION
- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A780.
 - B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 "Exterior Painting" and "Interior Painting" Section.
 - D. Touchup Priming: Cleaning and touchup priming are specified in Division 09 "High-Performance Coatings."
 - E. Repair of Openings: For all members exposed to view in the final structure, close all lifting holes, access openings, etc. in such a manner that no visual evidence of the opening remains.

END OF SECTION

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SECTION 051213

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Architecturally exposed structural-steel (AESS) framing and supplementary items required for installation.
 - 1. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.

1.2 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3 in the Contract Documents.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS.
 - 1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
 - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 3. Include embedment Drawings.
 - 4. Indicate orientation of mill marks and HSS seams.
 - 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 - 6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
 - 7. Indicate exposed surfaces and edges and surface preparation being used.
 - 8. Indicate special tolerances and erection requirements.
 - 9. Indicate weep holes for HSS and vent holes for galvanized HSS.
 - 10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- B. Samples: Submit Samples to set quality standards for AESS.
 - 1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.

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2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.
3. Round steel tube or pipe, minimum 8 inches in diameter, with end of another round steel tube or pipe, approximately 4 inches in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AECS similar to that indicated on this Project.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category ACSE or Category CSE, and is experienced in erecting AECS similar to that indicated on this Project.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, Endorsement P2 or Endorsement P3.
- D. Mockups: Build mockups of AECS to set quality standards for fabrication and installation.
 1. Build mockup of typical portion of AECS as shown on Drawings.
 2. Coordinate painting requirements with Division 9 Section Painting.
 3. Coordinate high-performance coatings requirements with Division 9 Section High Performance Coatings.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

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- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
 1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate surface preparation requirements for shop-primed items.
- C. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Bolts, Connectors, and Anchors: Refer to Division 05 Section Structural Steel Framing.

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2.2 PRIMER

- A. Steel Primer for High Performance Coatings: Refer to Division 09 Section High Performance Coatings.

2.3 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.
- B. Category AESS 3:
1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
 3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
 4. Make intermittent welds appear continuous, using filler or additional welding.
 5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
 6. Limit butt and plug weld projections to 1/16 inch.
 7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
 8. Remove weld spatter, slivers, and similar surface discontinuities.
 9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
 10. Grind tack welds smooth unless incorporated into final welds.
 11. Remove backing and runoff tabs, and grind welds smooth.
 12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
 13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
 14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
 15. Conceal fabrication and erection markings from view in the completed structure.
 16. Make welds uniform and smooth.
 17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
 18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
 19. Orient HSS seams as indicated or away from view.
 20. Align and match abutting member cross sections.
 21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
 22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

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2.4 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Pretensioned, or Slip critical as indicated on Drawings or as specified in Division 05 Section "Structural Steel Framing".

2.5 GALVANIZING

- A. Galvanizing: Refer to Division 05 Section Structural Steel Framing.

2.6 SHOP PRIMING

- A. High Performance Coatings: Refer to Division 09 Section High Performance Coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- C. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
 - 2. Where applicable, do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

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3.3 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
 2. Grind tack welds smooth.
 3. Remove backing and runoff tabs, and grind welds smooth.
 4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
 5. Remove erection bolts in Category AESS 4 AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
 6. Fill weld access holes in Category AESS 4 AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
 7. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
1. Erection of Category AESS 3:
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than 1/16 inch.
 - e. Continuous welds shall be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
 - i. Weld profiles, quality, and finish shall be as approved by Architect.
 - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, pretensioned, or slip critical as indicated on Drawings or as specified in Division 05 Section "Structural Steel Framing".
 2. Orient bolt heads as indicated on Drawings or, if not indicated, in same direction for each connection and to maximum extent possible in same direction for similar connections.

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3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 PROTECTION

- A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- C. Touchup High Performance Coatings: Refer to Division 9 Section High Performance Coatings for cleaning and touchup priming.

END OF SECTION

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SECTION 053100

STEEL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof deck.
- B. Composite floor deck.
- C. Stud shear connectors.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete topping over metal deck.
- B. Section 042000 - Unit Masonry: Placement of anchors for bearing plates embedded in unit masonry assemblies.
- C. Section 051200 - Structural Steel Framing: Support framing for openings larger than 18 inches.
- D. Section 051200 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.
- E. Section 055000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.3 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- J. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; 2022.
- K. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements; 2019, with Editorial Revision (2021).

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- L. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 ACTION SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. General:
 - 1. Review of submittals if of a general nature only, and responsibility for conformance with the intent of the Contract Documents shall remain with the Contractor. Review does not imply nor state that fabricator has correctly interpreted the Contract Drawings.
 - 2. All submissions shall be in accordance with the submission schedule developed and agreed between the Architect and Contractor at the commencement of the project. Submission shall include dates of order and delivery of materials to the shop and the site.
 - 3. Shop drawing schedule shall allow adequate time for reviews. Submittal shall include all related pieces in an assembled or area. The Contractor shall allow adequate time in shop drawing preparation stage for the dimensioning process and coordination with the Architectural Drawings and those of other disciplines. Submit a schedule for steel shop and erection drawings.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Powder-actuated mechanical fasteners and screws.
- E. LEED Submittals:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of post-industrial and post-consumer recycled content. Include statement indicating costs for each product having recycled content, materials cost only.
 - 2. Product Data for Credit MR 5.1 and Credit MR 5.2. For products and materials that meet or can contribute to the requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to project, cost for each regional material, and fraction by weight that is considered regional.
 - a. For product comprised of components sourced from different locations, include statement indicating (1) distance between project and extraction site and (2) weight contributing to regional extraction.
 - b. For products shipped by rail or water, compute the total travel distance of the project site using a weighted average determined through the following formula: $(\text{Distance by rail}/3) + (\text{Distance by inland waterway}/2) + (\text{Distance by sea}/15) + (\text{Distance by all other means}) \leq 100$ miles. If this total distance is within the 100 mile limit, provide the above documentation for each applicable product component.
 - 3. Environmental Product Declaration (EPD), in compliance with ISO 14025, third-party verified eco-label, for each structural steel product or component. Where not yet available, supply an industry-wide EPD or other product declaration conforming to requirements of LEEDv4.1 MRc2: Building Product Disclosure and Optimization – Environmental Product Declarations, Option 1.

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- a. Provide a Type I or III product specific EPD for each structural steel component as available. If an EPD is not available, provide written notification that the EPD has not been secured.
- 4. Health Product Declaration, publicly available manufacturer's inventory, Cradle-to-Cradle v3 Bronze or higher certification, or other USGBC-approved program for LEEDv4.1 MRc4: Building Product Disclosure and Optimization – Material Ingredient Reporting, Option 1, for each concrete mix type or each concrete mix qualifying as an individual product as defined by LEED.
- F. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit manufacturer's installation instructions.
- B. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.
- D. Environmental Management System (EMS): Submit evidence of an EMS for the steel manufacturers providing material for work of this section. For each steel manufacturing facility, submit copy of registration as per ISO 14001.
- E. Chain-of-custody certification: Submit manufacturer's certification that no open hearth furnaces were utilized in the production of structural steel to be incorporated into the Work. Submit evidence of energy efficiency for steel manufacturers providing material for work of this section. Acceptable certification includes:
 - 1. Bill of Lading indicating source of manufactured steel as North American facility; or,
 - 2. Manufacturer's certification that structural steel complies with CO2 limitations for crude steel production; or,
 - 3. Manufacturer's certification that structural steel complies with energy efficiency requirements for steel production; or, Participation in CO2 Breakthrough Program: Manufacturer's certification of participation in CO2 Breakthrough Program.
- F. Research/Evaluation Reports: For steel deck.

1.6 QUALITY ASSURANCE

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

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- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- E. Installer Qualifications: Company specializing in performing the work of this Section approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Cut plastic wrap to encourage ventilation.
- C. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.
- D. Delivery:
 - 1. Steel roof deck units shall be delivered to the job site in manufacturer's original, unopened bundles, containers and/or packaging.
 - 2. Steel roof deck bundle labels shall clearly indicate:
 - a. Product description.
 - b. Manufacturer.
 - c. Bundle weight.
 - d. Number of pieces.
 - e. Length.
 - f. Bundle number.
 - g. SDI approved installation safety warnings.
 - 3. Note on shipper's bill of lading any material damage or shortages, before signing for material and notify the deck supplier immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Steel Deck:
 - 1. Canam Steel Corporation: www.canam-steeljoists.ws.
 - 2. New Millennium Building Systems: www.newmill.com/#sle.
 - 3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.2 STEEL DECK

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus post-industrial recycled content is not less than 75 percent.
- B. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
 - 1. Calculate to structural working stress design and structural properties specified.
 - 2. Maximum Vertical Deflection of Floor Deck: 1/360 of span.
 - 3. Maximum Vertical Deflection of Roof Deck: 1/240 of span.
- C. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

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2. Nominal Height: 1-1/2 inch.
- D. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
 2. Span Design: Multiple.
 3. Nominal Height: 2 inches.
 4. Formed Sheet Width: 24 inch.
 5. Side Joints: Lapped, mechanically fastened.
 6. End Joints: Lapped, welded.
- 2.3 ACCESSORY MATERIALS
 - A. Stud Shear Connectors: Made from ASTM A108 Grade 1015 bars.
 - B. Welding Materials: AWS D1.1/D1.1M.
 - C. Fasteners: Galvanized hardened steel, self tapping.
 - D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point.
Comply with applicable requirements of ICC-ES AC70.
 1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
 2. Material: Steel; ASTM A510/A510M.
 - a. Hardness: Rockwell C 54.5, minimum.
 - b. Tensile Strength: 285 kips per square inch, minimum.
 - c. Shear Strength: 175 kips per square inch, minimum.
 - E. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
 1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
 - F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
 - G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
 - H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.
- 2.4 FABRICATED DECK ACCESSORIES
 - A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.
 - B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions prior to beginning work.

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3.2 INSTALLATION

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. On concrete and masonry surfaces provide minimum 4 inch bearing.
- F. On steel supports provide minimum 1-1/2 inch bearing.
- G. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- H. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- I. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, or as indicated otherwise on the Drawings, parallel with the deck flute and at each transverse flute using methods specified.
 - 1. Welding: Use fusion welds through weld washers.
- J. At mechanically fastened male/female side laps fasten at 24 inches on center maximum.
- K. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- L. Weld deck in accordance with AWS D1.3/D1.3M.
- M. At deck openings from 6 inches to 18 inches in size, provide 2 by 2 by 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
- N. At deck openings greater than 18 inches in size, provide steel angle reinforcement. as specified in Section 051200.
- O. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
- P. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- Q. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- R. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- S. Weld stud shear connectors through steel deck to structural members below.

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- T. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

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SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cold-formed metal framing assemblies and supplementary items necessary for installation.
 - 1. Exterior non-load-bearing curtain wall framing.
 - 2. Soffit framing.
 - 3. Ceiling joist framing.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

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1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, and installation instructions.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Include layout, spacing, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
 - 1. Indicate loads and reactions at interface with primary structural framing and foundations.
- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
 - 1. Steel sheet.
 - a. Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
 - 2. Expansion anchors. ICC ESR or other product approval acceptable to Engineer.
 - 3. Power-actuated anchors. ICC ESR or other product approval acceptable to Engineer.
 - 4. Mechanical fasteners. ICC ESR or other product approval acceptable to Engineer.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips.
 - 7. Miscellaneous structural clips and accessories.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.

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2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or similar organization that provides a verifiable code compliance program.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- D. Comply with AISI Code of Standard Practice for Cold Formed Steel Structural Framing.
- E. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.

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- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. CEMCO.
 - 2. ClarkDietrich Building Systems.
 - 3. Consolidated Fabricators Corp.
 - 4. Marino\WARE.
 - 5. MBA Metal Framing.
 - 6. United Metal Products, Inc.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S240 including but not limited to the following.
 - 1. Wall Studs.
 - 2. Headers.
 - 3. Lateral Design.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- D. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
 - 1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 - 2. Other Loads: As indicated on Drawings.
- E. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
 - 1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Structural Drawings.
 - 2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
 - 3. Maintain exterior wall design and incorporate an expansion and contraction joint located above ceiling line to isolate movement between interior and exterior finishes.
 - 4. Stud depth and spacing indicated is critical for performance of other materials and shall not be changed without consideration of other materials.
- F. Seismic Performance: Framing systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- G. Definition of Design Loads for Deflection Calculations: Nominal loads combined using allowable stress load combinations and code required wind loads based on a 50 year return interval wind speed. Reductions for a lower wind speed return interval are not allowed.

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- H. Deflection of Framing Members: Engineer framing systems to withstand design loads without deflections greater than following, without contribution from sheathing materials:
 - a. Exterior Wall Framing: Horizontal deflection of 1/360 of the wall span.
 - b. Exterior Wall Framing for Exterior Stone Cladding: Horizontal deflection of 1/720 of the wall span.
 - c. Exterior Soffit Framing: Vertical deflection of 1/360 of the span.
 - d. Ceiling Joist Framing (Interior Roof): Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
- I. Thermal Movements: Allow for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects
 - 1. Temperature Change (Range): 120 deg F, ambient.
- J. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 COLD-FORMED STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 955 for conditions indicated.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: ST33H minimum, as required by structural performance.
 - a. ST33H for minimum uncoated steel thickness of 0.0428 in and less.
 - b. ST50H for minimum uncoated steel thickness of 0.0538 in and greater.
 - 2. Coatings:
 - a. Interior Locations: CP 60 per ASTM C 955: G60 (Z180), A60, AZ50, or GF30).
 - b. Exterior Envelope: CP 90 per ASTM C 955: G90 (Z275), AZ50, or GF45.
- C. Steel Sheet for Vertical Deflection or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 33 minimum, as required by structural performance.

2.5 EXTERIOR NON-LOAD-BEARING CURTAIN WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 in.
 - 2. Flange Width: 1-5/8 in, minimum.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

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1. Minimum Base-Metal Thickness: 0.0428 in.
 2. Flange Width: 1-1/4 in, minimum.
- C. Vertical Deflection and Drift Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web and structure.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 in.
 2. Flange Width: Manufacturers standard deep flange, minimum 3 in, at head of exterior walls where studs occur between structural floors, standard flange elsewhere.
- E. Slotted Deflection Track - Contractors Option: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure, as follows:
1. Basis of Design: ClarkDietrich Building Systems; MaxTrak Slotted Deflection Track.
 2. Leg Dimension: 3 inches with 2 inch slot.

2.6 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 in.
 2. Flange Width: 1-5/8 in, minimum.

2.7 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 in.
 2. Flange Width: 1-5/8 in, minimum.

2.8 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.

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5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

C. Metal Deck: 9/16 in, corrugated, ASTM A 653 / A 653M, G90 hot-dip galvanized coating.

1. Design Uncoated-Steel Thickness: 0.02956 in (22 gage) minimum.

2.9 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
 1. Manufacturers:
 - a. Hilti Corp.
 - b. ITW Ramset/Red Head.
 - c. Powers Fasteners.
 - d. Simpson Strong Tie Anchor Systems.
 2. For post-tensioned concrete, anchors shall not exceed 1 in embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.
- E. Hold Down Clips: Wall anchoring system of type suitable for application indicated, hot dip galvanized unless indicated otherwise.
 1. Basis of Design: Simpson Strong-Tie; Hold Down HD Series.
- F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- G. Welding Electrodes: Comply with AWS standards.

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2.10 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Thermal Insulation: For boxed-in sections, ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.11 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 in in 10 ft and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 in from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 in.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. AISI's "Standard for Cold-Formed Steel Framing - General Provisions".
 - 2. Respective manufacturer's written installation instructions.
 - 3. Accepted submittals.
 - 4. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before Application: Attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
 - 2. After Application: Remove only as needed to complete installation of cold-formed steel stud framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 in to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.4 INSTALLATION, GENERAL

- A. Installation Options: Cold-formed steel stud framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install, cold-formed steel framing in accordance with ASTM C 1007 and AISI S240 and manufacturer's written instructions unless more stringent requirements are indicated.

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- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 in.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 in in 10 ft and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 in from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 EXTERIOR NON-LOAD-BEARING CURTAIN WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, and top track if slotted, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 in.

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- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Infill wall framing with deflection track: Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Curtain wall or panelized framing with deflection clips: Connect vertical deflection clips to bypassing studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 in apart. Fasten at each stud intersection. One of the following:
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 in of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 in.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 in from abutting walls, and as follows:
 - 1. Joist Spacing: 16 in.
- D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.

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- 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 054300

SLOTTED CHANNEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Slotted channel framing and accessories necessary to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.

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1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:
 1. Strapping, bracing, bridging, splices, and connection details.
 2. Materials, sizes, spacings, and thicknesses.
 3. Specifics for equipment being supported by framing.
 4. Adjacent building structure, mechanical and electrical elements.
 5. Details for anchoring and attachment to building structure.

1.4 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

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1. Horizontal Spanning Members; Upper, Lower and Main Subrails:
 - a. Cooper B-Line, Inc.; B12A channels
 - b. Hilti; MQ-124X channels
 - c. Unistrut Corp.; P5501 channels
2. Vertical Columns:
 - a. Cooper B-Line, Inc.; BTS 22TH struts
 - b. Hilti; MQ-41 channels
 - c. Unistrut Corp.; P9200 tubes
3. Diagonal and Horizontal Bracing:
 - a. Cooper B-Line, Inc.; BTS 22 channels
 - b. Hilti; MQ-41 channels
 - c. Unistrut Corp.; P1000 channels
4. Inside Vertical Columns:
 - a. Cooper B-Line, Inc.; BTS 22TH struts
 - b. Hilti; MQ-41 channels
 - c. Unistrut Corp.; P1000 H3 channels

2.2 SYSTEM DESCRIPTION

- A. Equipment Support: Framing consisting of necessary slotted channel framing members such as beams, columns, braces, fittings, spanning members, longitudinal rails, track supports, and components such as channel connectors, nuts, bolts, washers, shim plates, and general hardware, for a complete and properly functioning support structure for equipment.

2.3 PERFORMANCE REQUIREMENTS

- A. Structural Requirements: Engineer slotted channel framing according to delegated engineering quality standards to withstand live and dead loads according to authorities having jurisdiction, applicable local building codes, and information indicated within limits and under conditions indicated, without material failure or permanent deformation of structural members.
 1. Structural Movement: Engineer to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep; accommodate 3/8 in differential vertical deflection of floors
 2. Design Loads: As required by scheduled equipment.
 3. Deflection: L/720 of span in either plane (vertical or horizontal) when maximum loading conditions is applied on either rail, due to equipment operation, including positioning of equipment at extremities of its travel.
 4. Design Criteria:
 - a. Equipment Information: Coordinate engineering with information provided by manufacturer of equipment being supported.
 - b. Minimum Factor of Safety: 2 based on ultimate strength under static loading conditions.

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- B. Delegated Engineering Quality Standards: Determine allowable working stresses of materials according to authorities having jurisdiction, applicable local building codes, framing manufacturers design data, MFMA-4, and MFMA-103.

2.4 FRAMING MATERIALS AND COMPONENTS

- A. Slotted Channels:
1. Product Quality Standard: MFMA-4.
 2. Interior Locations: C-shape channels fabricated from ASTM A 1011 Grade 33 cold-rolled steel sheet or ASTM A 1008 Grade 33 for hot-rolled steel sheet, structural classification; with continuous open slot formed by intumed serrated or unserrated lips, and intermediate slots in back of channel; riveted back-to-back type for primary horizontal framing members; wall thickness as required by engineering design.
 - a. Painted Factory Finish: Chemically cleaned, phosphated, electro deposited acrylic or electrostatically-applied polyester finished, then baked; resisting minimum 300 hours of salt spray exposure according to ASTM B 117.
 3. Profile Size: 1-5/8 in wide by depth required by delegated engineering.
- B. Channel Connectors: Standard 2 part connectors of type, size and material required by delegated engineering; fabricated from carbon steel with nuts and threaded bolts; with or without springs; electro-galvanized finish; from same manufacturer as slotted channels.
- C. General Hardware: Standard fittings, bases, brackets, and clamps of three-dimensional shape suitable for condition and type, size and material required by delegated engineering; fabricated from carbon steel; same finish as slotted channels; from same manufacturer as slotted channels.
- D. Fasteners to Building Structure: Welding rods and expansion anchors as specified in Division 5 Section "Metal Fabrications."
- E. PVC Closure Strip: Paintable PVC closure strip; Unistrut Corp; P1184P, grey color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. MFMA-103.
 2. Respective manufacturer/fabricator's written installation instructions.

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3. Accepted submittals.
 4. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Erection:
1. Install slotted channel framing members and components square, true to line, level and plumb; and securely in place to properly support schedule equipment.
 2. Cut slotted channels with powered cutting saws; flame-cutting is not permitted.
 3. Tighten all connections to torque required by engineering design
- B. Tolerances:
1. Horizontal Mounting Surfaces: Align within 1/32 in in 24 in and within 1/16 in in 18 ft.
 2. Elevation Between Rails: Difference between 2 rails within 1/16 in in 24 in.
- C. PVC Closure Strips: Install at all exposed rails.

END OF SECTION

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SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal fabrications and supplementary items necessary for installation.

1.2 DEFINITIONS

- A. Unprotected Areas: Exterior areas directly exposed to the elements such as rain, snow, or ice.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.
1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
- B. Welding Qualifications: Qualify procedures and personnel according to following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel".
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel".
 4. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

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1.6 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 FERROUS METAL MATERIALS

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, blemishes, or other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
 - 1. Marking Systems for Metal Fabrications: Where finished items are exposed to view, use temporary tags attached with wires or other system acceptable to Architect.
- B. Steel:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 2. Steel Tubing: ASTM A 500, cold-formed steel tubing.
 - 3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.

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4. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
5. Finish:
 - a. Unprotected Areas: Galvanized metal.
6. Metal Deck: 1-1/2 in, ASTM A 653 / A 653M, Structural Steel (SS) G90 hot-dip galvanized coating both sides; cleaned, pretreated and primed with manufacturer standard baked-on rust inhibitive prime, outside face only if indicated below.
 - a. Deck Profile: As indicated or Type B deck if not indicated.
 - b. Design Uncoated-Steel Thickness: 0.0358 in (20 gage) or as indicated on drawings.
 - c. Side Laps: Overlapped.
 - d. Location: Dumpster enclosure; prime outside face.
7. Metal Deck: 3 in, ASTM A 653 / A 653M, Structural Steel (SS) G90 hot-dip galvanized coating both sides; cleaned, pretreated and primed with manufacturer standard baked-on rust inhibitive prime, outside face only.
 - a. Deck Profile: As indicated or Type N (Deep, Wide Rib) deck if not indicated.
 - b. Design Uncoated-Steel Thickness: 0.0598 in (16 gage) minimum.
 - c. Side Laps: Overlapped.
 - d. Location: Roof mechanical equipment screen wall.

C. Stainless Steel:

1. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
3. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

2.4 NON-FERROUS METAL MATERIALS

- A. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221/B 221M, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.5 FASTENERS

- A. Fastener Type and Material: Select fasteners for type, grade, and class required to produce connections suitable for anchoring fabrications to other types of construction indicated.
- B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593/F 738M; with hex nuts, ASTM F 594/F 836M; and, where indicated, flat washers; and as follows:
 1. Unprotected Areas:

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- a. Alloy Group 1 (A1) for Type 304.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563/ A 563M; and, where indicated, flat washers. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Plain Washers: Round carbon steel, ASME B18.22.1/ASME B18.22M.
- E. Lock Washers: Helical, spring type carbon steel, ASME B18.21.1/ASME B18.21.2M.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3/B18.6.7M.
- H. Lag Screws: ASME B18.2.1/B18.2.3.8M.
- I. Wood Screws: ASME B18.6.1, flat head, carbon steel.

2.6 ANCHORS

- A. General: Provide anchors capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- B. Cast-in-Place Anchors in Concrete: Bolts, washers, and shims as needed, either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel; hot-dip galvanized according to ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Unprotected Areas: Stainless steel bolts, ASTM F 593/F 738M, and nuts, ASTM F 594/F 836M;
 - a. Alloy Group 1 for Type 304.
 - 2. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in embedment. Obtain Structural Engineer written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.7 MANUFACTURED PRODUCTS

- A. Anti-Slip Coating:
 - 1. Description: Proprietary material and application process that forms permanent, uniform, slip resistant surface texture on metals.
 - 2. Color: As selected from manufacturer/fabricators standard colors available.
 - 3. Static Coefficient of Friction Characteristics: Not less than 0.6 according to ASTM D 2047.
 - 4. Manufacturer/Fabricators:

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- a. IKG Industries, Division of Harsco Corporation.
 - b. SlipNOT Metal Safety Flooring, W. S. Molnar Company.
- B. Prefabricated Nonslip Ladder Rungs:
 - 1. Provide nonslip abrasive surfaces on top of each rung.
 - 2. Manufacturers and Products:
 - a. Algrip; Slip-Resistant Ladder Rungs and Floor Plate.
 - b. McNichols; Traction Tread Ladder Rung Plank.
 - c. P&R Metals; SlipNOT Ladder Rungs.
- C. Ladder Vertical Cable Safety System for Fixed Ladders 24 Feet or Higher: Comply with ANSI Z359.16 and OSHA 1910.23 ladder safety and personal fall arrest requirements. Assembly composed of following components:
 - 1. Basis of Design: 3M | DBI Sala; Lad-Saf Flexible Cable Vertical Safety Systems, Rung 2 User Stainless Steel 6116, cable length as required by ladder configuration.
 - a. Cable: Stainless steel cable with permanently swaged ends.
 - b. End Terminal: Stainless steel swaged cable termination at one end and stainless steel tensioner with shock absorber at other end.
 - c. Mounting Devices: Stainless steel shape as required by mounting conditions.
 - d. Cable Runner: Stainless steel device with automatic runner bypass for continuous hands free operation.
 - e. Data Plate: Permanent, non-corrosive plate clearly stating maximum service capacity and allowable number of users; prominently displayed at access points to system.
 - f. Harness: Manufacturer's standard Hands-free full body harness and lanyard complete with shock absorber.

2.8 PAINT MATERIALS

- A. Paint for Steel Fabrications: As specified in Division 09 Section "Painting".
- B. Galvanizing Repair Paint for Steel Fabrications in Unprotected Areas: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Bituminous Paint for Aluminum Fabrications: ASTM D 1187, cold-applied asphalt emulsion.

2.9 ACCESSORY ITEMS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28 day compressive strength of 3000 psi, unless otherwise indicated.
- C. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer/fabricator.

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2.10 FABRICATION, GENERAL

- A. Fabrication Quality Standard for Fixed Ladders: In addition to standards listed elsewhere, comply with following, unless otherwise specified in this Section:
 - 1. Standard Ladders: ANSI A14.3.
 - 2. Elevator Pit Ladders: ASME A17.1.
- B. General: Fabricate metal fabrications, including clips, brackets, and other components necessary to support and anchor fabrications to supporting structure, and to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.
 - 1. Join components by welding unless otherwise indicated.
- C. Shop Assembly: Assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces.
- D. Fabrication Requirements:
 - 1. Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges to a radius of approximately 1/32 in unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - 2. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - 3. Form work true to line and level with accurate angles and surfaces and straight sharp edges.
 - 4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - 5. Unprotected Areas:
 - a. Allow for thermal movement resulting from 120 deg F change (range) in ambient and 180 deg F surface temperatures by preventing buckling, opening up of joints, oversteering of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - b. Fabricate hot-dip galvanized fabrications so that field assembly will be by bolted connections and not welding.
 - c. Fabricate joints exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- E. Assembly Requirements:
 - 1. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 2. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

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3. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/4 in by 1-1/4 in, with a minimum 6 in embedment and 2 in hook, not less than 8 in from ends and corners of units and 24 in on center, unless otherwise indicated.
 4. Complete fabrication prior to shop painting or hot-dip galvanizing.
- F. Shop-Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously to develop full strength of member to comply with following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

2.11 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4 in bolts, spaced not more than 6 in from ends and 24 in on center, unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.

2.12 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural framework as necessary to complete the Work.
- B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 in wide by 1/4 in thick by 8 in long at 24 in on center, unless otherwise indicated.

2.13 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 in from each end, 6 in from corners, and 24 in on center, unless otherwise indicated.

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2.14 EXTRUDED NOSINGS FOR CAST IN PLACE CONCRETE STAIRS

- A. Nosings for Metal Pan Stairs: Refer to Division 05 Section "Metal Stairs".
- B. Abrasive Surfaced Extruded Aluminum Units:
 - 1. Product Quality Standard: ASTM B 221 / B221M, Alloy 6063-T6.
 - 2. Description: Extruded, ribbed aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder projecting 1/16 in above aluminum extrusion; with anchors for embedding in concrete.
 - 3. Exit Stairs at High Rise Structures: Provide photoluminescent strips, minimum 1 in wide by full width of stair nosing, incorporated into abrasive surfaced nosings.
 - 4. Manufacturers:
 - a. ACL Industries, Inc.
 - b. American Safety Tread Co., Inc.
 - c. Amstep Products.
 - d. Armstrong Products, Inc.
 - e. Balco Inc.
 - f. Granite State Casting Co.
 - g. Wooster Products Inc.
 - 5. Basis of Design (Product Standard): Wooster Products Inc.; Supergrit, WP-RN3SG -NG; color as selected by Architect from manufacturer's full range of colors.

2.15 FINISHES, GENERAL

- A. Finish Quality Standard: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish metal fabrications after assembly.
 - 2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL FINISHES

- A. Unprotected Areas:
 - 1. Galvanized Finish: Hot-dip galvanize according to following. For surfaces to be painted, do not quench or apply post galvanizing treatments that might interfere with paint adhesion. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - a. Steel and Iron Products: ASTM A 123.
 - b. Steel and Iron Hardware: ASTM A 153.
 - 2. Cleaning: After galvanizing, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- B. Field-Applied Coatings: As specified in Division 09 Section "Painting". Paint all steel fabrications unless noted otherwise.

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2.17 STAINLESS STEEL FINISHES

- A. Stainless Steel Fabrications: As-fabricated finish.

2.18 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive metal fabrications and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL FABRICATIONS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

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- C. Connections at Unprotected Areas: Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of units that have been coated or finished after fabrication and are intended for bolted or screwed field connections or other means without further cutting or fitting.
- D. Field Welding: Weld connections continuously to develop full strength of member to comply with following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Corrosion Protection: Coat concealed aluminum surfaces that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with heavy coat of bituminous paint.

3.5 INSTALLATION OF MISCELLANEOUS ITEMS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturer/fabricators' written instructions and requirements indicated on Shop Drawings.
- B. Stair Nosings at Cast-in-Place Concrete Stairs: Install with anchorage system to comply with manufacturer/fabricator's written instructions. Center nosings on tread widths to within 3 in of ends. Align nosings flush with riser faces and level with tread surfaces.

3.6 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.
- B. Galvanized Surfaces at Unprotected Areas: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

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SECTION 055113

METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal stairs and supplementary items necessary for installation.
 - 1. Metal pan stairs with concrete-filled metal pan treads and platforms.
 - 2. Metal pan stairs with precast terrazzo treads.
- B. Related Requirements:
 - 1. Refer to Division 5 Section Pipe and Tube Railings for railings, guards, and gates.

1.2 DEFINITIONS

- A. Unprotected Areas, Exterior Locations: Exterior areas exposed to the elements including but not limited to rain, snow, or ice.
- B. Protected Areas, Interior and Exterior Protected Locations: Interior and protected exterior areas not exposed to the elements including but not limited to rain, snow, or ice.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:

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1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
- E. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.
 1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance. Including but not limited to the following:
 - a. Abrasive nosings.
 - b. Post-installed anchors.
 - c. Shop primer products.
 - d. Nonslip-aggregate concrete finish.
 - e. Precast terrazzo treads.
 - f. Nonshrink, nonmetallic grout.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 1. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 2. Include plan at each level.
 3. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
 4. Indicate profile and dimensions of precast terrazzo treads.
- C. Samples for Verification: Each type and finish of the following items:
 1. Nosing.
 2. Precast terrazzo tread.

1.5 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

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- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- D. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1., the Building Code and Authorities Having Jurisdiction.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.

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1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 2. Protect steel members and packaged materials from corrosion and deterioration.
 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
- B. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Alfab, Inc. (STAIRCO).
 2. American Stair, Inc.
 3. Pacific Stair Corporation.
 4. Sharon Companies Ltd. (Duvinage LLC).

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

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- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform Load: 100 lbf/sq. ft..
 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 5. Deflection of treads, platforms, and framing members:
 - a. Typical Stairs: $L/360$ or 1/4 inch, whichever is less.
 - b. Stairs with Stone or Ceramic Tile: $L/720$.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

2.4 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
1. Protected Areas, Interior and Exterior Protected Locations: Provide uncoated, non-galvanized steel including but not limited to plates, shapes, bars, sheets, rods and wire.
 2. Unprotected Areas, Exterior Locations and where Indicated: Provide galvanized, steel including but not limited to plates, shapes, bars, sheets, rods and wire.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

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- C. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- D. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- E. Galvanized Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.
- F. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.5 ABRASIVE NOSINGS

- A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder.
 - 1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
 - a. Fabricate units in lengths necessary to accurately fit openings or conditions ending 1/8 in (3 mm) from face of stringer.
 - 2. Exit Stairs at High Rise Buildings: Provide photoluminescent strips, minimum 1 in (25 mm) wide by full width of stair nosing, incorporated into abrasive surfaced nosings.
- B. Manufacturers:
 - 1. ACL Industries, Inc.
 - 2. American Safety Tread Co., Inc.
 - 3. Amstep Products.
 - 4. Armstrong Products, Inc.
 - 5. Balco Inc.
 - 6. Granite State Casting Co.
 - 7. Wooster Products Inc.
- C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other listed manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Manufacturer and Product - Exit Stairs at High Rise Buildings: Wooster Products Inc.; Supergrit, WP-RN3SG -NG; color as selected by Architect from manufacturer's full range of colors.
- D. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

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2.6 FASTENERS

- A. General: Select fasteners for type, grade, and class required to comply with performance requirements and produce connections suitable for environmental exposure and anchoring stairs to other construction indicated.
 - 1. Non-Galvanized Steel Components: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Steel Components: Hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Protected Areas, Interior and Exterior Protected Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Unprotected Areas, Exterior Locations: Hot-dip zinc-coated steel bolts, ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.7 PAINT MATERIALS

- A. Coordination: Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Shop Primers for Paint: Provide primers that comply with Division 09 Section Painting.
 - 1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.8 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.

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- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
 - 1. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.9 CONCRETE-FILLED METAL PAN TREADS AND PLATFORMS

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.
- B. Nonslip-Aggregate Concrete Finish - Unprotected Areas: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- C. Reinforcement: Plain steel, welded-wire reinforcement, 2 by 2 inches by 0.062-inch- diameter steel wire; comply with ASTM A1064/A1064M, except for minimum wire size.
 - 1. Provide galvanized reinforcement for exterior, unprotected installations and where indicated.
- D. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
 - 2. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.10 PRECAST TERRAZZO TREADS

- A. Precast Terrazzo Stair Treads: Epoxy terrazzo units cast in maximum lengths possible. Comply with manufacturer's written instructions for fabricating precast terrazzo units in sizes and profiles indicated.
 - 1. Epoxy Resin Matrix: Manufacturer's standard recommended for use indicated.
 - 2. Aggregates: Comply with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
 - 3. Reinforcement: ASTM A615/A615M, Grade 60 bars, as required by unit size, profile, and thickness.
 - 4. Abrasive Inserts: 1/2-inch- wide, silicon carbon/epoxy mixture.

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- a. Provide three inserts, 1/2 inch apart, with first insert located 1 inch from nosing at adjacent stair riser locations.
- 5. Color: As selected by Architect from manufacturer's standard color selections.
 - a. Finish: Honed.
- 6. Surface Sealer: Slip- and stain-resistant, penetrating sealer that is chemically neutral with pH factor between 7 and 8; does not affect color or physical properties of terrazzo type indicated; is recommend by sealer manufacturer for use with specified terrazzo; and complies with NTMA guide specification for terrazzo type applicable for this Project.

2.11 PERFORATED METAL RISERS

- A. Materials: Refer to 2.4 METALS above. Refer to drawings for perforated design.

2.12 FABRICATION, GENERAL

- A. General: Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Unprotected Areas, Exterior Locations and where Indicated: Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
- B. Shop Assembly: Assemble stairs in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.

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- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 2. Locate joints where least conspicuous.
 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate internally.

2.13 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual."
1. Stair Classification: Commercial Class unless more stringent requirements are indicated.
 - a. Metal Pan Stairs.
 - 1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.
 2. Stair Classification: Architectural Class unless more stringent requirements are indicated.
 - a. Architecturally Exposed Open Stairs.
 - 1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.
 3. Stair Classification: Service Class unless more stringent requirements are indicated.
- B. Stair Framing:
1. Stringers: Fabricate of steel plates or steel channels as indicated on Drawings.
 - a. Stringer Size: As required to comply with Performance Requirements and as indicated on Drawings.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 2. Platforms: Construct of steel plates or steel channel headers and miscellaneous framing members as required to comply with Performance Requirements and as indicated on Drawings
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
 - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

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5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
1. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 2. Attach abrasive nosings to risers.
 3. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.14 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Division 05 Section Pipe and Tube Railings.

2.15 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish fabrications after assembly.
 2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- B. Selections: As scheduled or as indicated in Design Selections.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. Shop Priming:
1. Shop Primer for Galvanized Steel: Apply shop primer formulated for exterior use over zinc-coated metal stair components.
 - a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 16 surface preparation specifications
 2. Shop Primer for Uncoated Surfaces: Apply shop primer to uncoated surfaces of metal stair components.

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- a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications
 - b. Application: Comply with SSPC-PA 1, Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel, for shop painting.
 - 1) Primer need not be applied to surfaces to be embedded in concrete or masonry.
- C. Field-Applied Coatings: Paint all metal stairs unless noted otherwise.
- 1. Painting: Comply with Division 09 Section Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 2. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

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1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 3. Comply with requirements for welding in Fabrication Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 1. Install abrasive nosings with anchors fully embedded in concrete.
 2. Center nosings on tread width.
 3. Coat concealed aluminum surfaces in contact with concrete with corrosion resistant paint.
- G. Install precast terrazzo treads according to manufacturer's written instructions.

3.5 INSTALLATION OF RAILINGS AND GUARDS

- A. Comply with applicable requirements in Division 05 Section Pipe and Tube Railings.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

3.7 REPAIR

- A. Touchup Painting:
 1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.
 - a. Painting: Comply with Division 09 Section Painting.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

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END OF SECTION

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SECTION 055213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal railings and supplementary items necessary for installation.
 - 1. Steel railings.
- B. Related Requirements:
 - 1. Refer to Division 05 Section Metal Pan Stairs for steel tube railings associated with metal pan stairs.

1.2 DEFINITIONS

- A. Unprotected Areas, Exterior Locations: Exterior areas exposed to the elements including but not limited to rain, snow, or ice.
- B. Protected Areas, Interior and Exterior Protected Locations: Interior and protected exterior areas not exposed to the elements including but not limited to rain, snow, or ice.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:

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1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
- E. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.
 1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance. Including but not limited to the following:
 - a. Fasteners.
 - b. Post-installed anchors.
 - c. Handrail brackets.
 - d. Shop primer.
 - e. Nonshrink, nonmetallic grout.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 1. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
- C. Samples for Verification: For each type of exposed finish required.
 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.

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1.5 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1., the Building Code and Authorities Having Jurisdiction.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate installation of anchorages for railings.

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1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Schedule installation of railings and guards so wall attachments are made only to completed walls.
1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
1. Keep railing members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 2. Protect railing members and packaged materials from corrosion and deterioration.
- B. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Alfab, Inc. (STAIRCO).
 2. American Stair, Inc.
 3. Pacific Stair Corporation.
 4. Sharon Companies Ltd. (Duvinage LLC).

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance of Railings and Guards: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

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1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

2.4 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
 1. Protected Areas, Interior and Exterior Protected Locations: Provide uncoated, non-galvanized steel including but not limited to pipe, tubes, plates, shapes, bars, sheets, rods and wire.
 2. Unprotected Areas, Exterior Locations and where Indicated: Provide galvanized, steel including but not limited to pipe, tubes, plates, shapes, bars, sheets, rods and wire.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.5 STEEL RAILINGS

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight, unless another grade and weight are required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.6 FASTENERS

- A. General: Select fasteners for type, grade, and class required to comply with performance requirements and produce connections suitable for environmental exposure and anchoring railings to other construction indicated.

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1. Non-Galvanized Steel Components: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
 2. Hot-Dip Galvanized Steel Components: Hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
1. Protected Areas, Interior and Exterior Protected Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 2. Unprotected Areas, Exterior Locations: Hot-dip zinc-coated steel bolts, ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.7 PAINT MATERIALS

- A. Coordination: Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Shop Primers for Paint: Provide primers that comply with Division 09 Section Painting.
1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

2.8 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
1. Provide grout specifically recommended by manufacturer for interior and exterior applications.

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2.9 FABRICATION OF RAILINGS

- A. NAAMM Railing Standard: Comply with NAAMM AMP 521, "Pipe Railing Systems Manual."□□
 - 1. Metal Railings for Commercial Class Metal Stairs.
 - a. Metal Pan Stairs.
 - 1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.
 - 2. Metal Railings for Service Class Metal Stairs.
 - a. Metal Floor Plate or Metal Grating Stairs.
 - 1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 4 - Good quality, uniform undressed weld with minimal splatter.
- B. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
 - 1. Join components by welding unless otherwise indicated.
- C. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- D. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- E. Form work true to line and level with accurate angles and surfaces.
- F. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- H. Connections: Fabricate railings with welded connections unless otherwise indicated.
- I. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

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- J. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
- K. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- Q. Fixed Railing Posts: For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- R. Removable Railing Posts: For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish fabrications after assembly.
 - 2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

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- B. Selections: As scheduled or as indicated in Design Selections.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
1. Hot-dip galvanize steel railings, including hardware, after fabrication.
 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 3. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 4. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- B. Shop Priming:
1. Shop Primer for Galvanized Steel: Apply shop primer formulated for exterior use over zinc-coated metal stair components.
 - a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 16 surface preparation specifications
 2. Shop Primer for Uncoated Surfaces: Apply shop primer to uncoated surfaces of metal stair components.
 - a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications
 - b. Application: Comply with SSPC-PA 1, Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel, for shop painting.
 - 1) Primer need not be applied to surfaces to be embedded in concrete or masonry.
 3. For non-galvanized-steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- C. Field-Applied Coatings: Paint all metal railings unless noted otherwise.
1. Painting: Comply with Division 09 Section Painting.

2.12 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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- B. Fluoropolymer Finish for Exterior Locations: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 PREPARATION

- A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF RAILINGS

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.

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3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.5 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Fabrication Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.6 ANCHORING POSTS

- A. Anchoring Post onto Concrete:
1. Anchoring post: As follows and as indicated on Drawings:
 - a. Attach flange to concrete using post-installed anchors in pre-drill holes, welded or attached with set screws to post.
- B. Anchoring Posts onto Metal Surfaces:
1. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - a. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
- C. Removable Railings: Install removable railing sections, where indicated, in slip-fit stainless-steel sockets cast in concrete.

3.7 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with clearance from inside face of handrail and finished wall surface as indicated.
1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

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- B. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.
- C. Install railing gates level, plumb, and secure for full opening without interference.
 - 1. Attach hardware using tamper-resistant or concealed means.
 - 2. Adjust hardware for smooth operation.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

3.9 REPAIR

- A. Touchup Painting:
 - 1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.
 - a. Painting: Comply with Division 09 Section Painting.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 055300

METAL GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal gratings and supplementary items required for installation.

1.2 DEFINITIONS

- A. Unprotected Areas: Exterior areas directly exposed to the elements such as rain, snow, or ice.
- B. Protected Areas: Interior and exterior areas not directly exposed to the elements such as rain, snow, or ice.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

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2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 1. Provide templates for anchors and bolts specified for installation under other Sections.
 2. For installed products indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
 2. AWS D1.3, "Structural Welding Code - Sheet Steel".
- C. Metal Bar Grating Standards: Comply with the following as appropriate:
 1. NAAMM MBG 531, "Metal Bar Grating Manual".
 2. NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual".

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1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate installation of anchorages for metal gratings. Furnish setting drawings, templates, and directions for installing anchorages, including concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - 2. IKG Industries; a division of Harsco Corporation.
 - 3. McNichols Co.
 - 4. Ohio Gratings, Inc.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.
- B. Design Loads: Engineer to withstand design loads including, but not limited to, gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable local building codes, and as indicated.

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1. Structural Movement: Engineer to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.
 2. Floor Gratings: Uniform load of 125 lbf/sf or concentrated load of 2000 lbf, whichever produces the greater stress.
 3. Gratings in Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sf.
 4. Limit deflection to $L/360$ or $1/4$ in, whichever is less.
- C. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.
1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
- D. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- C. Wire Rod for Bar Grating Crossbars: ASTM A 510 .

2.5 FASTENERS

- A. Fastener Type and Material: Select fasteners for type, grade, and class required to produce connections suitable for anchoring gratings to other types of construction indicated and capable of withstanding design loads.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A/ F 568M, Property Class 4.6; with hex nuts, ASTM A 563/ A 563M; and, where indicated, flat washers.
- C. Bolts and Nuts:
 1. Protected Areas: Regular hexagon-head bolts, ASTM A 307, Grade A ; with hex nuts, ASTM A 563 /; and, where indicated, flat washers.
 2. Unprotected Areas: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594/; and, where indicated, flat washers and as follows:
 - a. Alloy Group 1 for Type 304.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563/ A 563M; and, where indicated, flat washers. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Plain Washers: Round carbon steel, ASME B18.22.1/ASME B18.22M.

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- F. Lock Washers: Helical, spring type carbon steel, ASME B18.21.1/ASME B18.21.2M.

2.6 ANCHORS

- A. General: Provide anchors capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- B. Cast-in-Place Anchors in Concrete: Bolts, washers, and shims as needed, either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel; hot-dip galvanized according to ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Protected Areas: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/, Class Fe/Zn 5, unless otherwise indicated.
 2. Unprotected Areas: Stainless steel bolts, ASTM F 593/, and nuts, ASTM F 594/
 - a. Alloy Group 1 for Type 304.
 3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.7 PAINT MATERIALS

- A. Paint for Steel Gratings: As specified in Division 09 Section "Painting".
- B. Galvanizing Repair Paint for Steel Gratings at Unprotected Areas: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.8 ACCESSORY ITEMS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.9 FABRICATION, GENERAL

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 in unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

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- D. Fit exposed connections accurately together to form hairline joints.
- E. Shop-Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously to develop full strength of member to comply with following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surfaces.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 - 2. Toeplate Height: 4 in unless otherwise indicated.

2.10 METAL BAR GRATINGS

- A. Welded Steel Grating:
 - 1. Bearing Bar Spacing: 1-3/16 in on center, except at walking surfaces.
 - 2. Bearing Bar Depth: As required to comply with structural performance requirements.
 - 3. Bearing Bar Thickness: As required to comply with structural performance requirements.
 - 4. Crossbar Spacing: 4 in on center.
 - 5. Traffic Surface: Plain.
 - 6. Finish:
 - a. Protected Areas: Shop primed.
 - b. UnProtected Areas: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.
- B. Metal Gratings in Walking Surfaces: Fabricate metal gratings with bearing bars spaced with 1/4 in maximum spacing between bars to meet ADA requirements. Arrange so that bearing bars are perpendicular to the dominant direction of travel.
- C. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - 1. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 in or less in thickness and spaced 15/16 in or more on center, with each clip designed and fabricated to fit over two bearing bars.
 - 2. Furnish threaded bolts with nuts and washers for securing grating to supports.
- D. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

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1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

E. Do not notch bearing bars at supports to maintain elevation.

2.11 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 in on center and provide minimum anchor units in the form of steel straps 1-1/4 in wide by 1/4 in thick by 8 in long.

B. Steel Gratings at Unprotected Areas: Galvanize steel frames and supports.

2.12 FINISHES, GENERAL

A. Finish Quality Standard: NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL FINISHES

A. Unprotected Areas:

1. Galvanized Finish: Hot-dip galvanize according to following. For surfaces to be painted, do not quench or apply post galvanizing treatments that might interfere with paint adhesion. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - a. Steel and Iron Products: ASTM A 123.
 - b. Steel and Iron Hardware: ASTM A 153.
2. Cleaning: After galvanizing, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

B. Protected Areas:

1. Shop Priming: Comply with Division 09 Section 09210 Painting and as follows:
 - a. Preparation of Uncoated Surfaces: Prepare uncoated surfaces to comply with requirements of coating product to be used, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications and environmental exposure conditions of installed fabrications.

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- b. Application: SSPC-PA 1; apply shop primer to uncoated surfaces. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- C. Field-Applied Coatings: As specified in Division 09 Section 09210 Painting. Paint all steel gratings unless noted otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL GRATINGS, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; measured from established lines and levels.
- C. Connections at Unprotected Areas: Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of units that have been coated or finished after fabrication and are intended for bolted or screwed field connections or other means without further cutting or fitting.

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- D. Field Welding: Weld connections continuously to develop full strength of member to comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- F. Toeplates: Attach toeplates to gratings by welding at locations indicated.

3.5 INSTALLATION OF METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Removable Grating Sections: Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach non-removable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.6 FIELD QUALITY CONTROL

- A. Owner's Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

3.7 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.
- B. Galvanized Surfaces at Unprotected Areas: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

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SECTION 055813

ORNAMENTAL METAL COLUMN COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes ornamental metal column covers and supplementary items necessary to complete for their installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Samples for Verification: Include 6 in square samples for each type of metal finish required, prepared on metal of same thickness and alloy indicated for the Work. If finishes involve normal color and texture variations, include sample sets, consisting of two or more units, showing the full range of variations expected.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3, "Structural Welding Code - Sheet Steel."

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- D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.4 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate installation of anchorages for ornamental metal items. Furnish Setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Construction Services, Inc.
 2. Firestone Metal Products, LLC; Una-Clad.
 3. Fry Reglet Corporation.
 4. Industrial Louvers, Inc.
 5. MM Systems Corporation.
 6. Pittcon Industries.

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- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: As scheduled or as indicated in Design Selections.

2.2 COLUMN COVERS

- A. Snap-Together Type: Form column covers to shapes indicated from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that will engage continuous mounting clips.
- B. Metals:
1. Aluminum Sheet: Flat sheet complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H32.
- a. Thickness at Exterior Units: Thickness required to comply with performance requirements.
2. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A 879/A 879M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.
- a. Thickness at Interior Units: 0.060 in.
- C. Base and Ceiling Rings: If indicated on drawings, fabricate base and ceiling rings to match column covers. If base and ceiling rings are not indicated, then fabricate with calk stop/stiffener ring.

2.3 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in units and remain weathertight; as recommended in writing by column cover manufacturer.
1. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
2. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
- B. Sealants, Exterior: Where indicated, provide ASTM C 920; elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in decorative formed metal and remain weathertight; and as recommended in writing by decorative formed metal manufacturer.
- C. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
1. Use filler metals that will match the color of metal being joined and will not cause discoloration.

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- D. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless exposed fasteners are unavoidable or are the standard fastening method.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- E. Structural Anchors: For applications indicated to comply with certain design loads, provide chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- F. Anchor Materials:
 - 1. Material for Exterior Units: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
 - 2. Material for Exterior Stainless Steel Units: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 PAINTS AND COATINGS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble units in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of units with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2 in wide hem on the concealed side, or ease edges to a radius of approximately 1/32 in and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce units as needed to attach and support other construction.

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- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install units.
- G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
 - 1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Color and Gloss: As scheduled or as indicated in Design Selections.
- B. Mechanical Finishes:
 - 1. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
 - 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Apply organic and anodic finishes to units after fabrication unless otherwise indicated.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

2.8 STEEL SHEET FINISHES

- A. Pretreatment: Galvanized for machine room.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Locate and place units level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install units.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
- E. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

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3.5 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.6 PROTECTION

- A. Protect finishes of units from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

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SECTION 057300

ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes ornamental railings along with supplementary items necessary to complete their installation.
 - 1. Interior Wood railings and steel support.
 - 2. Exterior Stainless Steel cable added to Existing railing.

1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.
- B. Interior: Areas located in conditioned spaces.
- C. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

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2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 2. Manufacturer's product lines of railings assembled from standard components.
 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Samples for Verification: For each type of exposed finish required.
 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 2. Fittings and brackets.
 3. Welded or brazed connections, as applicable.
 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

1.5 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- B. Product Test Reports: For tests performed by a qualified testing agency, in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.
- C. Field Quality Control Reports: Written report of inspection required by "Field Quality Control".

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

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3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

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- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION AND SCHEDULING

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- C. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- D. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Manufacturers:

- a. Blum, Julius & Co., Inc.
- b. Blumcraft of Pittsburgh.
- c. CraneVeyor Corp.
- d. Laurence, C.R. Co., Inc.
- e. Livers Bronze Co.
- f. Newman Brothers, Inc.

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- g. Sterling Dula Architectural Products, Inc. Div. of Kane Manufacturing.
- h. Trex Commercial Products.
- i. VIVA Railings.
- j. Wagner, R & B, Ins.; a division of the Wagner Companies.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Engineering: Engineer railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Wind Loads: Wind Loads: For exterior glazed decorative metal railings, capable of withstanding the following wind loads in accordance with the IBC and ASTM E1300:
 - 1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.4 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
 - 1. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.

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2.5 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- E. Stainless Steel Cable and Cable Fittings:
 - 1. Basis of Design: As indicated or scheduled in Design Selections.
 - 2. Cable, Configuration and Diameter: Wire cable made from wire complying with ASTM A492, Type 316.
 - 3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
 - 4. Intermediate Cable Supports: Stainless steel flat bar, 1/4 by 1 inch, predrilled.

2.6 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
 - 2. Dissimilar Metals for Interior Railings: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
 - 1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Post-Installed Anchors: Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

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2.7 MISCELLANEOUS MATERIALS

- A. Wood Rails:
 - 1. Clear, straight-grained hardwood rails secured to metal subrail as indicated on Drawings.
 - a. Comply with Section 064023 Interior Architectural Woodwork.
- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- C. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Anchoring Cement: Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.8 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
- D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 in unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- E. Form work true to line and level with accurate angles and surfaces.
- F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- H. Connections: Fabricate railings with welded or Non-welded connections unless otherwise indicated.

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- I. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- J. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- K. Form changes in direction by flush bends or by inserting prefabricated flush-elbow fittings. Where applicable, by radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- L. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of hollow railing members with prefabricated end fittings.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 in or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. Interior Installations at Plaster or Gypsum Board Partitions: At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- Q. For railing posts set in concrete, provide steel sleeves not less than 6 in long with inside dimensions not less than 1/2 in greater than outside dimensions of post, with metal plate forming bottom closure.
- R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products", the Aluminum Association and AAMA / FGIA for recommendations for applying and designating finishes.

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1. Selections: As scheduled or as indicated in Design Selections.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.10 STEEL AND IRON FINISHES

- A. Non-Galvanized Railings for Interior Installations:
 1. For non-galvanized-steel railings, provide Non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
 2. Preparing Non-Galvanized Railings for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
 - a. Exterior Railings: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
 - b. Railings Indicated to Receive Primers Specified in Section 099600 High-Performance Coatings: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
 - c. Interior and Other Railings: SSPC-SP 7/NACE No. 4, Brush-off Blast Cleaning .
- B. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 1. Shop prime uncoated railings with primers specified in Division 09 Section Painting.
 2. Do not apply primer to galvanized surfaces.
- C. Shop-Painted Finish:
 1. Comply with Division 09 Section Painting.
- D. Field-Painted Finish:
 1. Comply with Division 09 Section Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Interior Installations: Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 in in 3 feet.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 in in 12 feet.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.5 RAILING CONNECTIONS

- A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

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- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 in beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 in of post.

3.6 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, non-metallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, non-metallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- D. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. Steel Railings: For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.7 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using non-welded connections.
- C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2 in clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

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3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.8 REPAIR

- A. Touchup Painting: Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.
 1. Comply with Division 09 Section Painting.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
- C. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358 for compliance with performance requirements.
- D. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements
- E. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.10 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.
- B. Clean wood rails by wiping with a damp cloth and then wiping dry.

3.11 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

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- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

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SECTION 061053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Miscellaneous rough carpentry and supplementary items necessary for installation.
 - 1. Preservative treated wood materials.
 - 2. Fire retardant treated wood materials

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Preservative-Treated Wood: Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Fire-Retardant-Treated Wood: Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - a. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.

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- 3. Power-driven fasteners.
- 4. Post-installed anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Material Compatibility: Provide materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.
- C. Structural Loads: Installed materials and fabrications shall withstand loads within limits of allowable working stresses of the materials involved under conditions indicated, including but not limited to, requirements established by authorities having jurisdiction and applicable building codes.
- D. Miscellaneous Rough Carpentry within Roofing System Assemblies: Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing system assembly and flashings shall be fabricated and installed to withstand specified uplift pressures and thermally induced movement without contributing to failure of roofing system or flashings.
- E. Surface Burning Characteristics for Fire-Retardant-Treated Wood: Products and construction identical to assemblies tested for fire resistance according to ASTM E 84/NFPA 255/UL 723 and included under Category BPVV published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory"; or listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

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2.2 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP U1; Use Category UC4a.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application Schedule: Treat miscellaneous carpentry items indicated on Drawings and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, air water barriers, and waterproofing.
 - a. Contractor Option - Untreated Wood within Roofing System Assemblies: Contractor may use untreated wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing assemblies that are concealed within the roofing membrane.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

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1. Identification: Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Concealed Wood Blocking: Chemical formulations for fire retardant treatment to contain a compatible, non-bleed, light fast, colored dye to identify and indicate treatment.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application Schedule: Treat miscellaneous carpentry items indicated on Drawings and the following:
1. Concealed blocking within interior partitions.
 2. Plywood backing panels supporting equipment at interior locations.

2.5 LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Cants.
 4. Furring.
 5. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
 7. Northern species; NLGA.
 8. Eastern softwoods; NeLMA.

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- C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
 - 1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
 - 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWP.
 - 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWP.
 - 4. Eastern softwoods, No. 2 Common grade; NELMA.
 - 5. Northern species, No. 2 Common grade; NLGA.
 - 6. Western woods, Construction or No. 2 Common grade; WCLIB or WWP.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.
 - 1. Panel Grades: According to installation location.
 - a. A-C, exposed at occupied interior locations.
 - b. B-C, exposed at mechanical and electrical equipment rooms.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Unless indicated otherwise, where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
 - a. Contractor Option - Untreated Wood within Roofing System Assemblies: Provide fasteners with Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C1002 for drywall studs and ASTM C954 for structural studs, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.

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1. Mechanical Anchors in Masonry or Concrete: ICC-ES AC01 or ICC-ES AC193.
2. Adhesive Anchors in Masonry or Concrete: ICC-ES AC58 or ICC-ES AC308.
3. Material:
 - a. Interior Locations: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5, unless indicated otherwise.
 - b. Exterior Locations and where Stainless Steel is Indicated: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products, fabrications, and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
- C. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

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1. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the requirements of authorities having jurisdiction and the following:
 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - a. Select fasteners of appropriate size, type, and length that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Predrill members when necessary to avoid splitting wood while installing fasteners. Do not countersink nail heads, unless otherwise indicated. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
 2. ICC-ES evaluation report for fastener.

3.3 INSTALLATION OF WOOD BLOCKING AND NAILER

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.4 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

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3.5 PROTECTION

- A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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SECTION 061643

EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Exterior gypsum sheathing products and supplementary items necessary for installation.
- B. Related Section:
 - 1. Refer to Division 7 for applicable Air and Water Barrier system and related requirements. Ensure compatibility of joint treatment components with Air and Water Barrier system.

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms not defined in this Section or in other referenced quality standards.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

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1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
- B. Exposure Limitation: Exterior gypsum sheathing shall not be exposed to weather for more than 180 days.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
1. Ensure compatibility of joint treatment components and installation requirements with Air and Water Barrier systems incorporated into project.

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1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Exterior Gypsum Sheathing Boards:
 - 1. Generic Type: Glass-mat faced exterior gypsum sheathing board.
 - 2. Material Quality Standard: ASTM C 1177 / C 1177M, Type X.
 - 3. Description: Paperless, treated, water resistant, noncombustible, gypsum core with inorganic glass mat partially or completely embedded on both faces; 5/8 in thick. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
 - 4. Manufacturers and Products:
 - a. American Gypsum; M-Glass Exterior Sheathing.
 - b. CertainTeed Corporation; GlasRoc Sheathing, Type X.
 - c. Georgia-Pacific Gypsum LLC; DensGlass Fireguard Type X Sheathing.
 - d. National Gypsum Company; Gold Bond Brand eXP Fire-Shield Extended Exposure Sheathing.
 - e. United States Gypsum Company (USG); Securock Firecode Type X Glass-Mat Sheathing.
- C. Vertical Cover Boards (Back of Parapet) at Roofing: Provide same product used for horizontal roof cover boards.

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1. Generic Type: Exterior sheathing board specifically manufactured for use beneath roofing systems.
 2. Material Quality Standard: ASTM C 1177 / C 1177M, Type X.
 3. Description: Non-combustible moisture-resistant board with non-asphaltic coatings; 5/8 in thick. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
 4. Manufacturers and Products:
 - a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
 - b. USG; SECUROCK Gypsum-Fiber Roof Board.
 - c. Georgia-Pacific Gypsum LLC; DensDeck StormX Prime.
- D. Horizontal Roof Cover Boards: As specified in Division 07 Section for roofing membrane.
- E. Screw Fasteners:
1. Material Quality Standards:
 - a. Metal Framing Members less than 0.030 in Thick: ASTM C 1002, Type S.
 - b. Metal Framing Members from 0.033 in to 0.112 in Thick: ASTM C 954, Type S-12.
 2. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by manufacturer; minimum 1 in long; with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 3. Limitation: Nails and staples are not permitted.
- F. Joint and Penetration Treatment Materials:
1. General: Joint and penetration treatment materials shall be compatible with and recommended by gypsum sheathing manufacturer and air / water barrier manufacturer for application indicated.
 2. Air Barrier Liquid Membrane: Liquid detail and substrate patching membrane for use with sheathing tape at joints and penetrations and for covering exposed fasteners.
 - a. Sheathing Tape: Type recommended by sheathing manufacturer and air / water barrier manufacturer for use with air barrier liquid membrane in sealing joints and penetrations in glass-mat gypsum sheathing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standard: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. GA-253.
 - 2. ASTM C 1280.
 - 3. Respective manufacturer's written installation instructions.
 - 4. Accepted submittals.
 - 5. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Installation of Exterior Gypsum Sheathing Boards and Back of Parapet Boards:
 - 1. Install boards with coated face out, with panel lengths oriented vertically or horizontally as recommended by manufacturer, with vertical edges centered over flanges of studs, with edges and ends fitted tightly together.
 - 2. Do not install imperfect, damaged, wet, or damp boards.
 - 3. Cut boards at penetrations, edges, and other obstructions of the Work; fit tightly against abutting construction with 1/4-inch maximum gap, except provide maximum 3/8 in setback where boards abuts structural elements or materials that may retain moisture.
 - 4. Coordinate installation of boards with flashing and joint treatment so materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
 - 5. Install screws at perimeter and within field to each stud approximately 8 in on centers; set back minimum 3/8 in from edges and ends; apply so screw heads bear tightly against board face but do not cut into facing.
 - 6. Do not bridge building expansion joints or deflection joints with boards; cut and space edges to match spacing of structural support elements.
- B. Joint and Penetration Treatment at Exterior Gypsum Sheathing Boards and Back of Parapet Boards:
 - 1. Coordinate installation with applicable air / water barrier system to ensure compatibility of joint and penetration treatment.
 - 2. Apply liquid membrane to joints and fasteners and trowel flat. Apply liquid membrane sufficiently to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 3. Apply sheathing tape to glass-mat gypsum sheathing joints. Apply and trowel liquid membrane to embed entire face of tape. Apply liquid membrane to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

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3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 PROTECTION

- A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions. Remove and replace products that are exposed to weather for more than number of days allowed by manufacturer.

END OF SECTION

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SECTION 064023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Shop-finished interior architectural woodwork and supplementary items necessary for installation.
- B. Simulated Stone Countertops: Refer to Division 12 Section "Simulated Stone Countertops" for solid surfacing, quartz agglomerate, or cultured marble countertops incorporated into work specified in this Section. Simulated stone trim is specified in this Section.

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- B. Exposed Surfaces, Semi-Exposed Surfaces, Concealed Surfaces, Types of Cabinet Construction, and other related terms are defined in referenced quality standards.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Wood Veneered Items: Include finishing materials and processes.
 - 3. Fire Retardant Treated Wood: Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
 - 4. Wood Paneling with Transparent Finish: For paneling noted or schedule to be blueprint matched work, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- C. Samples for Verification:

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1. Items with Transparent Finish:
 - a. Lumber with or for transparent finish, not less than 50 sq. in. or 5 in wide by 24 in long, for each species and cut, finished on 1 side and 1 edge.
 - b. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
 - c. Veneer-faced panel products with or for transparent finish, 8 in by 10 in, for each species and cut. Include at least one face-veneer seam and finish as specified.
2. Items with Opaque Finish:
 - a. Lumber and panel products with shop-applied opaque finish, 50 sq. in. for lumber and 8 in by 10 in for panels, for each finish system and color, with 1/2 of exposed surface finished.
3. Items with Plastic Laminate Finish:
 - a. Plastic laminates, 8 in by 10 in, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
4. Simulated Stone Trim: 6 in long.
5. Cabinets:
 - a. Corner Piece: Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 in high by 18 in wide by 6 in deep.
 - b. Cabinet Hardware and Accessories: Exposed cabinet hardware and accessories, one unit for each type and finish.
 - c. Countertops: Section of countertop showing top, front edge, and backsplash construction.
6. Standing and Running Trim: Corner piece showing miter joints.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Certification: Certified participant in AWI's Quality Certification Program or licensee of WI's Certified Compliance Program.
- B. Source Limitations for Wood Veneered Items: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with "Architectural Woodwork Standards" for standards and for grades of interior architectural woodwork indicated for construction, finish, installation and other requirements:

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1. Provide manufacturer certification indicating that woodwork complies with requirements of referenced quality standards.
 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
- D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated or required, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- E. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.
- F. Mock-ups, Cabinets:
1. One full-size sample of finished base cabinet unit complete with hardware, doors, and drawers, but exclusive of countertop.
 2. One full-size sample of finished wall-mounted cabinet unit complete with hardware, doors, and adjustable shelves.
 3. Accepted sample units will be used as a standard for judging the completed work. Unless otherwise directed, accepted sample units may be incorporated in work. If not incorporated in work, retain accepted sample units at Project site until completion of work and remove sample units from premises when directed by Architect.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.

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- c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate Shop Drawings and fabrication with hardware requirements.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Provide materials that comply with requirements of "Architectural Woodwork Standards" quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

2.3 MATERIALS

- A. Wood Species and Cut for Transparent Finish:
 - 1. Selections: As scheduled or as indicated in Design Selections.
- B. Wood Species for Opaque Finish: Any closed-grain hardwood unless indicated otherwise.
- C. Fire Retardant Wood Products for Paneling:
 - 1. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Industrial Grade M-2 Exterior Glue, made with binder containing no added urea formaldehyde, 43 pcf Density.
 - 3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
- D. Wood Products for Cabinets:
 - 1. Hardboard for Vertical Dividers Only: AHA A135.4, tempered, smooth two sides, 1/4 in minimum thickness unless indicated otherwise.
 - 2. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
 - 3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
 - 4. Softwood Plywood: DOC PS 1.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Fire-Rated Laminates: Where indicated or scheduled; NEMA LD 3, grades as follows:

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- a. Vertical Surfaces: General Purpose Type 604 (VGF), 0.032 in thick.
 - b. Horizontal Surfaces: General Purpose Type 605 (HGF) 0.048 in thick.
2. Manufacturers:
- a. Formica Corporation.
 - b. International Paper.
 - c. Lamin-Art, Inc.
 - d. Nevamar Company, LLC; Decorative Products Div.
 - e. Pioneer Plastics Corp.
 - f. Westinghouse Electric Corp.; Specialty Products Div.
 - g. Wilsonart International; Div. of Premark International, Inc.
3. Colors, Patterns, and Finishes:
- a. Selections: As scheduled or as indicated in Design Selections.
- F. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:
1. Laminate has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.9.5:
- a. Nitric Acid (30 Percent): Moderate effect.
 - b. Sulfuric Acid (77 Percent): Moderate effect.
 - c. Hydrochloric Acid (37 Percent): Moderate effect.
 - d. Phosphoric Acid (75 Percent): No effect.
 - e. Acetic Acid (98 Percent): No effect.
 - f. Formaldehyde: No effect.
 - g. Ethyl Acetate: No effect.
 - h. Ethyl Ether: No effect.
 - i. Phenol (85 Percent): Moderate effect.
 - j. Benzene: No effect.
 - k. Xylene: No effect.
 - l. Butyl Alcohol: No effect.
 - m. Furfural: No effect.
 - n. Methyl Ethyl Ketone: No effect.
 - o. Sodium Hydroxide (25 Percent): No effect.
 - p. Sodium Sulfide (15 Percent): No effect.
 - q. Ammonium Hydroxide (28 Percent): No effect.
 - r. Zinc Chloride: No effect.
 - s. Gentian Violet: No effect.
 - t. Methyl Red: No effect.
2. Manufacturers and Products:
- a. Formica Corporation; Lab Grade 840 Black.
 - b. Panolam Industries International Incorporated; Pionite Chemguard.
 - c. Wilsonart International, Div. of Premark International, Inc.; Chemsurf.
3. Colors, Patterns, and Finishes:
- a. Selections: As scheduled or as indicated in Design Selections.

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G. Simulated Stone Trim:

1. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

- a. Manufacturers:

- 1) Avonite Surfaces.
 - 2) E. I. du Pont de Nemours and Company.
 - 3) Formica Corporation.
 - 4) LG Chemical, Ltd.
 - 5) Meganite Inc.
 - 6) Samsung Chemical USA, Inc.
 - 7) Swan Corporation (The).
 - 8) Transolid, Inc.
 - 9) Wilsonart International.

2. Colors, Patterns, and Finishes:

- a. Selections: As scheduled or as indicated in Design Selections.

H. Glass:

1. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick, unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated or required, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment types:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Interior Type A: Low-hygroscopic formulation.
3. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
4. Kiln-dry materials before and after treatment to levels required for untreated materials.

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- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.5 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
 - 1. Refer to Interior Design Documents and Schedules for additional hardware selections.
- B. Hinges: Provide number of hinges recommended by hinge manufacturer for size and weight of door.
- C. Butt Hinges: 2-3/4 in, 5-knuckle steel hinges made from 0.095 in thick metal, and as follows:
 - 1. Semi-concealed Hinges for Flush Doors: BHMA A156.9, B01361.
 - 2. Semi-concealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- D. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602,
 - 1. Product Standard: Grass; "Tiomos 120 Series", 120 degree swing, self-closing from 10 deg.
 - a. Angle Reduction Clip: Provide angle reducing clip at doors adjacent to walls and corners, door swing to be limited to 85 degrees. Finish: Steel with nickel plating. Manufacturer and Product: Grass; Tiomos Angle Reduction Clip, F072135751.
- E. Back-Mounted Pulls: BHMA A156.9, B02011.
- F. Wire Pulls: Back mounted, solid metal, 4 in long, 5/16 in in diameter.
 - 1. Product Standard: EPCO-MC-402-4, 4 in center to center of screws, 1-5/16 in projection, 5/16 in diameter. Stainless steel.
- G. Catches: Magnetic catches, BHMA A156.9, B03141.
- H. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- I. Shelf Rests: BHMA A156.9, B04013; metal.
 - 1. Product Standard: K & V No. 345, nickel plated.
- J. Drawer Slides: BHMA A156.9, B05091.

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1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
 2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 in high and 24 in wide.
 - a. Product Standard for 24 in Wide and Less: Full extension; Accuride "7434".
 - b. Product Standard for Wider than 24 in: Full extension; Accuride "7432".
 3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 in high or 24 in wide.
 - a. Product Standard for 42 in Wide and Less: Full extension with 1 in over travel; Accuride "3640".
 4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 in high and 24 in wide.
 - a. Product Standard for 16 in Wide and Less: Low profile, 75 lb load rating (at 2/3 travel), full extension; Accuride "2632".
 - b. Keyboard Slides: Grade 1HD-100; for computer keyboard shelves.
 - c. Product Standard for Slides Only, 16 in Wide and Less: Adjustable height, 75 lb load rating; Accuride "2109".
 - d. Product Standard for Slides and Tray: Fixed tilt, adjustable height; Accuride "Cbergo-Tray 200".
 - e. Product Standard for Slides, Tray and Accessories: Adjustable tilt, adjustable height, cable management, palm rest, and mouse pad; Accuride "Cbergo-Tray 300".
 5. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 in high and 16 in wide.
- K. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- L. Door Locks: BHMA A156.11, E07121.
1. Product Standard: K & V No. 984, nickel plated.
- M. Drawer Locks: BHMA A156.11, E07041.
1. Product Standard: K & V No. 986, nickel plated.
- N. Sliding Door Locks:
1. Product Standard: K & V No. 984, nickel plated.
- O. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Size: 1-1/4 in or 2 in OD as indicated.
 2. Color: Brown, black or white as indicated or selected by Architect.
 3. Product Standards: Doug Mockett & Company, Inc "OG or SG Series" or Hafele 429.93.
- P. Concealed Pocket Door Slides (Vertical Swing/Slide/Retract):

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1. Description: Side mounted flipper door slide assembly suitable for recessed full overlay door, 42 in high and less, 30 lb load rating, into concealed pocket within cabinet, painted steel slides with all steel ball bearings.
 2. Product Standard: Accuride "" "1321".
- Q. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630, unless otherwise indicated.
- R. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- S. Manufacturers:
1. Accuride.
 2. Julius Blum, Inc.
 3. The Engineered Products Company.
 4. Grass America, Inc.
 5. Hafele America Company.
 6. Hettich America Corporation.
 7. Knap & Vogt Manufacturing Company (K & V).
 8. Stanley Hardware, Division of the Stanley Works.
- T. Cabinet Accessories:
1. Flat-Screen Computer Monitor and Keyboard Mounting System:
 - a. Product Standard: Hafele; Monitor Suspension System (Flat Screen Monitors).
 2. Counter Support Brackets: Unless noted otherwise, provide brackets factory-primed for field painting.
 - a. Manufacturers and Products:
 - 1) A&M Hardware, Inc.; Work Station Brackets.
 - 2) Rakks/Rangine Corporation; Counter Support Brackets, EH Series.
 3. Table Legs:
 - a. Product Standard: Richelieu; Round Table Legs, Product UC250175, 28 in long by 2-1/2 in diameter steel table leg with satin chrome finish.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

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- C. Adhesives:
 - 1. General: As recommended by woodwork fabricator to suit application.
 - 2. Adhesive for Bonding Plastic Laminate Faces and Edges: PVA as recommended by woodwork fabricator to suit application.
- D. Hanging Clips: Provide manufacturer's standard nonferrous-metal or hot-dip galvanized zee hanging clips.

2.7 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium Grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fire Retardant Treated Wood: Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 in Thick or Less: 1/16 in.
 - 2. Edges of Rails and Similar Members More Than 3/4 in Thick: 1/8 in.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Countertops: Seal edges of openings in countertops.
- G. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual". For glass in wood frames, secure glass with removable stops.

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2.8 INTERIOR STANDING AND RUNNING TRIM

- A. Grade for Transparent Finish: Premium.
- B. Grade for Opaque Finish: Premium.
- C. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- D. For trim items wider than available lumber, use veneered construction. Do not glue for width.
- E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- F. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.9 INTERIOR FRAMES AND JAMBS

- A. Grade for Transparent Finish: Premium.
- B. Grade for Opaque Finish: Premium.
- C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.

2.10 FLUSH WOOD PANELING

- A. Grade for Transparent Finish: Premium.
- B. Grade for Opaque Finish: Premium.
- C. Lumber Trim and Edges: If not indicated, trim and edges shall be solid wood lumber compatible with grain and color of veneered panels.
- D. Matching Requirements: As scheduled or as indicated in Design Selections.
- E. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of 75 or less and smoke-developed index of 450 or less per ASTM E 84.

2.11 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.
- C. Lumber Trim and Edges: If not indicated, trim and edges shall be solid wood lumber compatible with grain and color of veneered panels.
- D. Grain Direction: Vertically for drawer fronts, doors, and fixed panels, unless indicated otherwise.

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- E. Matching Requirements: As scheduled or as indicated in Design Selections.
- F. Semi-exposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
 - 2. Lumber Trim and Edges: Solid wood of same species and cut indicated for exposed surfaces.
 - 3. Drawer Sides, Backs and Sub-Fronts: 1/2 in minimum thickness, as indicated.
 - a. Solid-hardwood lumber, same species indicated for exposed surfaces.
 - 4. Drawer Bottoms: 1/4 in minimum thickness, as indicated.
 - a. Hardwood plywood with veneer core.
 - 5. Drawer Box Construction: One of the following:
 - a. Glued multiple dovetail.
 - b. Glued French dovetail.
 - c. Glued and doweled.
 - 6. Interior Drawer Box Finish, as indicated:
 - a. Clear catalyzed polyurethane.
- G. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in minimum thickness.
- H. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in thick minimum thickness. Do not use hardwood plywood if hinge screws enter edge of rail only.
- I. Shelves: Hardwood plywood with veneer core with the following thickness:
 - 1. For Spans Up To 32 in: 3/4 in.
 - 2. For Spans Up To 42 in: 1 in.
- J. Drawer Fronts: Medium density fiberboard, 3/4 in thick minimum thickness.
- K. Doors:
 - 1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in .
 - a. Maximum cabinet door size: 24 in width and 84 in height.
 - b. For Doors Larger Than Sizes Above: 1-3/8 in or 1-3/4 in doors; refer to Division 8 Section 0860 Flush Wood Doors.
 - c. If hinge screws enter only edge of door, provide 3/4 in lumber edges glued to core prior to laminating.
 - 2. Sliding Flush Type: As required by referenced quality standard for grade specified.
 - 3. Stile and Rail Type: As required by referenced quality standard for grade specified.

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2.12 WOOD CABINETS FOR OPAQUE FINISH

- A. Grade: Premium.
- B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.
- C. Lumber Trim and Edges: If not indicated, trim and edges shall be solid wood lumber compatible with grain and color of veneered panels.
- D. Panel Product for Exposed Surfaces: Hardwood plywood with veneer core.
- E. Semi-exposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces.
 - 2. Lumber Trim and Edges: Solid wood compatible with grain and color of veneered panels.
 - 3. Drawer Sides, Backs and Sub-Fronts: 1/2 in minimum thickness, as indicated.
 - a. Solid-hardwood lumber.
 - 4. Drawer Bottoms: 1/4 in minimum thickness, as indicated.
 - a. Hardwood plywood with veneer core.
 - 5. Drawer Box Construction: One of the following:
 - a. Glued multiple dovetail.
 - b. Glued French dovetail.
 - c. Glued and doweled.
 - 6. Interior Drawer Box Finish, as indicated:
 - a. Clear catalyzed polyurethane.
- F. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in minimum thickness.
- G. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in thick minimum thickness. Do not use hardwood plywood if hinge screws enter edge of rail only.
- H. Shelves: Hardwood plywood with veneer core with the following thickness:
 - 1. For Spans Up To 32 in: 3/4 in.
 - 2. For Spans Up To 42 in: 1 in.
- I. Drawer Fronts: Medium density fiberboard, 3/4 in thick minimum thickness.
- J. Doors:
 - 1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in .
 - a. Maximum cabinet door size: 24 in width and 84 in height.

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- b. For Doors Larger than Sizes Above: 1-3/8 in or 1-3/4 in doors; refer to Division 8 Section 08080 Flush Wood Doors.
 - c. If hinge screws enter only edge of door, provide 3/4 in lumber edges glued to core prior to laminating.
- 2. Sliding Flush Type: As required by referenced quality standard for grade specified.
 - 3. Stile and Rail Type: As required by referenced quality standard for grade specified.

2.13 PLASTIC-LAMINATE CABINETS

- A. Grade: Premium.
- B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGP, .038 in thick.
 - 2. Postformed Surfaces: Grade HGP, .038 in thick.
 - 3. Doors and Vertical Surfaces: Grade VGS, .028 in thick.
 - 4. Edges: PVC Edge Banding, 0.12 in thick, matching laminate in color, pattern, and finish.
- D. Semi-exposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade CLS, .020 in thick.
 - 2. Edges: PVC Edge Banding, .038 in thick, matching laminate in color, pattern, and finish.
 - 3. Drawer Sides, Backs and Sub-Fronts: 1/2 in minimum thickness, as indicated.
 - a. Solid-hardwood lumber.
 - 4. Drawer Bottoms: 1/4 in minimum thickness, as indicated.
 - a. Hardwood plywood with veneer core.
 - 5. Drawer Box Construction: One of the following:
 - a. Glued multiple dovetail.
 - b. Glued French dovetail.
 - c. Glued and doweled.
 - 6. Interior Drawer Box Finish, as indicated:
 - a. Clear catalyzed polyurethane.
- E. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in minimum thickness.
- F. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in thick minimum thickness.
- G. Shelves: Hardwood plywood with veneer core with the following thickness:

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1. For Spans Up To 32 in: 3/4 in.
 2. For Spans Up To 42 in: 1 in.
- H. Drawer Fronts: Medium density fiberboard, 3/4 in thick minimum thickness.
- I. Doors:
1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in .
 - a. Maximum cabinet door size: 24 in width and 84 in height.
 - b. For Doors Larger than Sizes Above: 1-3/8 in or 1-3/4 in doors; refer to Division 08 Section "Flush Wood Doors".
 - c. If hinge screws enter only edge of door, provide 3/4 in lumber edges glued to core prior to laminating.
 2. Sliding Flush Type: As required by referenced quality standard for grade specified.
 3. Stile and Rail Type: As required by referenced quality standard for grade specified.
- J. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL, .020 in thick.
- K. Concealed Edges of Base Cabinet Panels: Including but not limited to floors, vertical edges, splashes and countertops; Clear Catalyzed Polyurethane.

2.14 SOLID SURFACING COUNTERTOPS

- A. Refer to Division 12 Section "Simulated Stone Countertops".

2.15 STAINLESS STEEL COUNTERTOPS AND SHELVING

- A. Stainless-Steel: 0.0625 in thick, stainless-steel sheet, ASTM A 666, Type 304, with No. 4 satin finish.
- B. Countertops: Weld shop-made joints, and grind and polish surfaces to produce uniform, directional, textured, polished finish indicated, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
1. Sound-deaden entire undersurface with heavy-build mastic coating.
 2. Extend top down to provide a 1 in thickness and a 1/2 in return flange under frame.
 3. Form backsplash coved to and integral with top surface.
 4. Provide raised marine edge around perimeter of tops containing sinks; pitch two ways to sink to provide drainage without channeling or grooving.
- C. Integral Sinks: Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit, grind welds smooth, and polish, passivate, and rinse.
1. Fabricate stainless-steel sinks with corners rounded and coved to at least a 5/8 in radius. Slope sink-bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least a 1/2-in diameter.

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- D. Fixed Shelving: Fold front and side edges down to provide 1-inch thickness. Fold rear edge up 1-1/2 inch to form a mounting flange. Weld corners. Construct integral wall mounting brackets of 0.0781 inch stainless steel with 1-1/2 inch flange at wall and completely welded to underside of shelf.
- E. Adjustable Shelving: Fold front, side, and rear edges down to provide a 1-inch thickness and mounting flange. Weld corners. Mount on adjustable stainless steel brackets supported by slotted wall standards.

2.16 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Shop Priming: Shop apply the prime coat including backpriming, if any, for items specified to be field finished. Refer to Division 09 Painting Sections for material and application requirements.
- D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate.
- E. Finish:
 - 1. Selections: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive interior architectural woodwork and associated work to which interior architectural woodwork will be applied for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

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1. Quality standards. (The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.)
2. Respective manufacturer/fabricator's written installation instructions.
3. Accepted submittals.
4. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.4 INSTALLATION

- A. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication, to extent that it was not completed in the shop.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 in per 96 in.
- C. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 in long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
 3. Install standing and running trim with no more variation from a straight line than 1/8 in per 96 in.

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- G. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless covered by trim or otherwise indicated.
1. Install flush paneling with no more than 1/16 in per 96 in vertical cup or bow and 1/8 in per 96 in horizontal variation from a true plane.
 2. Flush Paneling with Revealed Joints: Install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 in.
- H. Cabinets, General: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 in per 96 in sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of cabinets with transparent finish.
- I. Base and Wall Cabinets: Set base cabinets straight, level, and plumb. Adjust subtops within 1/16 in of a single plane. Fasten base cabinets to partition framing, or reinforcements in partitions with fasteners spaced 24 in on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 in on center. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
 2. Wall Cabinets: Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 in on center with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish.
- J. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Where possible make field jointing in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 2. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
 3. Simulated Stone Countertops: Refer to Division 12 Section "Simulated Stone Countertops".
 4. Install countertops with no more than 1/8 in per 96 in sag, bow, or other variation from a straight line.
 5. Secure backsplashes to tops with concealed metal brackets at 16 in on center and to walls with adhesive.
 6. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".
- K. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

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3.5 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 066100

SIMULATED STONE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: The following simulated stone fabrications along with supplementary items necessary for installation:
 - 1. Solid surfacing fabrications.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Show materials, finishes, edge profiles, methods of joining, locations, and details of joints.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in fabrications.
 - 3. Show direction of directional pattern, if any.
- C. Samples for Verification Purposes:
 - 1. Panel Material: 6 in ()square, showing color and pattern selected. Trim piece samples to be 6 in ()long.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For simulated stone fabrications to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of sources for products.

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1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
- C. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to adjacent construction, and requirements of installation.
 - 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 - 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 - 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install fabrications until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Solid Surfacing:

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- a. Avonite Surfaces
- b. E. I. du Pont de Nemours and Company
- c. Formica Corporation
- d. Inpro Architectural Products.
- e. LG Chemical, Ltd.
- f. Meganite Inc.
- g. Samsung Chemical USA, Inc.
- h. Swan Corporation (The)
- i. Transolid, Inc.
- j. Watermark Fabrication.
- k. Wilsonart International

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 SOLID SURFACE MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
 - 1. Colors and Patterns: As scheduled or indicated in Design Selections.
- B. Panel Thickness: Minimum 1/4 in (6 mm) or as indicated on drawings or as recommended by simulated stone manufacturer.
- C. Trim Piece Thickness: As recommended by simulated stone manufacturer/fabricator.

2.4 FABRICATION

- A. Comply with simulated stone manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate items without joints unless otherwise indicated.
- B. Cutouts and Holes:
 - 1. Make cutouts using template or pattern. Form cutouts to smooth, even curves.
 - 2. Drill fabrications for fittings and similar items.
- C. Accurately cut holes and drill panels in shop for penetrations and fittings indicated on Drawings. Obtain field measurements prior to fabrication and maintain minimum clearance at walls.

2.5 INSTALLATION MATERIALS

- A. Adhesives: Product recommended by simulated stone manufacturer.
- B. Accessories: Provide joint seam adhesives and other items required for a complete installation as recommended in writing by simulated stone manufacturer.

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- C. Sealant: Mildew resistant silicone sealant as specified in Division 07 Section Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 in per 48 in ().
- B. Variation from Level: Do not exceed 1/8 in per 96 in (), 1/4 in (maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.
- D. Variation in Plane at Joints (Lipping): Do not exceed 1/64 in ()difference between planes of adjacent units.
- E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64 in ()difference between edges of adjacent units, where edge line continues across joint.

3.5 INSTALLATION OF SIMULATED STONE FABRICATIONS

- A. Install fabrications according to material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

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- B. Bond joints with adhesive and draw tight as fabrications are set. Mask surfaces of fabrications adjacent to joints to prevent adhesive smears.
 - 1. Clamp units to temporary bracing, supports, or each other to ensure that fabrications are properly aligned and joints are of specified width.
- C. Complete cutouts not finished in shop. Mask areas of fabrications adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- D. Apply sealant and compress to form bond with simulated stone material and adjacent surfaces and tool sealant surfaces to clean, straight lines.
 - 1. Comply with Division 07 Section Joint Sealants

3.6 CLEANING

- A. Promptly clean simulated stone as work progresses. Do not leave adhesive or sealant to dry on simulated stone faces.
- B. Clean and protect installed fabrications in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 066413

TRANSLUCENT RESIN PANEL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this Section includes translucent resin panel (aka "3Form") fabrications and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Samples for Verification: 8 by 10 in, for each type, color, pattern, and surface finish of translucent resin panel products.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 3 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 3 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.
- B. Fire-Test-Response Characteristics: Provide panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 450 or less.
- C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

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1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. 3Form, Inc.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 FABRICATION

- A. Comply with manufacturer's written recommendations for fabrication.
- B. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
 - 1. Sawing: Select equipment and blades suitable for type of cut required.
 - 2. Drilling: Drills specifically designed for use with plastic products.
 - 3. Milling: Climb cut where possible.
 - 4. Routing.
 - 5. Tapping.
- C. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.
 - 1. Cold Bending.
 - 2. Hot Bending.
 - 3. Thermoforming: Acceptable only on uncoated material.
 - 4. Drape Forming.
 - 5. Matched Mold Forming.
 - 6. Mechanical Forming.
- D. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaner: Type recommended by manufacturer.
- C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.
- D. Bonding Cements: Manufacturer's recommended bonding adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Approved submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Manufacturer's shop to fabricate items to the greatest degree possible.
- B. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.
- C. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- D. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

3.5 CLEANING AND PROTECTION

- A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

END OF SECTION

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SECTION 070152

PATCHING OF EXISTING ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required of this Section includes cutting and patching of existing roofing for new mechanical equipment; and supplementary items necessary to complete the installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Submit documentation as specified in Warranties article of this specification section.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
 - a. Installer is to be approved by warrantor of existing roofing system to work on existing roofing.
- C. Quality Standards:

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1. Unless otherwise recommended by roofing manufacturer provide built-up roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
2. Comply with FM System Loss Prevention Data Standard 1-49 for attachment and anchorage if nailers, blocking, cants, and other associated members.
3. Comply with FM System Loss Prevention Data Standards 1-28 and 1-28S for attachment and anchorage of roof insulation to metal decking.

1.5 PREINSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit roofing to be installed in accordance with manufacturers' recommendations and warranty requirements.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during Work, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
 1. Notify warrantor of existing roofing system on completion of Work, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. New materials required by the Work shall be compatible with the existing products.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Cut existing membrane roofing and replace with new membrane roofing to ensure a watertight, roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

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- B. Water Drainage: New work shall maintain existing water drainage patterns; if new work adversely affects the water drainage, make necessary roofing changes to accommodate new water drainage pattern.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations of standards specified in Quality Assurance article of this specification section.
- B. Protect other work from damage during application of roofing materials. Replace/restore other work damaged when installing roofing system work.
- C. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

END OF SECTION

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SECTION 071326

SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sheet waterproofing systems and supplementary items necessary for installation at the following applications
 - 1. Vertical post-applied modified bituminous sheet waterproofing at foundation walls.
 - 2. Vertical pre-applied (blindsided) sheet waterproofing at retention system walls.
 - 3. Horizontal pre-applied (blindsided) sheet waterproofing below slabs-on-grade over mud slab or prepared subgrade.
- B. Related Requirements:
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
 - 2. Foundation Drainage System: Refer to Division 33 Section Foundation Drainage System.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include construction details, material descriptions, tested physical and performance properties, and installation instructions for waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of installation, including plans, elevations, sections, details of components and attachments to other work.
 - 1. Include details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 2. Include manufacturer's written approval of shop drawings prior to submission.
- C. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch square of drainage panels.

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1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Provide written confirmation by the manufacturer that Geotechnical Report has been reviewed and that manufacturer takes no exception to the design of the below grade waterproofing system.
- B. Field quality-control reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranties:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- C. Pre-Construction Subsoil Water Testing: Provide subsoil water testing as recommended or required by waterproofing manufacturer.
 - 1. General Requirements: Test subsoil water for compatibility with waterproofing materials.
 - 2. Test Method: Use manufacturer's standard test method to test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
 - 3. Specimen Quantity: Obtain and submit as many subsoil water samples required from Project at approximate locations where waterproofing will be installed.
 - 4. Reports: Interpret test results and certify reports indicating requirements for use of waterproofing materials and for corrective measures necessary.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, sealing at penetrations, crack and joint treatments, inside and outside corner treatments, and protection.

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- a. Size: 100 sq. ft. in area.
 - b. Description: Each type of wall and deck installation.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- a. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
3. Accepted mock-ups may become part of completed Work if undisturbed at time of Substantial Completion.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
- 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
- B. Record discussions, including decisions and agreements, and prepare report.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

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- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.
 - a. Warranty includes waterproofing, flashings, counter-flashings, insulation, below grade expansion joints and other components of waterproofing system necessary to provide a complete installation.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

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- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Post-Applied Sheet Waterproofing:
 - a. Basis of Design: GCP Applied Technologies; Bituthene 3000 or 4000.
2. Pre-Applied Sheet Waterproofing for Vertical Applications:
 - a. Basis of Design: GCP Applied Technologies; Preprufe 160R Plus.
3. Pre-Applied Sheet Waterproofing for Horizontal Applications:
 - a. Basis of Design: GCP Applied Technologies; Preprufe 300R Plus.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
1. Provide waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.
 2. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

2.3 PERFORMANCE REQUIREMENTS

- A. General: Provide sheet waterproofing systems that prevent the passage of liquid water.
- B. Material Compatibility: Provide waterproofing materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

2.4 POST-APPLIED SHEET WATERPROOFING

- A. Post-Applied Sheet Waterproofing: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56-mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.
1. Manufacturers and Products:
 - a. AVM Industries Inc.; Aussie Mate 580 AL.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
 - c. CETCO Building Materials Group; Envirosheet.
 - d. GCP Applied Technologies; Bituthene 3000 or 4000.
 - e. Meadows, W. R., Inc.; Mel-Rol.
 - f. Polyguard Products, Inc.; Polyguard 650.
 - g. Sika Corporation; SikaShield S-60.
 - h. Soprema; Colphene 3000.

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2. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.5 PRE-APPLIED (BLINDSIDE) SHEET WATERPROOFING

- A. Pre-Applied (Blindside) Sheet Waterproofing for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly.

1. Self-Adhering HDPE Sheet Waterproofing:

- a. Description: Minimum 73-mils thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

- 1) Manufacturer and Product: AVM Industries Inc.; Aussie Skin 550G Blindside Waterproofing Membrane.

- b. Description: Minimum 32-mils thick, uniform, flexible sheets consisting of 16-mils thick HDPE sheet coated with pressure-sensitive rubber adhesive, protective adhesive coating, and release liner.

- 1) Manufacturer and Product: GCP Applied Technologies; Preprufe 160R Plus.

- c. Description: Minimum 73-mils thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

- 1) Manufacturer and Product: Polyguard Products Inc.; Underseal Blindside Waterproofing Membrane.

2. Self-Adhering TPO Sheet Waterproofing:

- a. Description: Minimum 70-mils thick, uniform, flexible sheets consisting of 45-mils thick reinforced TPO backing sheet with 25-mil butyl alloy membrane / adhesive.

- 1) Manufacturer and Product: Carlisle Coatings & Waterproofings; MiraPly V Vertical Blindside Waterproofing.

- b. Description: Minimum 1.10-mm thick, uniform, flexible composite sheet consisting of 0.50 mm thick polyolefin membrane with non-woven polypropylene fleece.

- 1) Manufacturer and Product: Sika; SikaProof A-05.

3. Self-Adhering SBS Modified Bitumen Sheet Waterproofing:

- a. Description: Minimum 120-mils thick, uniform, flexible sheets consisting of self-adhesive SBS modified bitumen with composite reinforcement and release film.

- 1) Manufacturer and Product: Soprema; Colphene BSW V.

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4. Self-Adhering Composite Sheet Waterproofing:
 - a. Description: Minimum 73-mils thick, uniform, flexible composite sheet membrane consisting of an elastomeric membrane bonded to a multi-ply plasmatic matrix and non-woven geotextile fabric.
 - 1) Manufacturer and Product: W.R. Meadows; PRECON Vertical Blindside Waterproofing Membrane.
5. Thermoplastic Sheet Waterproofing:
 - a. Description: Minimum 60-mil nominal thick PVC, Elvaloy KEE thermoplastic membrane reinforced with 5 oz. weft inserted knit polyester fabric integrally bonded to an Active Polymer Core (APC)
 - 1) Manufacturer and Product: CETCO Building Materials Group; Coreflex 60.
- B. Pre-Applied (Blindside) Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly.
 1. Adhesive-Coated HDPE Sheet Waterproofing:
 - a. Description: Minimum 73-mils thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.
 - 1) Manufacturer and Product: AVM Industries Inc.; Aussie Skin 550G Blindside Waterproofing Membrane.
 - b. Description: Minimum 46-mils thick, uniform, flexible sheets consisting of 30-mils thick HDPE sheet coated with pressure-sensitive rubber adhesive, protective adhesive coating, detackifying surface treatment, an uncoated self-adhering side lap strip, and release liner.
 - 1) Manufacturer and Product: GCP Applied Technologies; Preprufe 300R Plus.
 - c. Description: Minimum 85-mils thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.
 - 1) Manufacturer and Product: Polyguard Products Inc.; Underseal Underslab Waterproofing Membrane.
 2. Adhesive-Coated TPO Sheet Waterproofing:
 - a. Description: Minimum 70-mils thick, uniform, flexible sheets consisting of 45 mils thick reinforced TPO backing sheet with 25-mil butyl alloy membrane / adhesive.
 - 1) Manufacturer and Product: Carlisle Coatings & Waterproofings; MiraPly H Horizontal Blindside Waterproofing.

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- b. Description: Minimum 68-milsthick, uniform, flexible polyolefin membrane with hybrid bonding layer, mechanical adhesive bond.
 - 1) Manufacturer and Product: Sika; SikaProof A+ 12.
- 3. SBS Modified Bitumen Sheet Waterproofing:
 - a. Description: Minimum 140-mils thick, uniform, flexible sheets consisting of SBS modified bitumen with polyester reinforcement.
 - 1) Manufacturer and Product: Soprema; Colphene BSW H.
- 4. Self-Adhering Composite Sheet Waterproofing:
 - a. Description: Minimum 73-mils thick, uniform, flexible composite sheet membrane consisting of an elastomeric membrane bonded to a multi-ply plasmatic matrix and non-woven geotextile fabric.
 - 1) Manufacturer and Product: W.R. Meadows; PRECON Below Grade Underslab Waterproofing Membrane.
- 5. Thermoplastic Sheet Waterproofing:
 - a. Description: Minimum 60-mil nominal thick PVC, Elvaloy KEE thermoplastic membrane reinforced with 5 oz. weft inserted knit polyester fabric integrally bonded to an Active Polymer Core (APC).
 - 1) Manufacturer and Product: CETCO Building Materials Group; Coreflex 60.

2.6 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. When required by waterproofing manufacturer, obtain Engineer of Record's approval to use manufacturer's recommended waterstops to meet warranty requirements.
- B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity, provided by waterproofing manufacturer.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating, provided by waterproofing manufacturer.
- F. Mastic and Adhesives: Liquid mastic and adhesives, and adhesive tapes provided by waterproofing manufacturer.

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- G. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 in wide, with tack-free protective adhesive coating on one side and release film on self-adhering side; provided by waterproofing manufacturer.
- H. Termination Bars: Aluminum bars or stainless steel bars ASTM A 666, Type 304; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in thick; predrilled at 8 in centers; with stainless steel fasteners.
- I. Epoxy Grout: High performance, solvent free, impermeable three-part epoxy grout designed to maintain continuity of waterproofing system at structural penetrations.
 - 1. Basis of Design: GCP Applied Technologies; Grout EG 75.
 - a. Locations: Piles, piers, and similar structural penetrations, other locations recommended by waterproofing manufacturer.
- J. Injectable Waterstop: As required by waterproofing manufacturer to ensure watertight installation.
 - 1. Basis of Design: GCP Applied Technologies; INJECTO Tube Groutable Hose Waterstop used with Flex SLV or LV PURE hydrophobic polyurethane chemical grout as recommended by waterproofing manufacturer for this application.
 - a. Locations: Concrete cold joints at base of foundation, around block-out openings, other locations recommended by waterproofing manufacturer.
- K. Waterstop: Polymer/butyl rubber waterstop strip that expands when in contact with water.
 - 1. Basis of Design: GCP Applied Technologies; Adcor 500S.
 - a. Locations: All typical concrete to concrete cold joints.
- L. Expansion Joint System: Heavy-duty, double-celled, thermoplastic extruded sealing gland flanked by integral side flashing sheets. System shall include manufacturer's standard termination bars and anchors. For blind-side below grade applications.
 - 1. Basis of Design: Sika Corp.; Emseal BG System.
- M. Tieback Covers: Cover system used to maintain waterproofing integrity at soil retention tieback heads. Provide detail components as recommended by manufacturer for application conditions.
- N. Protection Course: As recommended by waterproofing manufacturer for this application.
 - 1. ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - a. Thickness: Nominal 1/8 inch for vertical applications; 1/4 inch elsewhere.
 - b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

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2.7 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel with Polymeric Film, Vertical Applications: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of the core and a polymeric film bonded to the other side (facing waterproofing).
1. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.
 - a. Minimum Compressive Strength: 15,000 lbf/sf (718 kPa) according to ASTM D 1621.
 - b. Minimum In-Plane Flow Rate: 15 gpm/ft of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psi according to ASTM D 4716.
 2. Manufacturers and Products:
 - a. AVM Industries Inc.; Drain Board 6020 XL.
 - b. CETCO Building Materials Group; 15XP Prefabricated Drainage Composite.
 - c. GCP Applied Technologies; Hydroduct 220.
 - d. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 6200.
 - e. Polyguard Products Inc.; Polyflow 15P.
 - f. Sika Corporation; SikaDrainage Mat 420.
 - g. Soprema; Sopradrain 15G.
 - h. W.R. Meadows; Mel-Drain 5035 B.
- B. High-Capacity, Molded-Sheet Collector-Panel System Wrapped with Geotextile: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; wrapped with a nonwoven-geotextile facing. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped sub-drainage system.
1. Compressive Strength per ASTM D1621: 9000 psf minimum.
 2. Flow Rate per ASTM D4716: 17 to 80 gpm per ft. minimum.
 3. Manufacturers and Products:
 - a. AVM Industries Inc.; Bottom Drain.
 - b. CETCO Building Materials Group; Aquadrain 100BD.
 - c. GCP Applied Technologies; Hydroduct Coil 600.
 - d. Carlisle Coatings & Waterproofings; CCW MiraDRAIN HC.
 - e. Polyguard Products Inc.; Totalflow.
- C. Drainage Panel Auxiliary Materials.
1. Adhesive for Bonding Drainage Panels: Product compatible with drainage panels being bonded and with demonstrated capability to bond securely to substrates indicated without damaging substrates.
 2. Miscellaneous Accessories: As required by manufacturer for complete installation assembly, including flanges around piping penetrations and expanded base and tie-in fittings as necessary to coordination with foundation drainage system.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 3. Verify that compacted subgrade or mud slab is dry, smooth, sound, and ready to receive waterproofing sheet.
- C. Excavation Support and Protection System:
 - 1. Fill minor gaps and spaces 1/2 in wide or wider with wood, metal, concrete, or other appropriate filling material.
 - 2. Cover or fill large voids and crevices with cement mortar.
 - 3. Encase tieback rods, nuts, and plates with detail tape and prepare for covering with waterproofing.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. ASTM D 6135.
 - 2. Respective manufacturer's written installation instructions.
 - 3. Accepted submittals.
 - 4. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Excavation Dewatering: Verify that the waterproofing application area is dry and free of standing and uncontrolled water. Should the dewatering system fail at any time during application of waterproofing system, the materials shall be completely removed and work shall start over with new materials once the area is dry and free of water.

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- C. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- D. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- E. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- F. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- G. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- H. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- I. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
 - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- J. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D6135.

3.4 INSTALLATION OF POST-APPLIED SHEET WATERPROOFING

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D6135.
- B. Primer: Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 6-inch- minimum lap widths and end laps. Overlap and seal seams with liquid membrane, and stagger end laps to ensure watertight installation. Roll membrane and seams with a hard neoprene roller.

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1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
 2. Apply sheets so that direction of flow of water is over and not against laps.
 3. Apply sheet strips under waterproofing membrane at, but not limited to, the following locations:
 - a. Expansion joints.
 - b. Discontinuous deck-to-wall and deck-to-deck joints.
 - c. Under clamping ring at drains.
 - d. Wall angles and corners.
 - e. Substrate cracks.
 - f. Penetrations.
 - g. Isolation, construction and contraction joints.
 - h. Locations where waterproofing membrane may be subjected to unusual strain.
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.
- F. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.
1. Unless indicated otherwise, terminate top edges of sheets under metal counterflashings or with metal termination bars and sealants.
 2. Seal all exposed sheet edges at terminations, vertical and horizontal, not concealed by metal counterflashings or metal termination bars and sealants with liquid membrane or mastic.
- G. Damaged Waterproofing: Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.
1. Patch tears, voids, misaligned or inadequately lapped seams.
 2. Slit fishmouths and blisters, overlap flaps, and patch.
- H. Immediately install protection course with butted joints over waterproofing membrane.
1. Molded-sheet drainage panels or insulation panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.5 INSTALLATION OF PRE-APPLIED (BLINDSIDE) SHEET WATERPROOFING

- A. Install blindside sheet waterproofing according to manufacturer's written instructions.

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- B. Molded-Sheet Drainage Panels at Vertical Applications: Place and secure over substrate with adhesive, with geotextile filter fabric facing excavation support and protection system. Lap edges and ends of geotextile filter fabric to maintain continuity. Protect installed drainage panels during subsequent construction.
- C. Vertical Applications: Install sheet with appropriate face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
 - 1. Seams and Laps: Install 12-inch strip of post-applied membrane sheet strips behind laps and 4-inch strip of membrane detail tape over front of lap. Additionally at field cut seams, provide a 6-inch overlap with a full bed of liquid membrane. Roll membrane and seams with hard neoprene roller.
 - 2. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.
- D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.
 - 1. Seams and Laps: Install 12-inch strip of post-applied membrane sheet strips behind laps and 4-inch strip of membrane detail tape over front of lap. Additionally at field cut seams, provide a 6-inch overlap with a full bed of liquid membrane. Roll membrane and seams with hard neoprene roller.
- E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- G. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.
- H. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.
- I. Damaged Waterproofing: Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANEL

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

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3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
 - 2. Agency shall be certified by waterproofing manufacturer to provide observations and inspections required to provide warranty indicated.
 - a. Agency shall prepare reports and digital photographs documenting observations. Reports shall be made available to the Contractor, waterproofing installer, waterproofing manufacturer and Architect.
 - 3. Pre-Applied Sheet Waterproofing: Including but not limited to the following:
 - a. Prior to beginning concrete slab reinforcing installation, inspect waterproofing membrane for rips, tears, and punctures.
 - b. Prior to concrete placement work, inspect concrete installer's tools and notify Contractor to have tools with spikes or other sharp surfaces that could inflict intentional or unintentional damage on the installed waterproofing membrane removed from work area.
 - c. Immediately prior to concrete placement work, inspect waterproofing membrane for rips, tears, and punctures, inspect penetrations at columns and mechanical and electrical piping.
 - d. Continuously inspect concrete placement work, watching for damage to waterproofing membrane.
 - e. Periodically inspect portions of slab that were not placed (block-outs, voids, and leave-outs) for water infiltration of subgrade until concrete is subsequently placed.
- C. Correction of Deficiencies: Waterproofing will be considered defective if it does not pass tests and inspections.
 - 1. Correct deficiencies in or remove waterproofing that does not comply with requirements: repair substrates, reapply waterproofing, and repair flashing until waterproofing installation is watertight.
 - 2. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be performed at Contractor's expense.

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- D. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.
- E. Prepare test and inspection reports.

3.8 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

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SECTION 071416

COLD FLUID APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cold fluid applied waterproofing systems and supplementary items necessary for installation.
- B. Related Sections:
 - 1. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
 - 2. Refer to Division 07 Section Thermal Insulation for board insulation requirements.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details for each condition encountered in Work.
 - 1. Include substrate joints and crack treatments, flashing sheets, penetrations, inside and outside corners, vertical intersections, slope, expansion joints, tie-ins with adjoining waterproofing, transitions and other membrane terminations.
 - 2. Include waterproofing manufacturer written approval of shop drawings prior to submission.
- C. Samples for Verification: For each of the following components, 12 by 12 inches (300 by 300 mm) or manufacturer's standard size:
 - 1. Membrane: Cured membrane on solid backing layered to indicate various components, including reinforcing.
 - 2. Rigid and flexible protection boards.
 - 3. Prefabricated drainage course.
 - 4. Extruded board insulation.
 - 5. Drainage panel.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

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1. Submit the following certifications prior to installation:
 - a. Concrete Substrate: Roofing manufacturer shall certify that concrete substrate condition and corrections, if necessary, comply with roofing manufacturer installation guidelines.
- B. Field quality-control reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranties:
 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Quality Standards:
 1. Unless otherwise recommended by waterproofing system manufacturer, provide waterproofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
- C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.
 - a. Size: 100 sq. ft. in area.
 - b. Description: Each type of wall and deck installation.
 2. Include accessories and demonstrate surface preparation, sealing at penetrations, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Include adhesion testing on mock up area.

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3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
5. Acceptance of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - a. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
6. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - f. Testing agency.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - 1) Review field quality control requirements for adhesion testing and water testing.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 - g. Review deck substrate requirements for conditions and finishes, including presence of moisture.
 - 1) Review curing compounds, form release agents and concrete mix design for compatibility with membrane manufacturer.
 - h. Review base flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affects system.
 - i. Review governing regulations and requirements for insurance and certificates if applicable.

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- j. Review temporary protection requirements for waterproofing during and after installation.
 - k. Review observation and repair procedures after installation.
3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer Warranty: Furnish manufacturer's written "Total System" warranty signed by an authorized representative using manufacturer standard form, without monetary limitation (NDL), agreeing to provide materials and labor required to repair or replace Work which exhibits defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required..
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 15 years from date of Substantial Completion.
 - a. Warranty includes removing and reinstalling waterproofing, flashings, counter-flashings, insulation, accessories, other components of waterproofing system and overburden.

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- b. Warranty includes flashings integral with waterproofing system specified in Division 07 Section Sheet Metal Flashing and Trim.
- B. Installer Warranty: Furnish installer written warranty signed by an authorized representative using installer standard form agreeing to provide materials and labor required to repair or replace Work which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
 - a. Warranty includes removing and reinstalling waterproofing, flashings, counter-flashings, insulation, accessories, other components of waterproofing system and overburden.
 - b. Warranty includes flashings integral with waterproofing system specified in Division 07 Section Sheet Metal Flashing and Trim.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
 - 1. Provide waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.
 - 2. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Material Compatibility: Provide waterproofing materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

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2.3 PERFORMANCE REQUIREMENTS

- A. General: Provide cold fluid applied waterproofing systems that prevent the passage of liquid water. Waterproofing shall accommodate normal substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without deterioration.

2.4 COLD FLUID APPLIED WATERPROOFING MEMBRANE

- A. Single Component Elastomeric Waterproofing Membrane: Single component, reinforced, 100% solids elastomeric membrane, ASTM C 836/C 836M, minimum 120-mils thick
 - 1. Manufacturer and Product: Carlisle Coatings and Waterproofing Incorporated; MIRASEAL 120 Reinforced Liquid Applied Waterproofing Membrane.
- B. Two Component Elastomeric Waterproofing Membrane: Two component, self-curing, 100% solids monolithic elastomer membrane, ASTM C 836/C 836M, minimum 80-mils thick.
 - 1. Manufacturer and Product: GCP Applied Technologies; Silcor 900MP Fluid Applied Waterproofing Membrane.
- C. Single Component Elastomeric Waterproofing Membrane: Single component, reinforced, high solids, modified aliphatic polyurethane membrane, ASTM C 836/C 836M, minimum 120-mils thick.
 - 1. Manufacturer and Product: Tremco, Inc.; TREMproof 250GC Fluid Applied Waterproofing Membrane.
- D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

2.5 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing.
 - 1. Substrate Repair Materials: As recommended by waterproofing manufacturer.
 - 2. When required by waterproofing manufacturer, obtain Engineer of Record's approval to use manufacturer's recommended waterstops to meet warranty requirements.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated
- C. Elastomeric Flashing Sheet: 60 mils (1.5 mm) minimum thickness, non-staining, uncured sheet neoprene.
- D. Protection Course: As recommended by waterproofing manufacturer for this application.
 - 1. ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

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- a. Thickness: Nominal 1/8 inch for vertical applications; 1/4 inch elsewhere.
 - b. Adhesive: Type recommended by waterproofing manufacturer for protection course type.
- E. Termination Bars: ASTM A 666, Type 304 formed stainless-steel bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in thick; predrilled at 8 in centers; with stainless steel fasteners. Aluminum or plastic bars not allowed.
- F. Sealants and Accessories: Waterproofing manufacturer's recommended sealants and accessories.
- G. Miscellaneous Accessories: Provide preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, stainless steel draw bands and other accessories required for complete installation.

2.6 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel with Polymeric Film, Vertical Applications: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of the core and a polymeric film bonded to the other side (facing waterproofing).
- 1. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.
 - a. Minimum Compressive Strength: 15,000 lbf/sf (718 kPa) according to ASTM D 1621.
 - b. Minimum In-Plane Flow Rate: 15 gpm/ft of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psi according to ASTM D 4716
 - 2. Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 6200.
 - b. GCP Applied Technologies; Hydroduct 220.
 - c. Tremco, Inc.; TREMDrain 2000.
- B. Molded-Sheet Drainage Panel with Polymeric Film, Horizontal Applications: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing laminated to one side of the core and a polymeric film bonded to the other side (facing waterproofing).
- 1. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.
 - a. Minimum Compressive Strength: 18,000 lbf/sf (862 kPa) according to ASTM D 1621.
 - b. Minimum In-Plane Flow Rate: 18 gpm/ft of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psi according to ASTM D 4716.
 - 2. Manufacturers and Products:

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- a. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 9000.
 - b. GCP Applied Technologies; Hydroduct 660.
 - c. Tremco, Inc.; TREMDrain 2000.
- C. Adhesive for Bonding Drainage Panels: Product compatible with drainage panels being bonded and with demonstrated capability to bond securely to substrates indicated without damaging substrates.

2.7 BOARD INSULATION

- A. Extruded Polystyrene Board Insulation: As specified in Division 07 Section "Thermal Insulation".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- 1. Verify that openings and penetrations are in place and set and braced and that drains are securely clamped in place.
 - 2. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 3. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263 or as recommended by manufacturer.
 - 4. Verify that concrete curing compounds and form oils that will impair adhesion of roofing components to roof deck have been removed.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
- 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

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- B. Dewatering: Verify that the waterproofing application area is dry and free of standing and uncontrolled water. Should the dewatering system fail at any time during application of waterproofing system, the materials shall be completely removed and work shall start over with new materials once the area is dry and free of water again.
- C. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- D. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- E. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- F. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
 - 1. When recommended by waterproofing manufacturer, abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D4258.
 - a. Adhesion Testing: Prior to installation of membrane, test adhesion to substrate using manufacturer's recommended test procedure.
- G. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

3.4 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.
- B. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.
- C. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.
 - 1. Unless indicated otherwise, terminate top edges of sheets under metal counterflashings or with metal termination bars and sealants.
- D. Flexible Flashings: Install elastomeric flashing sheet at all inside and outside corners and transitions in plane, extending a minimum 6 in (150 mm) onto deck and minimum 8 in (200 mm) onto wall and parapet substrates.
- E. Metal Termination Bars: Install and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of waterproofing.

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3.5 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Comply with ASTM C1193 for joint-sealant installation.
- B. Install sheet flashing and bond to deck and wall substrates where required according to waterproofing manufacturer's written instructions.
 - 1. Extend sheet flashings onto perpendicular surfaces and items penetrating substrate as recommended by waterproofing manufacturer.

3.6 INSTALLATION OF WATERPROOFING

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.
- B. Primer: Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.
- C. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes.
 - 2. Apply waterproofing to prepared wall terminations and vertical surfaces.
 - 3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
- D. Reinforced Waterproofing Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.
 - 1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes.
 - 2. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.
 - 3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
- E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.
- F. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
 - 1. Molded-sheet drainage panels or insulation panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.
- G. Damaged Waterproofing: Repair waterproofing not complying with requirements.

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1. Repair damaged waterproofing in accordance with the manufacturer's written repair procedures.

3.7 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Root Barrier at Planters: Install root barrier over protection course, lapping adjacent sheets as recommended by manufacturer. Turn up root barrier at vertical, roofed/flushed surfaces to completely protect waterproofing and flashings. Seal all seams with root stop tape.
- B. Installation: Place and secure molded-sheet drainage panels with adhesive, with geotextile filter fabric facing away from waterproofing. Lap edges and ends of geotextile filter fabric to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.8 BOARD INSULATION INSTALLATION

- A. Install board insulation over waterproofed area designated on the Drawings in accordance with Division 07 Section "Thermal Insulation".
- B. Install air layer between board insulation and concrete toppings or reinforced mortar setting beds. Overlap geotextile fabric with adjacent sheets as recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
 1. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
- C. Adhesion Testing: Perform adhesion testing at designated locations or one test per 1000 sq ft. Contractor, manufacturer's technical representative, Architect and Waterproofing Consultant shall mutually agree upon adhesion test methods during pre-construction meeting.
 1. Repair membrane damage resulting from testing per manufacturer recommendations.
- D. Electronic Leak-Detection Testing, Electronic Field Vector Mapping (EFVM): Perform leak testing by an electronic detection process to verify entire waterproofing membrane is free of defects. EFVM shall be performed by a qualified testing agency.

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1. Test each deck area for leaks using an electronic leak-detection method that locates discontinuities, holes, open seams, and capillary defects in the waterproofing membrane.
 - a. Perform leak detection of horizontal waterproofing membrane prior to placement of remaining system components
 2. Perform tests on abutting or overlapping smaller areas as necessary to cover entire test area.
 - a. Perform flood test at drains and penetrations for 48 hours per ASTM D 5957.
 3. Create a conductive electronic field over the area of waterproofing to be tested and electronically determine locations of discontinuities or leaks, if any, in the waterproofing.
 4. Provide survey report indicating locations of discontinuities, if any.
- E. Correction of Deficiencies: Waterproofing will be considered defective if it does not pass tests and inspections.
1. Correct deficiencies in or remove waterproofing that does not comply with requirements: repair substrates, reapply waterproofing, and repair flashing until waterproofing installation is watertight.
 2. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be performed at Contractor's expense.
- F. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.
- G. Prepare test and inspection reports.

3.10 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

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SECTION 071800

TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Traffic coatings and supplementary items necessary for application.
 - 1. Pedestrian traffic coating systems.
 - 2. Pedestrian traffic coating systems, heavy duty.
 - 3. Vehicular traffic coating systems, heavy duty.
- B. Related Requirements:
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include installation instructions and details, material descriptions, dry- or wet-film thickness requirements, finish., and recommendations for maintenance.
- B. Shop Drawings: Show extent of each traffic coating.
 - 1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
 - 2. Include manufacturer's written approval of shop drawings prior to submission.
- C. Samples for Verification Purposes: For each type of traffic coating required, prepared on rigid backing and of same thickness and material indicated for the Work.
 - 1. Provide stepped samples on backing large enough to illustrate build-up of traffic coatings.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Product Certificates: For each type of traffic coating.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranty:

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1. Provide manufacturer's written warranty covering materials and application (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

- B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.
 - a. Show typical components and requirements of installation.
 - b. Size: 100 sq. ft. (9 sq. m) of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-APPLICATION CONFERENCE

- A. Pre-Application Conference: Before Work begins, conduct conference at Project site.

1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:
 1. Manufacturer's brand name.
 2. Type of material.
 3. Directions for storage.
 4. Date of manufacture and shelf life.
 5. Lot or batch number.
 6. Mixing and application instructions.
 7. Color.
- B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of the substrate.
- B. Do not apply traffic coating until items that will penetrate membrane have been installed.

1.9 COORDINATION

- A. Coordinate application of products and systems with interfacing and adjoining construction to provide a successful application without failure.

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1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and application of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Defects of traffic coatings includes, but is not limited to, the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.
 - d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
 2. Warranty does not include deterioration or failure of traffic coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new substrate cracks exceeding 1/16 in in width, fire, vandalism, or abuse by maintenance equipment.
 3. Warranty Period - Vehicular and Pedestrian Traffic Coatings: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.
- B. Installer Warranty: Furnish installer written warranty signed by an authorized representative using installer standard form agreeing to provide materials and labor required to repair or replace Work which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by manufacturer listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Sika Corp..
 2. Gaco Western.
 3. Neogard.
 4. Pacific Polymers International, Inc.
 5. Pecora Corporation
 6. Tremco Incorporated.

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- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
1. Pedestrian Traffic Coating System - Mechanical Equipment Rooms:
 - a. Basis of Design: Neogard; Peda-Gard M.
 2. Pedestrian Traffic Coating System, Heavy Duty:
 - a. Basis of Design: Neogard; Peda-Gard FC.
 3. Vehicular Traffic Coating System, Heavy Duty:
 - a. Basis of Design: Neogard; Auto-Gard FC.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
1. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- C. Regulatory Requirements: Provide products that comply with local regulations controlling use of volatile organic compounds (VOCs).

2.4 TRAFFIC COATINGS

- A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for service condition; according to ASTM C957/C957M.
- B. Primer: Liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.
1. Material: Epoxy or as recommended by manufacturer for substrate.

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- C. Preparatory and Base Coats: Single- or multi-component as recommended by manufacturer.
 - 1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.
- D. Intermediate Coat: Single- or multi-component as recommended by manufacturer.
 - 1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.
- E. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.
 - 1. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated.
- F. Top Coat: Single- or multi-component as recommended by manufacturer with UV inhibitors.
 - 1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
 - 2. Aggregate: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated, and as required to achieve slip-resistant finish.
 - 3. Chemical Resistant Topcoat: At locations exposed to chemical spills, provide chemical resistant topcoat as recommended in writing by traffic-coating manufacturer.
 - 4. Topcoat Finish: As required to achieve slip-resistant finish.
 - a. Coefficient of Friction: Coefficient of friction shall be not less than 0.6 for level surfaces and 0.8 for ramps, when tested according to ASTM C 1028 (field test) or ASTM D 2047 (laboratory test).
 - 5. Color: As scheduled or as indicated in Design Selections.

2.5 ACCESSORY MATERIALS

- A. Joint Sealants: As specified in Division 07 Section "Joint Sealants".
- B. Sheet Flashing: Non-staining sheet material recommended in writing by traffic-coating manufacturer or uncured neoprene sheet.
 - 1. Thickness: Minimum 52 mils .
- C. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.
- D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic coating manufacturer.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify that substrates are visibly dry and free of moisture.
 - a. Test for moisture according to ASTM D4263 or method recommended in writing by traffic-coating manufacturer.
 - 2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
 - a. Begin coating application only after substrate construction and penetrating work have been completed.
 - b. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.

3.2 APPLICATION, GENERAL

- A. Application Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written application instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective application or would cause latent defects in Work.
- B. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- C. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.
 - 1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

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- D. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.
- E. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.
- F. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259 using self-contained recirculating blast cleaning apparatus and manufacturer's recommendations. Do not acid etch.
 - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - 2. Remove concrete fins, ridges, and other projections.
 - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.4 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.5 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and traffic coating manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

3.6 TRAFFIC COATING APPLICATION

- A. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.
- B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Unless approved otherwise by Architect, start traffic-coating application in presence of manufacturer's technical representative.

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- D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft. (9 sq. m).
- E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.
- F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.
- H. Pedestrian Traffic Coating System: Apply primer, base, intermediate, and top coats and aggregate according to traffic coating manufacturer's recommendations and as follows:
 - 1. Pedestrian Traffic Coating System: Apply a minimum total dry film thickness of 32 mils, excluding substrate primer and aggregate.
 - a. Aggregate: Apply aggregate at a minimum rate of 8 to 10 lb/100 sf and backroll to imbed.
 - 2. Pedestrian Traffic Coating System, Heavy Duty: Apply a minimum total dry film thickness of 48 mils, excluding substrate primer and aggregate.
 - a. Aggregate: Apply silica aggregate at minimum rate of 10 to 15 lb/100 sf.
 - b. Locations:
 - 1) Locations scheduled or indicated on Drawings.
- I. Vehicular Traffic Coating System: Apply base, intermediate, and top coats and aggregate according to traffic coating manufacturer's written recommendations and as follows:
 - 1. Vehicular Traffic Coating System, Heavy Duty: Apply a minimum total dry film thickness of 60 mils, excluding substrate primer and aggregate.
 - a. Aggregate: Apply aggregate at minimum rate of 20 to 25 lb/100 sf.
 - b. Location:
 - 1) Locations scheduled or indicated on Drawings.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

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- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
- C. Verify applied thickness before material attains final set, by use of mil-thickness gage as work progresses. Immediately apply additional coating to produce required thickness where readings indicate thickness less than that specified.
- D. Visually inspect all areas for voids, damage, or rupture. Repair as required.
- E. Final Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- F. Waterproofing will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

3.8 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 072100

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Thermal insulation and supplementary items necessary for installation.
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Mortar faced, extruded polystyrene foam-plastic board insulation.
 - 3. Molded (expanded) polystyrene foam-plastic board insulation.
 - 4. Glass-fiber blanket insulation.
 - 5. Glass-fiber board insulation.
 - 6. Mineral-wool board insulation.
 - 7. Thin profile, high thermal blanket insulation.
 - 8. Spray-applied glass fiber insulation.
 - 9. EPS Geofoam

1.2 DEFINITIONS

- A. Mineral Fiber: Insulation composed principally of fibers manufactured from rock, slag, or glass, with or without binders. Mineral fiber includes "glass fiber" insulation and "mineral wool" insulation.
- B. Mineral Wool: A synthetic vitreous fiber insulation made by melting predominantly igneous rock, and/or furnace slag and other inorganic material, physically forming the melt into fibers.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings for Spray-Applied Thermal Insulation: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.
 - 1. Indicate locations and types of surface preparations required before applying spray-applied thermal insulation.
 - 2. Indicate extent of minimum thicknesses needed to achieve required thermal rating, color, and texture.
 - 3. Treatment of spray-applied thermal insulation after application.
- C. Samples of Spray-Applied Thermal Insulation for Verification: For each exposed product of each color and texture specified, 12-inch square in size.
- D. Insulation Schedule: Include the following information:

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1. Insulation type and location.
2. Insulation manufacturer and product name.
3. Insulation method of installation and fastening.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer Project Acceptance Document for Spray-Applied Thermal Insulation: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.
- B. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope unless labeled by manufacturer.
 1. For blown-in or sprayed insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 2. Sign, date, and post the certification in a conspicuous location on Project site.
- C. Product Test Reports for Spray-Applied Thermal Insulation: Written reports based on evaluation of comprehensive tests performed by qualified testing agencies indicating that each product complies with requirements.
 1. Certificates: Furnish manufacturer's certification that spray-applied thermal insulation is free of asbestos (including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite), or other toxic materials.
 2. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:
 - a. Materials have been tested for bonding with substrates.
 - b. Materials have been verified by spray-applied thermal insulation manufacturer to be compatible with substrate primers and coatings.
 - c. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- D. Research Reports: For foam-plastic insulation, from ICC-ES.
- E. Field Quality Control Reports for Spray Thermal Insulation: Written report of testing and inspection required by Field Quality Control.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications for Spray-Applied Thermal Insulation:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

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1.6 MOCKUP FOR SPRAY-APPLIED THERMAL INSULATION

- A. Mock-ups: Prior to installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Participants:
1. Architect.
 2. Contractor, including superintendent.
 3. Installer, including project manager and supervisor.
 4. If requested, Manufacturer's qualified technical representative.
 5. Installers of other construction interfaced with Work.
- B. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
1. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 2. Review Contract Document requirements.
 3. Review accepted submittals.
 4. Review inspection and testing requirements.
 5. Review environmental conditions and procedures for coping with unfavorable conditions.
 6. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
- C. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation materials in original packaging with identification labels intact. Ensure that insulation materials are not exposed to moisture during delivery.
- B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

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- C. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.
- D. Protect mineral-wool insulation by storing materials off ground, away from harmful conditions, and at temperature conditions recommended by manufacturer. Store in original packaging.

1.9 FIELD CONDITIONS FOR SPRAY-APPLIED THERMAL INSULATION

- A. Environmental Limitations: Do not apply sprayed thermal insulation when ambient or substrate temperature is 34 deg F (1 deg C) or lower, unless temporary protection and heat are provided to maintain temperature at or above this level until material is dry and firm to the touch, completely cured through to substrate.
- B. Ventilation: Ventilate building spaces during and after application of sprayed thermal insulation and provide complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until sprayed thermal insulation is fully cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from a single manufacturer. Provide secondary materials only as recommended by the manufacturer of primary materials.
- B. General: Provide insulating materials that comply with requirements and referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

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2.3 PERFORMANCE REQUIREMENTS, GENERAL

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Fire Rated Assemblies: Provide materials and assemblies selected from UL Fire Resistance Directory for fire-resistance rated designs, or other Testing Agency acceptable to Authorities Having Jurisdiction.
- C. Surface Burning Characteristics: Provide materials and assemblies tested in accordance with ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. Combustibility: Provide materials and assemblies tested in accordance with ASTM E136 Standard Test Method for Assessing Combustibility of Materials.
- E. Plenum Rated: Provide materials and assemblies tested in accordance with UL 181 Standard Closure Systems for Use with Flexible Air Ducts and Air Connectors, or other independent testing agency acceptable to Authorities Having Jurisdiction.
 - 1. Air Erosion Testing: No evidence of fiber erosion after initial blowdown.
 - 2. Mold Growth and Humidity Testing: No evidence of microbial growth, delamination or other deterioration resulting from high humidity conditions.

2.4 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EXTRUDED POLYSTYRENE RIGID INSULATION)

- A. Performance Requirements:
 - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches and wider in width unless installer provides certification.
- B. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 - 1. Manufacturers:
 - a. DiversiFoam Products; CertiFoam 25.
 - b. Dow Chemical Company (The); STYROFOAM Square Edge.
 - c. Owens Corning; FOAMULAR 250.
 - 2. Locations:
 - a. Backfilled walls, as indicated on Drawings.
- C. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type VI, 40-psi minimum compressive strength.
 - 1. Manufacturers:
 - a. DiversiFoam Products; CertiFoam 40.

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- b. Dow Chemical Company (The); STYROFOAM Roofmate or Highload 40.
- c. Owens Corning; FOAMULAR 400 or 404.

2. Locations:

- a. Below slabs-on-grade, as indicated on Drawings.

D. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type VII, 60-psi minimum compressive strength.

1. Manufacturers:

- a. DiversiFoam Products; CertiFoam 60.
- b. Dow Chemical Company (The); STYROFOAM Plazamate or Highload 60.
- c. Owens Corning; FOAMULAR 600 or 604.

2. Locations:

- a. Landscaping or vegetative roofing over elevated decks.

2.5 MORTAR-FACED, EXTRUDED-POLYSTYRENE FOAM PLASTIC BOARD INSULATION

A. Performance Requirements:

- 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
- 2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
- 3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches and wider in width unless installer provides certification.

B. Mortar-Faced, Extruded Polystyrene Board Insulation (XPS-MF): ASTM C578, Type VI, 40-psi minimum compressive strength, tongue-and-groove edges on long dimension, minimum 3/8-inch latex-modified cement mortar topping.

1. Manufacturers:

- a. Sika, Sarnatherm Lightguard.
- b. T. Clear Corporation, Lightguard.

2.6 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EXPANDED POLYSTYRENE RIGID INSULATION)

A. Performance Requirements:

- 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
- 2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
- 3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches and wider in width unless installer provides certification.

B. Molded (Expanded) Polystyrene Board Insulation (EPS): ASTM C578, Type II, 15-psi minimum compressive strength.

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2.7 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Refer to Division 07 Roofing Sections for polyisocyanurate rigid insulation used as roofing insulation.

2.8 GLASS-FIBER BLANKET INSULATION (GLASS MINERAL FIBER BATT INSULATION)

- A. Performance Requirements:
1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches and wider in width unless installer provides certification.
- B. Glass-Fiber Blanket Insulation, Unfaced (GF-U): ASTM C665, Type I; passing ASTM E136 for combustion characteristics, free of formaldehyde.
1. Manufacturers:
 - a. CertainTeed Corporation; CertaPro Sustainable Insulation.
 - b. Johns Manville; a Berkshire Hathaway company; Unfaced.
 - c. Knauf Insulation; EcoBatt with ECOSE Technology.
 - d. Owens Corning; EcoTouch Thermal.
 2. Thickness: Full depth of metal stud cavity unless indicated otherwise.
 3. Adhesive or Sealing Tape: Product provided or recommended by manufacturer with demonstrated capability to bond securely to substrates indicated.
 4. Locations:
 - a. As indicated on Drawings.

2.9 GLASS-FIBER BOARD INSULATION (GLASS MINERAL FIBER SEMI-RIGID INSULATION)

- A. Performance Requirements:
1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 3. Nominal Density: 3 lb/cu. ft. (48 kg/cu. m).
 4. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 5. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches and wider in width unless installer provides certification.
- B. Glass-Fiber Board Insulation, Unfaced (GFB-U): ASTM C612, Type IA; unfaced, passing ASTM E136 for combustion characteristics.
1. Manufacturers:
 - a. CertainTeed Corporation; CertaPRO Commercial Board 300.
 - b. Johns Manville; a Berkshire Hathaway company; Insul-SHIELD 300.
 - c. Knauf Insulation; Insulation Board with Ecosse Technology.
 - d. Owens Corning; 703.

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2. Thickness: As indicated on Drawings but not less than 2-inches.

2.10 MINERAL-WOOL BOARD INSULATION (MINERAL WOOL SEMI-RIGID INSULATION)

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches and wider in width unless installer provides certification.

B. Mineral-Wool Board Insulation, Unfaced (MWB-U): ASTM C612, Type IVA; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); ROCKBOARD 40.
2. Manufacturers:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. ROCKWOOL (Roxul, Inc.)
 - c. Thermafiber, Inc.; an Owens Corning company.
3. Nominal Density: 4 lb/cu. ft..
4. Thermal Resistivity: 4.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
5. Locations:
 - a. As indicated on Drawings.

C. Mineral-Wool Board, Unfaced (MWB-UEC) - Closed Joint Cladding Assemblies: ASTM C612, Type IVB; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); Cavityrock.
2. Manufacturers:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. ROCKWOOL (Roxul, Inc.)
 - c. Thermafiber, Inc.; an Owens Corning company.
3. Monolithic Nominal Density - Thicknesses up to 2 Inches: Greater than 4.3 lb/cu. ft..
4. Dual Nominal Density - Thicknesses greater than 2 Inches:
 - a. Inner Layer: 3.8 lb/cu. ft..
 - b. Outer Layer: 6.24 lb/cu. ft..
5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.
6. Locations:
 - a. Exterior cavity wall and rainscreen applications, closed joints.

D. Mineral-Wool Board, Faced (MWB-FEC) - Open Joint Cladding Assemblies: ASTM C612, Type IVB; passing ASTM E136 for combustion characteristics, black mineral fleece facing.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); Cavityrock Black.
2. Manufacturers:

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- a. Johns Manville; a Berkshire Hathaway company.
 - b. ROCKWOOL (Roxul, Inc.)
 - c. Thermafiber, Inc.; an Owens Corning company.
 - 3. Monolithic Nominal Density - Thicknesses up to 2 Inches: Greater than 4.3 lb/cu. ft..
 - 4. Dual Nominal Density - Thicknesses greater than 2 Inches:
 - a. Inner Layer: 3.8 lb/cu. ft..
 - b. Outer Layer: 6.24 lb/cu. ft..
 - 5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 6. Locations:
 - a. Exterior cavity wall and rainscreen applications, open joints.
- E. Mineral-Wool Board, Faced (MWB-FCW): ASTM C612, Type IVA; passing ASTM E136 for combustion characteristics, reinforced foil facing.
- 1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); CURTAINROCK 40 or CURTAINROCK 80, as recommended by manufacturer for project specific installation requirements.
 - 2. Manufacturers:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. ROCKWOOL (Roxul, Inc.)
 - c. Thermafiber, Inc.; an Owens Corning company.
 - 3. Nominal Density: Not less than 4 lb/cu. ft..
 - 4. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 5. Locations:
 - a. Curtain wall applications.

2.11 THIN PROFILE, HIGH THERMAL BLANKET INSULATION

- A. Performance Requirements:
 - 1. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.
- B. Silicon Aerogel Insulation: Unfaced, reinforced silicon aerogel insulation blankets.
 - 1. Basis of Design: Dow; DOWSIL HP-1000 Building Insulation Blanket.
 - 2. Thickness: As indicated on Drawings but not less than thickness required for an R-19.

2.12 SPRAY-APPLIED THERMAL INSULATION

- A. Performance Requirements:
 - 1. Flame-Spread Index: Not more than zero when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.

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3. Thermal Conductivity: 4.00/inch R-value (0.25 K-factor) in accordance with ASTM C518.
 4. Noise Reduction Coefficient (NRC): 0.75 at 1 inch; 0.95 at 2 inches in accordance with ASTM C423 and ISO 354.
 5. Bond Strength: Minimum 43-lbf/sq. ft. cohesive and adhesive strength based on field testing in accordance with ASTM E736.
 6. Dry Density: 2.2 lb/cu. ft. (36.7 kg/cu. m) in accordance with ASTM D1622/D1622M.
 7. Air Erosion: Maximum weight loss of 0.0 oz./sq. ft. (0 g/sq. m) in 24 hours in accordance with ASTM E859.
 8. Fungus and Bacterial Resistance: No growth in accordance with MIL STD810F.
- B. Self-Supported, Spray-Applied Glass Fiber Insulation (GF-SA): Type 902 bio-soluble white fiberglass conforming to CAN/ULC S102-10 and ASTM E136 and sprayed using manufacturer's liquid water-based bonding adhesive. Does not contain asbestos, crystalline silica, or combustible fibers. Noncombustible in accordance with ASTM E136.
1. Basis-of-Design Product: Monoglass Inc.: Sonoglass Spray-On Insulation, grey color.
 2. Application Thickness: As indicated on Drawings but not less than 5 inches before tamping.
- C. Substrate Primers: For spray-applied insulation, use manufacturer-approved, spray-applied, stain-blocking primers.
- D. Spray-Applied Insulation Adhesive: Manufacturer's standard water-based, spray-applied adhesive for mixing with fibers at point of discharge during spray application of thermal insulation and for final topcoat of sprayed thermal insulation.
- E. Spray-Applied Insulation Sealer: Spray-applied, water-soluble, liquid-copoly emulsion.
1. Basis-of-Design Product: Monoglass Inc.; InsulSeal.
 - a. Tint Color: Gray, unless indicated otherwise.
 2. Locations:
 - a. Installations exposed to view in finished construction.
 - b. Installation in crawl spaces.
 3. Acoustical Installations: Insulation sealer thickness shall not reduce the acoustical performance of the underlying insulation.

2.13 EPS GEOFOAM

- A. Performance Requirements:
1. Must meet ASTM D6817, "Standard Specification for Rigid, Cellular Polystyrene Geofoam".
 2. Need construction loads for engineer to determine the ASTM D6817 Type required.
- B. Location:
1. Refer To Drawings.

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2.14 INSULATION FASTENERS

- A. Power-Driven, Thermal Break Insulation Fasteners: High density polyethylene washer with heat-treated carbon steel pin, zinc plated; capable of holding insulation of specified thickness securely in position with pin type and minimum penetration recommended by manufacturer.
 - 1. Basis-of-Design Product: Ramset I-F Insulation Fastening System, IFS (Steel) and IFC (Concrete or CMU)

2.15 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to which thermal insulation will be applied for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed unless installer provides certification.
- D. For dual density products, install insulation with manufacturer's "THIS SIDE OUT" label exposed after insulation is installed.

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- E. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- F. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.4 INSTALLATION OF EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.
 - 1. If not otherwise indicated at foundations and slabs, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.
- C. Seal joints between insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are placed. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

3.5 INSTALLATION OF MORTAR-FACED, EXTRUDED POLYSTYRENE FOAM PLASTIC BOARD

- A. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested. Stagger end joints of adjoining rows and abut insulation.

3.6 INSTALLATION OF MINERAL FIBER BLANKETS AND BOARD INSULATION ON CONCRETE CONSTRUCTION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install insulation on concrete substrates by Power-Driven, Thermal Break Insulation Fasteners:
 - 1. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.

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- C. Adhered insulation anchors are not allowed.

3.7 INSTALLATION OF EXTERIOR CAVITY-WALL INSULATION

- A. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.
 - 1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.
- B. Adhered insulation anchors are not allowed.

3.8 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - a. For partitions with gypsum board on only one side, apply adhesive to backside of gypsum board and press insulation in place to form bond and prevent insulation from sagging within cavity.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
 - 2. Spray Polyurethane Insulation: Apply in accordance with manufacturer's written instructions.

3.9 INSTALLATION OF SPRAY-APPLIED INSULATION

- A. Spray-Applied Glass Fiber Insulation: Apply spray-applied glass-fiber insulation according to manufacturer's written instructions and using powered spray equipment that introduces water-based adhesive to fibers as they discharge from the spray nozzle, to produce a uniform thickness, free of starved spots or other evidence of thin application or of application patterns. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in installation areas is completed, and other items not indicated to receive insulation are masked.

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1. Primer: Prepare and apply primer to gypsum panels and other prepared substrates to receive sprayed thermal insulation.
2. Place insulation in full thickness over the entire area of each substrate to be protected.
 - a. Spray-apply insulation materials to maximum extent possible. Complete coverage by trowel application or other placement method recommended in writing by manufacturer.
 - b. Maintain profile of substrates except fill voids between members, including voids formed by fluted decks above beams and similar voids.
3. Immediately remove droppings and overspray to prevent damage in accordance with manufacturer's written instructions.
4. Board- or spray-tamp surface of spray-applied thermal insulation to provide an even texture and apply coating of adhesive to provide a sound surface.

3.10 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction in accordance with curtain-wall manufacturer's written instructions.
 1. Hold insulation in place by securing metal clips, brackets, pins and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place.
 2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 3. Install insulation to fit snugly without bowing.
 4. Install insulation mullion covers, minimum 8 in (200 mm) width centered over horizontal and vertical aluminum frames within spandrel.

3.11 FIELD QUALITY CONTROL FOR SPRAY-APPLIED THERMAL INSULATION

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Owner's Testing Agency Field Service for Spray-Applied Thermal Insulation: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- C. Tests: As determined by Owner testing agency for adhesion/cohesion, density and thickness.
- D. Spray-applied thermal insulation will be considered defective if they do not pass tests and inspections.

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1. When spray-applied thermal insulation material is not in compliance with requirements, perform additional random testing to determine extent of non-compliance.
 2. Remove and replace spray-applied thermal insulation to correct deficiencies.
 3. Apply additional insulation material, according to manufacturerTM's written instructions, where inspection results indicate insufficient thickness.
- E. Repair damage to insulation caused by testing; follow manufacturer written instructions.
- F. Prepare test and inspection reports.

3.12 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Remove sprayed thermal insulation from surfaces not required to be insulated.
1. Broom-clean work areas affected by the Work of this Section.
- D. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

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SECTION 072119

FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Spray polyurethane foam insulation and supplementary items necessary for a complete installation.
 - 1. Foamed-in-Place Insulation: Closed-cell spray polyurethane foam insulation.
- B. Related Requirements:
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 REFERENCE STANDARDS

- A. ASTM International (ASTM):
 - 1. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
 - 2. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics
 - 3. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 - 4. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
- B. International Code Council-Evaluation Service (ICC-ES):
 - 1. ICC-ES AC 377 - Acceptance Criteria for Spray-Applied Foam Plastic Insulation
- C. National Fire Protection Association (NFPA) Standards
 - 1. NFPA 259 - Standard Test Method for Potential Heat of Building Materials.
 - 2. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
 - 3. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers.
 - 4. NFPA 285 - Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

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1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer technical literature and tested physical and performance properties for each product and system indicated.
 - 1. Include manufacturer printed instructions for evaluating, preparing, and treating substrates, temperature and other limitations of installation conditions.
 - 2. Include manufacturer printed instructions for field adhesion testing, thickness measurement and reporting protocols.
- B. Shop Drawings
 - 1. Show locations and extent of installations. Details shall include, but not be limited to, installations at the following conditions:
 - a. Perimeter fire containment at slab edge.
 - b. Head, sill, and jamb of punched openings.
 - c. Expansion joints, penetrations, roof, and all terminations.
 - d. Panel connections to building structural frame.
 - e. Thermal barrier, materials and assemblies used for this purpose.
 - 2. Indicate intersections with other envelope assemblies and materials, and details for gaps inside and outside corners, materials that cover or intersect with the insulation and penetrations such as conduits, pipes electric boxes and similar items.
 - 3. Indicate types of substrate preparations required before applying insulation.
 - a. Include recommended values for field adhesion test on each substrate.
 - 4. Indicate minimum thicknesses needed to achieve required thermal rating specified.
- C. Samples for Verification: Submit clearly labeled samples, 12 in (300 mm) square of spray-applied thermal insulation on rigid backing and 3 by 4 in (75 by 100 mm) minimum size of each additional material specified or required.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Submit documentation from primary materials manufacturer indicating compatibility of products not manufactured by primary manufacturer.
- B. Product Test and Evaluation Reports: Written reports based on evaluation of comprehensive tests performed in compliance with design and quality control standards indicating that each product complies with requirements.
 - 1. Research Reports: For spray-applied polyurethane foam-plastic insulation and thermal barriers, from ICC-ES or an agency acceptable to authorities having jurisdiction showing compliance with requirements.

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- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.
- D. Warranty:
 - 1. Provide manufacturer written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

1.6 MOCK-UPS

- A. Mock-ups: Before overall installation of spray insulation, construct an on-site, in-place mockup as required to verify construction methods, demonstrate qualities of materials and execution and to facilitate site testing. Include all components in the assembly, including penetrations and attachments. Build mockups to comply with the following requirements, using exposed and concealed materials indicated for the completed Work.
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Minimum size:
 - 1) Interior Side of Exterior Wall Assemblies: 10 ft. wide by floor-to-floor height; include intersecting floor slab and one representative window.
 - 2) Underside of Elevated Slab: 10 ft. by 10 ft.; replicate representative penetrations and perimeter conditions.
 - b. Phased Mockups: When installation requires the use of thermal barrier coatings, construct mockup as follows:
 - 1) Phase 1: Complete installation of foam insulation.
 - 2) Phase 2: Complete installation of thermal barrier over foam installation.
 - 3) Obtain acceptance of testing and results for each phase prior to proceeding to the next phase and proceeding with overall installation of products

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- c. Adhesion Testing and Thickness Measurements: Perform adhesion testing and thickness measurements of site mock-up in accordance with manufacturer's recommendations. Reports shall indicate whether results comply with manufacturer's recommendations.
- 2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
- 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
- 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
- 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

- 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - f. If requested, testing and inspection agencies.
- 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - 1) Review recommended ventilation requirements.
 - b. Review Contract Document requirements.
 - c. Review approved submittals of details for the following conditions:
 - 1) Perimeter fire containment at slab edge.
 - 2) Head, sill and jambs of punched windows.
 - 3) Expansion joints, penetrations, roof and terminations.
 - 4) Intersecting framing members.
 - d. Review construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction.
 - 1) Review substrate requirements and drying procedures.
 - 2) Review adjacent surface protection and clean-up procedures and materials.
 - 3) Review procedures to remedy voids that are identified after installation.

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- e. Review inspection and testing requirements.
- f. Review environmental conditions and procedures for coping with unfavorable conditions.
- g. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages or containers with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier membrane manufacturer. Protect stored materials from direct sunlight.
- C. Handle materials in accordance with manufacturer's recommendations and applicable regulatory requirements

1.9 PROJECT CONDITIONS

- A. Temperature: Install within ambient temperature and humidity range and substrate temperatures recommended by foam insulation and thermal barrier manufacturers.
- B. Moisture: Do not apply air barrier to damp or wet substrates, including areas exposed to or contaminated by, snow, rain, fog, or mist.
- C. Ventilation: Provide adequate ventilation during application of air barrier in enclosed spaces. Maintain ventilation until foam products have cured.
- D. Substrate: Substrates to receive the spray foam air barrier material and other auxiliary materials are required to be clean, sound, and secure.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F, manufactured with low-GWP blowing technology.
 - 1. Manufacturers and Products:
 - a. NCFI Polyurethanes; InsulBloc.
 - b. BASF; WALLTITE US.
 - c. Demilec (USA) LLC; HEATLOK Soy 200 Plus.
 - d. JM Johns Manville; JM CORBOND III.
 - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.4 ACCESSORIES

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
- B. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
- C. Sealant at Transitions in Substrate, Connections to Adjacent Elements and Cladding Panel Joints: As recommended by foam insulation manufacturer, single-component, high-performance, low-modulus, high-movement, non-sag, fast-curing, hybrid sealant and backer rod.
- D. Transition Membrane: As recommended by foam insulation manufacturer, for use between spray polyurethane foam and roofing, other adjacent materials, and for use to flash around building fenestration, wall penetrations, and similar conditions.
- E. Foam Stop Angle: As recommended by foam insulation manufacturer, metal or plastic for use at foam stop locations.

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- F. Single-Component Foam Gap Sealer: As recommended by foam insulation manufacturer, for use around windows and doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to which thermal insulation will be applied, with Installer present, for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Manufacturer current Evaluation Service Report (ESR) as issued by International Code Council (ICC-ES) and written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
 4. Mock-Up Review and Approval.

3.3 PREPARATION

- A. General: Comply with manufacturer instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall be clean, dust-free, dry and have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Substrates: Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
1. Prepare surfaces by air blast, vacuum, brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the spray polyurethane foam.
- C. Priming: Prime substrates as recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.4 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

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- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Terminations, Gaps and Voids: Install according to manufacturer's written instructions.
- F. Install thermal barrier material.
 - 1. Do not cover insulation prior to any required spray foam insulation inspections.
- G. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
 - 1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
 - 2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
 - 3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.
- H. Patch and repair damaged areas as recommended by insulation manufacturer to maintain insulation thickness.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
 - a. Thickness Testing: Comply with ASTM D4541 and manufacturer's recommended adhesion testing protocol and acceptance criteria.
 - b. Adhesion Testing: Comply with manufacturer's recommended thickness control protocol and acceptance criteria.
 - c. Prepare test and inspection reports.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
- C. Contractor Responsibilities:
 - 1. Proceed with application for next area only when test and inspection results for previously completed applications indicate compliance with requirements.

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2. Remove and replace applications where test and inspection results indicate non-compliance with requirements.
 3. Perform additional testing and inspections to determine compliance of replaced or additional work with requirements at Contractor expense.
- D. Spray foam insulation systems will be considered defective if they do not pass tests and inspections

3.6 PROTECTION AND CLEANING

- A. Protection: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Cleaning: Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION

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SECTION 072617

BELOW SLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Below slab vapor retarders and supplementary items necessary for installation.
- B. Adhered and Specialty Floor Finishes at Slab-on-Grade Areas: Refer to floor finish section(s) for concrete moisture barrier treatment at adhered floorings, thin-set terrazzo and wood flooring systems.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, construction details, installation instructions, and recommendations for maintenance.
 - 2. Include manufacturer's standard drawing details for laps, openings, penetrations, corners, and other conditions applicable to this project.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.
- C. Warranties:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

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3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Mock-Ups: Prior to beginning Work of this Section, install minimum 150 sf mock-up of below slab vapor retarder using materials indicated for the completed Work; incorporating subgrade construction, sealing at penetrations, and seaming to demonstrate installation of below slab vapor retarder system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.
 1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.6 PROJECT CONDITIONS

- A. Ambient Conditions: Install below slab vapor retarder within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

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1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 BELOW SLAB VAPOR RETARDERS

- A. Vapor Retarder for Typical Concrete Slab-on-Grade Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible, lightweight material manufactured from raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted); not less than 15 mil thick.
3. Manufacturers and Products:
 - a. Barrier-Bac; VB-350
 - b. Fortifiber Building Product Systems; Moistop Ultra 15
 - c. W. R. Meadows, Inc.; Perminator, 15-mil
 - d. Raven Industries; VaporBlock 15
 - e. Reef Industries, Inc.; Griffolyn 15-mil Green
 - f. Reef Industries, Inc.; Vaporguard
 - g. Stego Industries LLC; Stego Wrap, 15-mil

- B. Vapor Retarder for Structured Concrete Slab Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible or semi-flexible, material manufactured of one of following compositions; with one face suited for integral bonding with concrete; not less than 20 mil thick.
 - a. Raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted).
 - b. Multiple ply board composed of a proprietary core with bituminous impregnated material and glass-mat liners, with polyethylene facers.

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3. Manufacturers and Products:

- a. Barrier-Bac; VBC-350
- b. Grace Construction Products; Florprufe 120
- c. W. R. Meadows, Inc.; Premoulded Membrane Vapor Seal with Plasmatic Core (PMCP), with felt face toward concrete
- d. Polyguard Products, Inc.; Underseal
- e. Stego Industries LLC; Stego Wrap, 15-mil

2.4 ACCESSORIES

- A. Barrier Seaming and Sealing Tape: Manufacturer's standard one-sided or two-sided pressure-sensitive tape of type, material and size for sealing membrane joints and for sealing membrane to other adjacent structures; provided by vapor retarder manufacturer.
- B. Penetration Accessories: Manufacturer's standard pre-molded products or mastic for sealing penetrations; provided by vapor retarder manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine subgrade and foundation surfaces to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
 - 1. ASTM E 1643, except place vapor retarder on top of granular fill.
 - 2. Respective manufacturer's installation written instructions.
 - 3. Accepted submittals.
 - 4. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and Project specifications for subgrade preparation. Subgrade surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work. Provide smooth, level, and properly compacted and moisture conditioned subgrade in accordance with Geotechnical Engineer's recommendations.
- B. Ensure that subgrade is smooth and even without sharp or protruding objects that might rip, tear, or puncture vapor retarder membrane.

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3.4 BELOW SLAB VAPOR RETARDER INSTALLATION

- A. Install multiple sheets to form continuously sealed below slab vapor retarder over properly prepared subgrade prior to concrete slab reinforcing installation.
1. Place vapor retarder membrane in widest width possible over subgrade with longest dimension parallel with direction of concrete placement with proper face toward concrete; pull taut to eliminate fishmouths, wrinkles, buckles, and kinks.
 2. Properly dry and clean mating surfaces of vapor retarder membrane prior to application of seaming tape.
 3. Overlap sides and ends of vapor retarder membrane not less than 6 in and apply seaming tape.
 4. Ensure vapor retarder membrane is continuous from edge to edge of concrete slab.
 - a. Perimeter Seal: Seal vapor retarder to perimeter wall or footing/grade beam with tape per manufacturer recommended installation instructions.
 5. Cut vapor retarder membrane carefully around penetrations and seal with either premolded accessories, or on-site collar fabrications using seaming tape or mastic; if field fabricated, comply with manufacturer's recommended details.
 6. Repair rips, tears, or punctures with seaming tape, or by cutting out damaged areas and patching with new vapor retarder membrane, overlapping damaged area minimum 6 in in each direction and apply seaming tape.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Inspection of In-Progress Work: Owner may employ and pay a qualified independent inspection agency to perform the following inspections for field quality control. Re-inspections of materials failing to meet specified requirements shall be done at Contractor's expense.
1. Prior to beginning concrete slab reinforcing installation, inspect vapor retarder membrane for rips, tears, and punctures.
 2. Prior to concrete placement work, inspect concrete installer's tools and notify Contractor to have tools with spikes or other sharp surfaces that could inflict intentional or unintentional damage on the installed vapor retarder membrane removed from work area.
 3. Immediately prior to concrete placement work, inspect vapor retarder membrane for rips, tears, and punctures, inspect penetrations at columns and mechanical and electrical piping.
 4. Continuously inspect concrete placement work, watching for damage to vapor retarder membrane.
 5. Periodically inspect portions of slab that were not placed (block-outs, voids, and leave-outs) for water infiltration of subgrade until concrete is subsequently placed.

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3.6 PROTECTION

- A. Protection during Concrete Work: Ensure vapor retarder membrane will be without damage or deterioration during in-place fabrication of concrete slab reinforcing and subsequent placement of concrete.
1. Prevent vehicles from driving over vapor retarder membrane once it has been placed.
 2. Prevent wood or steel stakes from penetrating vapor retarder membrane.
 3. At locations where portions of slab are not placed (block-outs, voids and leave-outs), provide protection to prevent water infiltration into void that would contaminate subgrade below vapor retarder membrane; maintain until concrete is subsequently placed.

END OF SECTION

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SECTION 072716

SELF-ADHERING AIR AND WATER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Self-adhering air and water barriers located within exterior wall assemblies; and supplementary items necessary for installation.
 - 1. Self-adhering air and water barrier - vapor retarding.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Testing for Air and Water Leakage.
 - 2. Refer to Division 6 Section Exterior Gypsum Sheathing for wall sheathing and sheathing joint-and-penetration treatments. Joint treatment components shall be compatible with air and water barrier assembly.

1.2 DEFINITIONS

- A. Air and Water Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air and Water Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air and Water Barrier Assembly: The collection of air and water barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- D. Air-Barrier System: The combination of air-barrier assemblies installed to provide a continuous barrier to the movement of air through building enclosures. This term applies to the whole building.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
 - 2. Include data on air and water-vapor permanence based on testing according to referenced standards.
 - 3. Include VOC content of each material, and applicable legal limit in the jurisdiction of the project.
- B. Samples: Actual samples for each of following:
 - 1. Air and Water Barrier Membrane: Minimum 8-1/2 in by 11 in ().

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2. Accessory Materials: Sample of each item.

C. Shop Drawings: For air and water barrier assemblies.

1. Show locations and extent of air and water barrier assemblies and details of typical and project specific conditions.
 - a. Include recommended values for field adhesion test on each substrate.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier system.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
1. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with other Project materials that attach to or that come in contact with the barrier.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranty:
1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.

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- c. Installer, including project manager and supervisor.
 - d. Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store weather barrier materials as recommended by manufacturer.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Install air and water barrier within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer.
 - 1. Protect substrates from environmental conditions that affect performance.
 - 2. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

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- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General: Air and water barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air and water barrier and as a liquid-water drainage plane flashed to discharge to the exterior. Air and water barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
 - 1. Assembly shall perform as a drainage plane flashed to discharge condensation or water penetration to the exterior.
 - 2. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and water seal materials at such locations, changes in substrate and perimeter conditions.
 - 3. Assembly shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure.
 - 4. Assembly shall not displace adjacent materials under full load.
 - 5. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement.
- B. Connections to Adjacent Materials: Provide connections to prevent air leakage and water migration at the following locations:
 - 1. Foundation and walls, including penetrations, ties and anchors
 - 2. Walls, windows, curtain walls, storefronts, louvers or doors.
 - 3. Different wall assemblies and fixed openings within those assemblies.
 - 4. Wall and roof connections.

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5. Floors over unconditioned space.
 6. Walls, floor and roof across construction, control and expansion joints.
 7. Walls, floors and roof to utility, pipe and duct penetrations.
 8. Seismic and expansion joints.
 9. Other leakage pathways in the building envelope.
- C. Air-Barrier Air Leakage - Assembly: Maximum 0.04 cfm/sq.ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.4 SELF ADHERING AIR AND WATER BARRIER - VAPOR RETARDING

- A. Aluminum-Faced Modified Bituminous Sheet: Self-adhering sheet consisting of rubberized asphalt laminated to cross-laminated polyethylene film faced with aluminum foil, with release liner on adhesive side and formulated for application with primer that complies with VOC limits. Use regular or low-temperature formulation depending on site conditions within temperature ranges specified by manufacturer. Provide related accessories including primer, transition and membrane flashings, seam tape and sealant recommended by manufacturer.
1. Manufacturers and Products:
 - a. Henry; Blueskin Metal Clad
 - b. Carlisle Coatings & Waterproofing; CCW-705FR-A.
 - c. GCP Applied Technologies; Perm-A-Barrier Aluminum Wall Membrane or Perm-A-Barrier Low Temperature Aluminum Wall Membrane.
 2. Physical and Performance Properties:
 - a. Air Permeance - Materials: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Puncture Resistance: Minimum 40 lbf; ASTM E154/E154M.
 - c. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541 as modified by ABAA. Test at 3 locations; During construction; once daily and a minimum of 4 tests per major elevation. Note: tests to be performed for each substrate type.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.5 ACCESSORY MATERIALS

- A. General: Provide compatible accessory materials recommended by air and water barrier manufacturer to produce a complete air and water barrier assembly.
1. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic/sealant, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air and water barrier manufacturer to produce a complete air and water barrier assembly and that are compatible with primary air and water barrier material and adjacent construction to which they may seal.

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- B. Primer: Liquid primer recommended for substrate by air and water barrier material manufacturer.
- C. Flexible Flashing: Minimum 40 mil self adhering sheet membrane consisting of rubberized asphalt integrally bonded to high density cross laminated polyethylene film as recommended for substrate by air and water barrier material manufacturer.
- D. Flexible Flashing - High Temperature Resistance: For use under exposed sheet metal and where indicated on Drawings. Minimum 30 mil self-adhering sheet membrane composed of a butyl rubber bonded to high density cross laminated polyethylene film as recommended for substrate by air and water barrier materials manufacturer.
- E. Foil Faced Flexible Flashing Membrane: Minimum 25 mil self-adhering sheet membrane composed of high density cross laminated polyethylene aluminum surfaced sheet backed by a pressure sensitive rubberized asphalt adhesive. Do not use foil faced products with cement plaster assemblies.
- F. Liquid Membrane: Liquid applied two-component asphalt modified urethane.
- G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- I. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
- J. Detail Membrane / Barrier Sealing Tape: Sheet material laminated to adhesive coated butyl or other barrier sealing tape approved by air and water barrier manufacturer for sealing fastener and anchor penetrations.
- K. Termination Bars:
 - 1. Bar: 1/8 in thick by 1 in wide continuous stainless-steel bar with 1/4 in diameter holes spaced at 8 in on centers.
 - 2. Mechanical Fasteners: Corrosion resistant, self-tapping drill point screws with hex washer head with bonded EPDM, shank size and length as required to penetrate steel stud flange and strap back-up by not less than 3 exposed threads.
- L. One-Piece Electrical Box:
 - 1. Description: Rigid reinforced polyethylene electrical box designed to prevent leaks at air and water barrier, with fixed or adjustable flange to suit installation conditions, with clear hinged weatherproof in-use cover.
 - 2. Manufacturer and Product: Arlington Industries, Inc.; In Box.
- M. Sheathing Joint Treatments: Refer to Division 6 Section "Exterior Gypsum Sheathing". All components shall be compatible with air and water barrier system.
- N. Joint Sealant: Silicone construction sealant and weather barrier sealant as specified in Division 07 Section "Joint Sealants".

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
 - 5. Verify sealants and joint treatments used in sheathing are compatible with membrane.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- C. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258
- D. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction
- E. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- F. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

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- G. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- H. At changes in substrate plane, apply sealant or termination mastic/sealant beads at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- J. Bridge and cover isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping membrane strips.
- K. Masonry joints shall be struck flush and cracks greater than crack bridging ability shall be filled (routed and filled where necessary) prior to application of membrane to the surface.
- L. Sheathing joints shall be treated in accordance with manufacturer installation details.

3.4 AIR AND WATER BARRIER INSTALLATION

- A. General: Install materials according to air and water barrier manufacturer's written instructions and details and according to recommendations in ASTM D6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. When recommended by air and water manufacturer for ambient and substrate temperature range, install self-adhering, modified bituminous air and water barrier sheet produced for low-temperature application.
 - 2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
- B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
- C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic/sealant and according to ASTM D 6135.
- D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Re-prime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 3-inch minimum lap widths and end laps.
 - 1. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - a. Lap 12 inches (300 mm) minimum at inside and outside corners; lap flashing 4 inches (150 mm) minimum.
 - 2. Beginning at bottom of wall, apply sheets in a shingled manner to shed water without interception by any exposed sheet edges. Seal leading edges with compatible sealant or liquid membrane.
 - 3. Roll sheets firmly to enhance adhesion to substrate. Use manufacturer approved roller.

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- F. Apply continuous sheets over strips bridging substrate cracks, construction, and contraction joints.
 - 1. Form bellows or use preformed silicone sheets at drift or deflection joints to allow movement.
 - 2. Install a 12 inch strip of flexible flashing centered at all inside and outside corners.
- G. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.
 - 1. Overlap horizontally adjacent sheets a minimum of 3-inches and roll seams.
 - 2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
 - 3. Seal masonry reinforcing or ties and penetrations with weather barrier sealant or liquid membrane..
 - 4. Continue the membrane into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.
- H. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch- wide, transition strip
- I. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counter-flashings or ending in reglets with compatible sealant or liquid membrane..
 - 1. Cladding Anchors: Apply 4 in (100 mm) by 7 in flashing tape to weather barrier membrane prior to the installation of cladding anchors.
- J. Seal air barrier to penetrations, pipes, conduits, electrical boxes, and similar items penetrating barrier with compatible sealant. Install sheet metal collar with a formed seal to the penetration. Apply flexible flashing over top and side flanges of the collar. Seal leading edges of membrane with compatible sealant or liquid membrane.
- K. Apply a layer of flexible flashing over all sheet metal and flanged cladding accessories. Apply a layer of flexible flashing over all sheet metal and flanged cladding accessories.
- L. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 - 1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install strip on roofing membrane or base flashing so that a minimum of 4 in of coverage is achieved over each substrate.
- M. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- N. One-Piece Electrical Box: Install in accordance with manufacturer's recommendations. Cover shall project from face of wall surface enough to allow hinged cover to fully open for access.

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- O. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic/sealant.
- P. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- Q. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or flashing sheet as indicated so that a minimum of 3 in of coverage is achieved over each substrate. Maintain 3 in of full contact over firm bearing to perimeter frames.
 - 1. Counter-flash membrane over metal flashings and girts as indicated in the Drawings.
- R. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier material with foam sealant
- S. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with flexible flashing sheet extending 6 in beyond repaired areas in all directions. Seal leading edges with compatible sealant or liquid membrane.
- T. Do not cover air barrier until it has been tested and inspected by testing agency
- U. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air-barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.

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5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed.
7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic/sealant applied on exposed edges), with no fishmouths.
8. Liquid membrane or weather barrier sealant has been applied on cut edges.
9. Air barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

D. Tests: As determined by Owner's testing agency from among the following tests:

1. Air Leakage Volume Testing - Assembly: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 783 or ASTM E 2357.
2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. according to ASTM D 4541.
3. Refer to Division 01 Section Field Testing for Air and Water Leakage.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 074213

FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Factory-formed metal wall panels and supplementary items necessary for installation.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 DEFINITIONS

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, and supplementary items necessary for a complete weathertight wall system.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

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2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:
 1. Show fabrication and installation layouts of metal wall panels.
 2. Show details and locations of edge conditions, side-seam and end-lap joints, panel profiles, corners, anchorages, trim, flashings, closures, and terminations.
 3. Show details for securing metal wall panel assembly, including layout of fasteners and other attachments.
 4. Show details of wall panel penetrations.
 5. Show details of connections to adjoining work.
 6. Indicate where and how the system deviates from Contract Documents.
 7. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
 8. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
 9. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
 10. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- C. Samples for Verification Purposes: For each type of exposed finish required, prepared on samples of size indicated below.
 1. Metal Wall Panels: 12 in long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 2. Trim and Closures: 12 in long. Include fasteners and other exposed accessories.
 3. Accessories: 12 in long samples for each type of accessory.
 4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2 in wide joints formed between two 6 in long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

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1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.
- D. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.11 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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1.12 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion
- B. Installer's Warranty: Furnish installer written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
- C. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. American Building Components.
 2. ATAS International, Inc.

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3. Berridge Manufacturing Company.
4. Kalzip.
5. Kingspan.
6. CENTRIA Architectural Systems.
7. MBCI

- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 2. Other Loads: As indicated on Drawings.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
 2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
- D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- E. Deflection of Framing Members and Panels: At design wind pressure.
1. Deflection of Framing Members Normal to Wall Plane (Panel Perimeter): Limited to 1/175 of clear span.
 2. Deflection of Panels: For short side panel edge dimension (L), limit center-of-panel deflection to not greater than L/100 or 1 in, whichever is less.

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- F. Structural-Test Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 or ASTM E 330 as follows:
1. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of the clear span.
- G. Water Penetration under Static Pressure: Test in accordance with ASTM E 331 as follows:
1. No evidence of water penetration for the system when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sf.
- H. Energy Performance:
1. Air Leakage: Test in accordance with ASTM E 283 as follows:
 - a. Air leakage for the system of not more than 0.06 cfm/sf at a minimum static-air-pressure differential of 6.24 lbf/sf when tested in accordance with ASTM E 283.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.
- J. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 METAL WALL PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
1. Surface: Smooth, flat.
 2. Exterior Finish: Fluoropolymer finish.
 3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mils.
- B. Aluminum Sheet: Coil-coated sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
1. Surface: Smooth, flat.

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2. Exterior Finish: Fluoropolymer finish.

2.5 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Custom Profile, Exposed Fastener Metal Wall Panels; Refer To Design Schedule sheet A5.01.
1. Basis of Design: Centria Paradigm
 2. Material: 0.050" Aluminum- Smooth PCE7 Profile.
- C. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.
1. Basis of Design: CENTRIA; Ecoscreen BR5-36
 2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in nominal minimum thickness.
 3. Panel Coverage: 36 in.
 4. Rib Spacing: 7.2 in on center.
 5. Panel Height: 1-1/2 in.

2.6 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and flat pan between panel edges; with narrow reveal joint between panels.
1. Basis of Design: CENTRIA; IW-41A
 2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in nominal minimum thickness.
 3. Panel Coverage: 11 in.
 4. Reveal Joint: 1 in wide.
 5. Panel Height: 1-1/2 in.

2.7 CONCEALED-FASTENER, METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and flat panel between panel edges; with flush joint between panels.
1. Basis of Design: CENTRIA; IW-10A

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- ~~2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer, 22 gage, 0.034 in nominal minimum thickness.~~
- ~~3. Panel Coverage: 12 in.~~
- ~~4. Panel Height: 1-1/2 in.~~

2.8 SUBFRAMING AND PANEL ACCESSORIES

- A. Metal Subframing and Furring: Provide manufacturer standard sections as required for support and alignment of metal panel system.
 1. Sub-girts, Zee Clips, Base or Sill Angles or Channels: Manufacturers standard C, U or Z-shaped sections, type as recommended by panel manufacturer.
 - a. Metallic Coated Steel Sheet: ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation.
 - 1) Thickness: Not less than 0.063 inch, 16 gauge nominal thickness.
 - b. Aluminum Sheet: Clear anodized sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1) Thickness: Not less than 0.051 inch, 16 gage nominal thickness.
 - c. Aluminum Extrusions: ASTM B 221 / B 221M, alloy and temper recommended by panel manufacturer for type of use and finish indicated.
- B. Composite Metal Hybrid Subframing System: Subframing system consisting of fire retardant polyester resin girts reinforced with integral continuous metal inserts and fasteners designed to integrate cavity insulation and eliminate thermal bridging of subframing and fasteners.
 1. Basis of Design: Advanced Architectural Products; SMARTci System GreenGirt CMH Sub-Framing, Z-Girt size as required for insulation thickness indicated.
- C. Fasteners for Sub-framing and Furring: Self-tapping screws, bolts, nuts, and other suitable fasteners, Series 300 stainless steel of size, corrosion resistance, holding power, and other properties required to comply with performance requirements.
 1. Provide fasteners with EPDM or PVC sealing washers.
- D. Insulated Composite Backup Panel System: Designed to be used with metal wall panel cladding to create a complete rain screen slution. A foam composite panel constructed of two roll formed steelfaces surrounding and entirely bonded to a closed cell poured-in-place polyisocyanurate foam core.
 1. Basis of Design: Centria MetalWrap Integrated Series
- E. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

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1. Closures: Provide closures fabricated of same metal as metal wall panels.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1 in ()thick, flexible closure strips; cut or pre-molded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- F. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- G. Panel Fasteners: Self-tapping screws, bolts, nuts, and other suitable fasteners, Series 300 stainless steel of size, corrosion resistance, holding power, and other properties required to comply with performance requirements. Provide exposed fasteners with heads matching color of metal panels factory-applied coating.
1. Provide fasteners with EPDM or PVC sealing washers.
- H. Panel Sealants: Provide the following as recommended by metal wall panel assembly manufacturer for installation indicated.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 in ()wide and 1/8 in ()thick.
 2. Elastomeric Joint Sealant: ASTM C 920; elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal exposed joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for concealed hooked-type expansion joints with limited movement.
- I. Self-Adhering, High-Temperature Rubberized Asphalt Flashing: Minimum 30 mils to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 3. Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. GCP Applied Technologies; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- J. Barrier Flashing Tape: Air-barrier manufacturer standard adhesive and pressure-sensitive adhesive tape. Refer to Division 07 Section "Air and Water Barriers".

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- K. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.

2.9 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.10 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.
- D. Finish Selections: As scheduled or indicated in Design Selections.

2.11 STEEL FINISHES

- A. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 621 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 621 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

2.12 ALUMINUM FINISHES

- A. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - 3. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before installation.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Subframing and Supports: Install subframing, subgirts, base angles, closure channels, sills, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

3.4 ASSEMBLY INSTALLATION

- A. General: Install metal wall panels according to manufacturer written instructions in orientation, sizes, and locations indicated on Drawings.
- B. Wall Panels: Install wall panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal wall panels.
 - 2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - a. Air and Water Barrier: Install a strip of barrier flashing tape behind through-wall attachments that penetrate air and water barrier. Seal all penetrations with weather barrier sealant.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal wall panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

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8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 9. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- C. Fasteners: Use stainless-steel fasteners.
- D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- E. Attachment Assembly, General: Install attachment assembly required to support metal wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
 2. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
- F. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
 7. At panel splices, nest panels with minimum 6 in end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

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3.5 METAL SOFFIT PANEL INSTALLATION

- A. In addition to complying with requirements in "Wall Panel Assembly Installation" Article, install metal soffit panels to comply with requirements in this article.
- B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
 - 1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - a. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in weathertight and weather-resistant performance.
 - a. Install escutcheons for pipe and conduit penetrating exterior walls.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft with no joints allowed within 24 in of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and weathertight, form expansion joints of intermeshing hooked flanges, not less than 1 in deep, filled with mastic sealant (concealed within joints).

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3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
- C. Metal panels will be considered defective if they do not pass test and inspections.
- D. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 074229

TERRA COTTA PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Factory-formed terra cotta panels, clips, sub-framing and supplementary items necessary for installation.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 DEFINITIONS

- A. Terra Cotta Panel Assembly: Terra cotta panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete panel system.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Contract Documents and Work:

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1. **Product Variations:** In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. **Allowable Adjustments:** Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. **Product Data:** Manufacturer's technical literature for each product and system indicated.
 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. **Shop Drawings:** Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:
 1. Show fabrication and installation layouts of panels.
 2. Show details of edge conditions, panel profiles, corners, anchorages, trim, flashings, closures, and terminations.
 3. Show details for securing panel assembly, including layout of fasteners and other attachments.
 4. Show details of panel penetrations.
 5. Show details of connections to adjoining work.
 6. Indicate where and how the system deviates from Contract Documents.
 7. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
 8. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
 9. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
 10. **Design Modifications:** If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- C. **Samples for Verification Purposes:** For each type of exposed finish required, prepared on samples of size indicated below.
 1. **Terra Cotta Panels:** 12 in long by actual panel width. Include fasteners, closures, and other panel accessories.
 2. **Trim and Closures:** 12 in long. Include fasteners and other exposed accessories.
 3. **Accessories:** 12 in long samples for each type of accessory.

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4. Exposed Gaskets: 12 in long.
5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2 in wide joints formed between two 6 in long strips of material matching the appearance of panels adjacent to joint sealants.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- E. Warranty:
 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer/Fabricator Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project
 3. Manufacturer Acceptance: Installer/fabricator shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Material Testing Service: Provide terra cotta panel systems that comply with test-performance requirements indicated, as evidenced by test reports based on testing by a qualified testing agency.
 1. Absorption: Test according to ASTM C 1167 using 24 hour submersion. (separate sets of specimens, minimum 5 specimens each). Absorption by submersion shall not be less than 4 percent or exceed 7 percent average and 8 percent individual specimen.

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2. Freezing and Thawing: Test according to ASTM C 1167 for 100 cycles requiring minimum of 50 days (minimum 5 specimens). No specimen shall lose more than 3 percent of its original dry weight. No specimen shall crack, crumble or fracture. Specimens shall conform to approved color range samples before and after testing.
3. Modulus of Rupture: Test according to modified ASTM C 1167 (minimum 5 specimens). Supports shall be actual hardware used for this project. Apply load at mid-span between supports. Report shall include breaking load, calculated section modules at mid-span, and calculated breaking stress.
4. Separate sets of specimens are required to be tested for each combination of color and texture. For a given color and texture combination, the most common size tile for the project shall be tested, except for breaking load, where tile size corresponding to maximum span shall be tested. If multiple widths occur to maximum span, test width shall be selected by Architect.
5. Thermal Shock Resistance: Test according to ASTM C 484 for glazed panels. Minimum of 5 specimens. Specimens shall pass one cycle.

1.9 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

- a. Architect.
- b. Contractor, including superintendent.
- c. Installer/fabricator, including project manager and supervisor.
- d. If requested, Manufacturer's qualified technical representative.
- e. Installers of other construction interfaced with Work.
- f. Testing agency.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in compliance with manufacturer's instructions and recommendations and industry standards.
- B. Store materials in manufacturer's original sealed, labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

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1.11 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.12 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.13 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of terra cotta and other materials beyond normal weathering.
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion
- B. Installer/Fabricator Warranty: Furnish installer/fabricator's written workmanship warranty signed by an authorized representative using installer/fabricator's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer/fabricator shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Boston Valley Terra Cotta
 - 2. NBK North America, a Div of Hunter Douglas Facades, Inc.
 - 3. Shildan, Inc.

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4. Terreal North America, a Div of Terreal Terra Cotta

- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: Shildan Longoton M2.

- a. Panel Profiles, Color and Texture: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS, EXTERIOR PANELS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
1. Live Load Deflection: Accommodate differential vertical deflection of floors:
- a. Deflection: As indicated on Drawings.
2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
- a. Design Displacement: As indicated on Drawings.
- D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- E. Deflection of Framing Members and Panels: At design wind pressure.
1. Deflection within Terra Cotta Panel System Normal to Wall Plane: Limited to L/360 of clear span or 5/8-inch, whichever is less when tested in accordance with ASTM E 330.

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- F. Structural-Test Performance: Provide panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 or ASTM E 330.
- G. Water Penetration under Static Pressure: Test in accordance with ASTM E 331 as follows:
 - 1. No evidence of water penetration for the system when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf.
- H. Energy Performance:
 - 1. Air Leakage: Test in accordance with ASTM E 283 as follows.
 - a. Air leakage for the system of not more than 0.06 cfm/sf at a minimum static-air-pressure differential of 6.24 lbf/sf when tested in accordance with ASTM E 283.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.
- J. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 TERRA COTTA PANELS

- A. General: Provide factory-formed and -assembled, terra cotta panels, formed into profile for installation method indicated. Include attachment system components and accessories required for a complete system.
- B. Terra Cotta Panels: Clay-based, unglazed or glazed ceramic, integrally colored wall panels and as follows:
 - 1. Panel Thickness: 1-1/4 in (32 mm) minimum or as required for meeting performance requirements.
 - 2. Panel Size: As indicated on the Drawings.
 - 3. Total installed assembly thickness: As indicated on the Drawings.
 - 4. Flatness: No noticeable warp buckling, deflection or surface irregularities.

2.5 SUBFRAMING AND PANEL ACCESSORIES

- A. Metal Sub-Framing and Furring: Provide manufacturer's standard sections as required for support and alignment of panel system.
 - 1. Sub-girts, Zee Clips, Base or Sill Angles or Channels: Manufacturers standard C, U or Z-shaped sections, type as recommended by panel manufacturer.

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- a. Aluminum Sheet: Mill finish, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1) Thickness: Not less than 0.051 inch, 16 gage nominal thickness.
 - b. Aluminum Extrusions: Mill finish, ASTM B 221 / B 221M, alloy and temper recommended by panel manufacturer for type of use indicated.
- B. Composite Metal Hybrid Subframing System: Subframing system consisting of fire retardant polyester resin girts reinforced with integral continuous metal inserts and fasteners designed to integrate cavity insulation and eliminate thermal bridging of subframing and fasteners.
- 1. Basis of Design: Advanced Architectural Products; SMARTci System GreenGirt CMH Sub-Framing, Z-Girt size as required for insulation thickness indicated.
- C. Fasteners for Sub-framing and Furring: Self-tapping screws, bolts, nuts, and other suitable fasteners, Series 300 stainless steel of size, corrosion resistance, holding power, and other properties required to comply with performance requirements.
- 1. Provide fasteners with EPDM or PVC sealing washers.
- D. Panel Accessories: Provide components required for a complete panel system including trim, copings, sills, corner units, clips, flashings, sealants, silicone gaskets, fillers, closure strips, and similar items. Match material and finish of terra cotta panels unless otherwise indicated.
- E. Flashing and Trim: Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, parapet caps, soffits, reveals, and fillers. Finish flashing and trim to match appearance of adjacent terra cotta panels.
- F. Panel Fasteners: Manufacturer standard stainless steel clips with silicone isolator, engineered to withstand design loads.
- G. Panel Sealants: ASTM C920; silicone sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended in writing by panel manufacturer.
- 1. Refer to Division 07 Section Joint Sealants.
- H. Self-Adhering, High-Temperature Rubberized Asphalt Flashing: Minimum 30 mils to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F ().
 - 3. Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. GCP Applied Technologies; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.

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- e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- I. Barrier Flashing Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape. Refer to Division 07 Section Air and Water Barriers.
- J. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.

2.6 FABRICATION

- A. General: Fabricate and finish terra cotta panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements for installation tolerances, terra cotta panel supports, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by panel manufacturer.
 - 3. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating terra cotta panels to verify actual locations of penetrations relative to joint locations before panel installation.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 ASSEMBLY INSTALLATION

- A. General: Install terra cotta panels and accessories according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Attachment Assembly, General: Install attachment assembly required to support terra cotta panels and to provide a complete system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
 - 2. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
- D. Installation: Attach terra cotta panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install escutcheons for pipe and conduit penetrating exterior walls.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft with no joints allowed within 24 in of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and weathertight, form expansion joints of intermeshing hooked flanges, not less than 1 in deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to following tolerances.

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1. Plumb: 1/8 in in 10 ft; 1/4 in in 40 ft; non-cumulative.
2. Level: 1/8 in in 20 ft; 1/4 in in 40 ft; non-cumulative.
3. Alignment: Limit offset to 1/6 in where surfaces are flush or less than 1/2 in out of flush and separated by less than 2 in by reveal or protruding work; otherwise limit offsets to 1/8 in.
4. Location: 3/8 in maximum deviation from measured theoretical location; any member and location.
5. Lipping between Units: 1/16 in maximum.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 2. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
- C. Terra cotta panels will be considered defective if they do not pass test and inspections.
- D. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as terra cotta panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
- B. After panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 074243

COMPOSITE METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Factory-formed composite metal panels and supplementary items necessary for installation.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 DEFINITIONS

- A. Metal Panel System includes metal panels, joints, attachment system components and other materials as needed for a complete weather-resistant exterior cladding system.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Contract Documents and Work:

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1. **Product Variations:** In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. **Allowable Adjustments:** Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. **Product Data:** Manufacturer's technical literature for each product and system indicated.
 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. **Shop Drawings:** Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:
 1. Show fabrication and installation layouts of metal panels.
 - a. Show details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, accessories, and special details.
 2. Include details of flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
 - a. Show details for securing metal panel assembly, including layout of fasteners and other attachments.
 - b. Show details of connections to adjoining work.
 - c. Show details of panel penetrations.
 3. Indicate where and how the system deviates from Contract Documents.
 4. Provide signed/sealed shop drawings and a written statement, by a qualified professional Engineer registered in Project jurisdiction, indicating the metal panel system complies with performance requirements, applicable codes and design criteria identified for this Project.
 5. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
 6. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
 7. **Design Modifications:** If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

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- C. Samples for Verification Purposes: For each type of exposed finish required, prepared on samples of size indicated below.
1. Metal Panel System: 12 inches long by actual panel width, fabricated into panel systems indicated. Include fasteners, closures, and other metal panel accessories
 2. Trim, Closures and Accessories: 12 in long samples for each type. Include fasteners and other exposed items.
 3. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2 in wide joints formed between two 6 in long strips of material matching the appearance of metal-faced composite panels adjacent to joint sealants.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Product Test and Evaluation Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
1. Metal Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC and Project requirements.
 2. Fabricator's Metal Panel System Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC and Project requirements.
 3. Research Reports: For metal panel systems, from an agency acceptable to authorities having jurisdiction or ICC-ES showing compliance with Project requirements.
 - a. Submit NFPA 285 Compliance Report for assemblies used on this Project.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- E. Warranty:
1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
- B. Warranty Documentation:
1. Manufacturers' special warranties.

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2. Installer's special warranties.

1.7 QUALITY ASSURANCE

A. Installer/Fabricator Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project
3. Manufacturer Acceptance: Installer/fabricator shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will be in contact with sealants and for each condition.

1. Test a minimum five production-run samples each of metal, glazing, and other material.
 - a. Include all adjacent materials with watertight seals to panel systems.
2. Prepare samples using techniques and primers required for installed assemblies.
3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers.
 - a. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

1.9 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer/fabricator, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - f. Owner's Building Enclosure Commissioning provider.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

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- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panel for period of metal panel installation.

1.11 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.12 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.13 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

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1. Coverage of warranty includes but is not limited to the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration or delamination of metals and other materials beyond normal weathering.
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion
- B. Installer/Fabricator Warranty: Furnish installer/fabricator's written workmanship warranty signed by an authorized representative using installer/fabricator's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Coverage of warranty includes but is not limited to the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 2. Warranty Period: Installer/fabricator shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
- C. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Alcoa Inc.
 2. Alucobond, division of 3A Composites USA, Inc.
 3. ALPOLIC, division of Mitsubishi Plastic Composites America, Inc.
 4. Larson, by Alucoil North America.
 5. Riverside Group

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- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: As scheduled or indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS, EXTERIOR PANELS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 2. Other Loads: As indicated on Drawings.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
 2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
- D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- E. Deflection of Framing Members and Panels: At design wind pressure.
1. Deflection of Framing Members Normal to Wall Plane (Panel Perimeter): Limited to 1/175 of clear span.
 2. Deflection of Panels: For short side panel edge dimension (L), limit center-of-panel deflection to not greater than L/100 or 1 in, whichever is less.
- F. Structural-Test Performance: Provide metal panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 or ASTM E 330 as follows:

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1. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
- G. Water Penetration under Static Pressure: Test in accordance with ASTM E 331 as follows:
1. No evidence of water penetration for the system when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf.
- H. Energy Performance:
1. Air Leakage: Test in accordance with ASTM E 283 as follows.
 - a. Air leakage for the system of not more than 0.06 cfm/sf at a minimum static-air-pressure differential of 6.24 lbf/sf when tested in accordance with ASTM E 283.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.
- J. Fire Propagation Characteristics: Composite metal panel system complies with and passes NFPA 285 Standard Method of Test for the Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components.
- K. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 COMPOSITE METAL PANELS

- A. General: Provide factory-formed and -assembled, metal-faced composite panels fabricated from two metal facings bonded, to manufacturers solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components, panel stiffeners and accessories required for a complete system.
1. Core: FR (Fire-Retardant).
 2. Panel Thickness: 0.157-inch minimum, provide thickness as required to meet performance requirements.
 3. Bond Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
 4. Fire Performance: Flame-spread index less than 25 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.
- B. Composite Metal Panel Materials:
1. Aluminum-Faced Panels: ASTM B209/B209M alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch- thick minimum, aluminum sheet facings.

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- a. Exterior Finish: As scheduled or indicated in Design Selections.

2.5 METAL PANEL SYSTEM

- A. Metal Panel System: Provide factory-formed and -assembled, metal panels formed into profile for system installation, drained. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
- B. System Panel Depth: As indicated on drawings.
- C. Attachment Assembly Components: Manufacturer's standard, compatible with panel facings.
- D. Labeling: Comply with labeling requirement of applicable building code.

2.6 METAL SOFFIT PANELS

- A. Composite Metal Soffit Panels: Composite metal panel manufacturer's standard panel for horizontal conditions; meeting same requirements as that for specified vertical panels.

2.7 SUBFRAMING AND PANEL ACCESSORIES

- A. Metal Subframing and Furring: Provide manufacturer's standard sections as required for support and alignment of metal panel system.
 - 1. Sub-girts, Zee Clips, Base or Sill Angles or Channels: Manufacturers standard C, U or Z-shaped sections, type as recommended by panel manufacturer.
 - a. Metallic Coated Steel Sheet: ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation.
 - 1) Thickness: Not less than 0.063 inch, 16 gauge nominal thickness.
 - b. Aluminum Sheet: Clear anodized sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1) Thickness: Not less than 0.051 inch, 16 gage nominal thickness.
 - c. Aluminum Extrusions: ASTM B 221 / B 221M, alloy and temper recommended by panel manufacturer for type of use and finish indicated.
- B. Composite Metal Hybrid Subframing System: Subframing system consisting of fire-retardant polyester resin girts reinforced with integral continuous metal inserts and fasteners designed to integrate cavity insulation and eliminate thermal bridging of subframing and fasteners.
 - 1. Basis of Design: Advanced Architectural Products; SMARTci System GreenGirt CMH Sub-Framing, Z-Girt size as required for insulation thickness indicated.
- C. Fasteners for Sub-framing and Furring: Self-tapping screws, bolts, nuts, and other suitable fasteners, Series 300 stainless steel of size, corrosion resistance, holding power, and other properties required to comply with performance requirements.

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1. Provide fasteners with EPDM or PVC sealing washers.
- D. Panel System Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- E. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.
 1. Aluminum Panels: Use aluminum or stainless-steel fasteners.
 2. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
 3. Steel, Titanium, or Zinc Panels: Use stainless steel fasteners.
 4. Provide exposed fasteners with heads matching the color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- G. Panel Sealants: ASTM C920; silicone sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended in writing by panel manufacturer.
 1. Refer to Division 07 Section Joint Sealants.
- H. Self-Adhering, High-Temperature Rubberized Asphalt Flashing: Minimum 30 mils to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (°).
 3. Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. GCP Applied Technologies; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- I. Barrier Flashing Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape. Refer to Division 07 Section Air and Water Barriers.
- J. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.

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2.8 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Shop-fabricate metal panel systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of metal panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.
 - 1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F. Allow for ambient temperature range at time of fabrication.
 - a. Curve components radii indicated on Drawings.
 - 2. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 3. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 - 4. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels.
 - 5. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.
 - a. Width: Plus or minus 0.079 inch @ 70°F (21°C).
 - b. Length: Plus or minus 0.079 inch @ 70°F (21°C).
 - c. Squareness: Plus or minus 0.079 inch @ 70°F (21°C).
 - 6. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal panel manufacturer.

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- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application but not less than thickness of metal being secured.

2.9 FINISHES, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.
- C. Finish Selections: As scheduled or indicated in Design Selections.

2.10 ALUMINUM FINISHES

- A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.
- B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Subframing and Supports: Install subframing, subgirts, base angles, closure channels, sills, furring, and other miscellaneous panel support members and anchorages according to metal panel manufacturer's written recommendations.

3.4 INSTALLATION OF METAL PANEL SYSTEM

- A. General: Install metal panel system in accordance with system manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panel system securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panel system.
 - 2. Flash and seal metal panel system at perimeter of all openings. Fasten with self-tapping screws.
 - a. Do not begin installation until the weather barrier and flashings that will be concealed by metal wall panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - a. Air and Water Barrier: Install a strip of barrier flashing tape behind through-wall attachments that penetrate air and water barrier. Seal all penetrations with weather barrier sealant.
 - 4. Install flashing and trim as metal panel system work proceeds.
 - 5. Provide weathertight escutcheons for all items penetrating system.
 - 6. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel system manufacturer.

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7. Attach metal panels to supports at locations, spacings, and with fasteners recommended by manufacturer to meet listed performance requirements.
- B. Attachment Assembly, General: Install attachment assembly required to support metal composite material panels and to provide a complete weathertight system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 1. Install subframing, furring, and other panel support members and anchorages.
 2. Install support system at locations, at spacings, and with fasteners recommended by metal panel system manufacturer to meet listed performance requirements.
 - a. Fasteners: Use stainless-steel fasteners.
- C. Install panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
- D. Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install accessory components required for a complete metal panel system assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel system manufacturer.
- E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in weathertight and weather-resistant performance.
 - a. Install escutcheons for pipe and conduit penetrating exterior walls.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft with no joints allowed within 24 in of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and weathertight, form expansion joints of intermeshing hooked flanges, not less than 1 in deep, filled with mastic sealant (concealed within joints).

3.5 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 in per 20 ft, non-accumulative, on level, plumb, and location lines as indicated and within 1/8 in offset of adjoining faces and of alignment of matching profiles.

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3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics
 - 2. Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
- C. Metal panels will be considered defective if they do not pass test and inspections.
- D. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 074263

INSULATED-CORE METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Factory-formed insulated-core metal wall panels and supplementary items necessary for installation.

1.2 DEFINITIONS

- A. Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

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1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:
1. Show fabrication and installation layouts of metal wall panels.
 2. Show details of edge conditions, side-seam and end-lap joints, panel profiles, corners, anchorages, trim, flashings, closures, and terminations.
 3. Show details for securing metal wall panel assembly, including layout of fasteners and other attachments.
 4. Show details of wall panel penetrations.
 5. Show details of connections to adjoining work.
 6. Indicate where and how the system deviates from Contract Documents.
 7. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
 8. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
 9. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
 10. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- C. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
1. Wall panel assembly and attachments.
 2. Girts and framing.
 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 4. Penetrations of wall panels by pipes and utilities.
- D. Samples for Verification Purposes: For each type of exposed finish required, prepared on samples of size indicated below.
1. Metal Wall Panels: 12 in long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 2. Trim and Closures: 12 in long. Include fasteners and other exposed accessories.
 3. Accessories: 12 in long samples for each type of accessory.
 4. Exposed Gaskets: 12 in long.
 5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2 in wide joints formed between two 6 in long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

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1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- E. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.11 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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1.12 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed panels.
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
- C. Factory Applied Finish Warranty for High-Performance Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. CENTRIA Architectural Systems
 2. Industrial Building Panels (IBP)
 3. Metl-Span, an NCI Building System Company.

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- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.
- B. Design Loads: Engineer to withstand design loads including, but not limited to, gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable local building codes and as indicated.
 - 1. Structural Movement: Engineer to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.
- C. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- D. Structural-Test Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 or ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection no greater than 1/240 of the span.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of the clear span.
- E. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sf of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sf.
- F. Water Penetration under Static Pressure: No evidence of water penetration through fixed panels and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf.
- G. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed panels and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf.

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- H. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- I. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 METAL WALL PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755 / A 755M.
 - 1. Provide one of the following:
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, G90 coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792 / A 792M, Class AZ50 coating designation, Grade 40; structural quality.
 - 2. Surface: Smooth and flat.
 - 3. Exposed Coil-Coated Finish: Fluoropolymer finish as specified elsewhere in this Section.
 - 4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mils.
- B. Foam Insulation: Closed cell, modified isocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place type, with maximum flame-spread index of 25 and smoke-developed index of 450.
 - 1. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.

2.5 INSULATED-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core factory-foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - 1. Panel Performance:
 - a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297.
 - b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
 - c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F according to ASTM D 2126.

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- d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F according to ASTM D 2126.
- e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sf positive and negative wind load and with deflection of L/180 for 2 million cycles.
- f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
- g. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1) Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
 - 2) Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
 - 3) Radiant Heat Exposure: No ignition when tested according to NFPA 268.
 - 4) Potential Heat: Acceptable level when tested according to NFPA 259.
 - 5) Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
 - 6) Label: Affix on the back of each panel a label identifying the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or materials' performance characteristics and approved agency's identification.

2. Foam Insulation-Core Performance:

- a. Density: 2.0 to 2.6 lb/cf when tested according to ASTM D 1622.
- b. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
- c. Shear Strength: 26 psi when tested according to ASTM C 273.

B. Concealed-Fastener Insulated-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

- 1. Basis of Design: Provide insulated-core metal wall panels that does not require a thermal barrier; such requirement to be supported by complying with and passing testing requirements of NFPA 286, FM 4880 (tested for height appropriate for this project), and either UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use.
- 2. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
- 3. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.86 mm) nominal minimum thickness.
- 4. Panel Thickness: 2 in (50 mm).

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a. Thermal-Resistance Value (R-Value): 14.

C. Panel Coverage: As indicated on drawings.

2.6 METAL SOFFIT PANELS

- A. Insulated-Core Metal Soffit Panels: Insulated-core metal wall panel manufacturer's standard panel for horizontal conditions; meeting same requirements as that for specified vertical panels.
- B. Formed Metal Soffit Panels: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
 - 1. Flush-Profile, Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and flat panel between panel edges; with flush joint between panels.
 - a. Basis of Design: CENTRIA; IW 10A
 - b. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in nominal minimum thickness.
 - c. Panel Coverage: 12 in.
 - d. Panel Height: 1-1/2 in.

2.7 METAL WALL PANEL ASSEMBLY ACCESSORIES

- A. General: Provide components approved by metal wall panel manufacturer and as required for a complete assembly including trim, corner units, closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
 - 1. Closures: Provide closures fabricated of same metal as metal wall panels.
 - 2. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1 in thick, flexible closure strips; cut or pre-molded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - 3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Formed Flashing and Trim: Match material, thickness, and color of metal wall panel face sheets.
- C. Extrusion Trim: Provide manufacturer-provided extruded trim for the following locations and as indicated on Drawings:
 - 1. Base trim.
 - 2. Coping.
 - 3. Panel installation perimeter.
 - 4. Opening perimeters.
- D. Panel Sealants: Provide the following as recommended by metal wall panel assembly manufacturer for installation indicated.

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1. Flashing Tape: 4-inch wide self-adhering butyl flashing tape.
 2. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 in wide and 1/8 in thick.
 3. Elastomeric Joint Sealant: ASTM C 920; elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal exposed joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 4. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for concealed hooked-type expansion joints with limited movement.
- E. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads as appropriate for metal wall panel material. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 / A 153M, ASTM F 2329, or Series 300 stainless steel.
- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, or cold-applied asphalt emulsion complying with ASTM D 1187; compounded for 15 mils dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Self-Adhering, High-Temperature Rubberized Asphalt Flashing: Minimum 30 mils to 40 mils ()thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F ().
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F ().
 3. Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
- H. Barrier Flashing Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape. Refer to Division 07 Section Air and Water Barriers.
- I. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity provided by waterproofing manufacturer.

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2.8 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653 / A 653M, G90 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.053 in (16 gage) nominal thickness.
- C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.9 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

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2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

2.11 STEEL FINISHES

- A. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 621 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 621 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.
 - 3. Selections: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - 3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.4 WALL PANEL ASSEMBLY INSTALLATION

- A. General: Install metal wall panels and accessories according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings.
- B. Wall Panels: Install wall panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal wall panels.
 - 2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - a. Air and Water Barrier Sheet Good Substrate: Install a strip of barrier flashing tape behind through-wall attachments that penetrate air and water barrier.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal wall panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - 8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 9. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

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10. Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
 11. Install concealed clips to supports with self-tapping fasteners.
 12. Fasten insulated-core metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels as recommended by manufacturer.
 13. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 14. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 15. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 16. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 17. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
- C. Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
- D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

3.5 METAL SOFFIT PANEL INSTALLATION

- A. In addition to complying with requirements in "Wall Panel Assembly Installation" Article, install metal soffit panels to comply with requirements in this article.
- B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

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3.6 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in weathertight and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft with no joints allowed within 24 in of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and weathertight, form expansion joints of intermeshing hooked flanges, not less than 1 in deep, filled with mastic sealant (concealed within joints).

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 in per 20 ft, non-accumulative, on level, plumb, and location lines as indicated and within 1/8 in offset of adjoining faces and of alignment of matching profiles.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Owner's Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Before installation of interior finishes, wall panel system shall be tested in accordance with Division 01 Section "Field Test for Water Leakage".

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- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 4616

ALUMINUM SIDING AND SOFFITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Soffits.
- B. Aluminum Thermally Broken Backframing System.
- C. Aluminum trim and accessories.
- D. Aluminum tubing

1.2 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
- B. Movement: Accommodate movement within system without damage to components or movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- C. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 2 inches (51 mm) by 3-1/2 inches (89 mm), representing actual product,

color, and gloss.

- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of components.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five years experience producing aluminum finishes of the types specified and AkzoNobel, AAMA 2605 and 2605 Certified.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and gloss are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package and store products under cover in manufacturer's unopened packaging until ready for transport and installation.
- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials capable of causing discoloration or staining.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not fabricate products under environmental conditions outside manufacturer's absolute limits.

1.7 COORDINATION

- A. Coordinate Work with installation of windows, louvers, and adjacent components or materials.

1.8 WARRANTY

- A. Mayne Coatings Corp. limited warranty against cracking, peeling and gloss/color retention within the guidelines stated by the American Aluminum Manufactures Association (AAMA).
 - 1. Standard Colors:
 - a. D2000 - AAMA 2604 (5 Year Florida) 15 Year manufacturer's Warranty
 - b. D3000 - AAMA 2605 (10 Year Florida) 20 Year manufacturer's Warranty
 - 2. Woodgrains
 - a. AAMA 2604 (5 Year Florida) 15 Year manufacture's

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.
- B. Manufacturer: Mayne Coatings Corp., which is located at: 27575-50th Ave. ; Langley, BC; Canada

2.2 MATERIALS

- A. Extruded Aluminum Siding and Soffits: Longboard Wood Grain Aluminum Siding and Soffits with Alluminate bonded film finish is extruded aluminum with integrated venting system.
 - 1. Size:
 - a. Width:
 - 1) 6 inch V Groove Siding and Soffit.
 - b. Available Lengths:
 - 1) 12 feet.
 - 2) 24 feet.
- B. Accessories: Prefinished aluminum: Provide with matching accessories and starter strips as required.
 - 1. J Track.
 - 2. J Track Non-Tempered.
 - 3. Craftsman Single J Trim.

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4. Craftsman Double J Trim.
 5. Wide Starter Strip.
 6. U Cap (pc 1 of 2) used with mill finish 102001 Base.
 7. Flat Cap (pc 1 of 2) used with mill finish 102001 Base.
 8. Inside Corner.
 9. Outside Corner.
 10. Closer Trim (pc 1 of 2) used with mill finish 102312 Closer Base.
 11. Craftsman Closer Trim (pc 1 of 2) used with mill finish 102312 Closer Base.
 12. Base (pc 2 of 2) used with Profile 102002 and 102315.
 13. Closer Base (pc 2 of 2) used with Profile 102313 and 102314.
 14. Rain Screen.
- C. Thermally Broken Backframing system: Provide clip sizes and girt lengths required.
1. Thermally Broken Clip for external insulation:
 - a. 2 inch Clip System.
 - b. 3 inch Clip System.
 - c. 4 inch Clip System.
 - d. 5 inch Clip System.
 - e. 6 inch Clip System.
 2. Girts: Extruded aluminum:
 - a. 12 foot Standard Length.

2.3 FINISHES

- A. Pretreatment: E-CLPS Chrome Free five stage aluminum pretreatment system. Complies with AAMA 2603 AAMA 2604 and AAMA 2605 Superior Performance Standard and meets EPA, OSHA, State and Local environmental requirements and contains no chromates, cyanides or other heavy metals. Waste treatment is usually a simple pH neutralization and disposal to the sanitary sewer.
- B. Super Durable Powder Coatings: Alluminate Premium Wood Finishes use a polyurethane powder coat with ink based wood grain patterns sublimated into the base powder effectively tattooing the powder. The combined effect creates all the aesthetic aspects of real wood while offering the same environmental advantages of powder coated finishes.
1. Wood Grained
 - a. As selected by Architect.
- A. Prepare surfaces, pre-treat and coat components in accordance with AAMA 2604 and 2605 Quality Standards and applicable European standards for the coating material specified.
- B. Wrap and package coated components using methods suitable for transit and covered site storage without damage.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until colors have been verified.
- B. Verify framing members are ready to receive panel system.
- C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the material under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Barrier Protection: Do not install over cementitious materials, dissimilar metals or pressure treated material without adequate barrier protection.
 - 1. Install building paper horizontally on walls to receive metal siding.
 - 2. Weather lap edges 6 inches (150 mm) and ends minimum 6 inches (150 mm).
 - 3. Stagger vertical joints of each layer.
 - 4. Securely staple, nail in place.
- C. Fasten siding to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Install expansion control joints where indicated.
- F. Use concealed fasteners unless otherwise approved by Architect.
- G. Install soffits, and accessories in accordance with best practice, with all joint members plumb and true.

3.4 FIELD QUALITY CONTROL

- A. After installation of soffits, check entire surface for obvious flaws or defects.
- B. Replace and repair any problem areas, paying close attention to the substrate for causes of the problem.

3.5 CLEANING

- A. After application of soffits, clean as necessary to remove all fingerprints and

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soiled areas.

- B. Upon completion of soffit application, clean entire area, removing all scrap, packaging, and unused materials related to this work.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 075013

SINGLE-PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Single-ply membrane roofing system and supplementary items necessary for installation.
 - 1. Adhered thermoplastic polyolefin (TPO) roofing system.
- B. Related Requirements:
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 ALLOWANCES

- A. Allowance for Concrete Moisture Barrier/Vapor Retarder: Include allowance to provide Roofing Manufacturer's recommended concrete moisture barrier/vapor retarder for concrete substrates that do not comply with Roofing Manufacturer's concrete moisture content and testing requirements.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- B. Roof Edge Regions: Definitions from ANSI/SPRI ED-1 shall be applicable to this project.
- C. TPO: Thermoplastic polyolefin.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - a. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

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- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
1. Show base flashings and membrane terminations.
 2. Show layout and thickness of flat insulation.
 3. Show layout and thickness of tapered insulation, including slopes.
 4. Show crickets and saddles, including slopes.
 5. Show roof plan indicating orientation of membrane roofing and fastener spacing.
 6. Show insulation and cover board fastening or adhesive patterns for corner, perimeter, and field-of-roof locations.
 7. Show cold-applied adhesive pattern for insulation and cover board installation; typical pattern of a 100 square foot area.
 8. Include project specific details for typical and non-typical conditions.
- C. Samples for Verification Purposes: For the following products:
1. Roofing membrane, 12 in by 12 in square, of color specified, including side and end lap seam.
 2. Flashing sheets.
 3. Vapor retarder, 12 in by 12 in square.
 4. Roof insulation and cover board.
 5. Termination bars.
 6. Fasteners of each type, length, and finish.
 7. Walkways, of color required.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.
1. Decorative Stone or Pavers: Comply with applicable provisions of ANSI-SPRI RP-4.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with Performance Requirements.
 - a. Submit evidence of compliance with performance requirements.
 2. Roofing manufacturer shall review and approve Shop Drawings in writing prior to submission.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Concrete Roof Deck - Moisture Content Measurement: Submit recorded readings when requested.
1. Submit moisture content readings to roofing manufacturer.

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- D. Substrate Surface Temperature Readings at Cold Fluid-Applied Insulation Adhesive: Submit recorded readings when requested.

1. Submit surface temperature readings to roofing manufacturer.

- E. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed or acceptable to manufacturer to install products.

- B. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.

- C. Quality Standards:

1. Unless otherwise recommended by roofing manufacturer, provide roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
2. Comply with FMG System Loss Prevention Data Sheets 1-28 and 1-28S for design wind loads and wind uplift pressures on roofs for Windstorm Resistance Classification indicated.
3. Comply with FMG System Loss Prevention Data Sheet 1-29 for roof deck securement and above deck components for Windstorm Resistance Classification indicated.
4. Comply with FMG System Loss Prevention Data Sheet 1-49 for perimeter flashing for Windstorm Resistance Classification indicated.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Participants:

- a. Architect.
- b. Contractor, including superintendent.

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- c. Installer, including project manager and supervisor (superintendent).
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 - g. Review deck substrate requirements for conditions and finishes, including flatness, presence of moisture, and fastening.
 - h. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - i. Review governing regulations and requirements for insurance and certificates if applicable.
 - j. Review temporary protection requirements for roofing during and after installation.
 - k. Review roof observation and repair procedures after roofing installation.
3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored material from direct sunlight.
 - 1. Discard and legally dispose of material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

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1.11 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.12 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written "Total Roofing System" warranty signed by an authorized representative using manufacturer's standard form, without monetary limitation (NDL), agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty Wind Speed: Minimum 90-mph Peak Gust Wind Speed.
 - 2. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover board, substrate board, roofing accessories and other components of roofing system.
 - 3. Warranty includes roof edge flashings integral with roofing system as specified in Division 07 Section Sheet Metal Flashing and Trim.
 - 4. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 20 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover boards, substrate board, roofing accessories, and other components of roofing system.
 - 2. Warranty includes roof edge flashings integral with roofing system as specified in Division 07 Section Sheet Metal Flashing and Trim.
 - 3. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.
1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Provide roofing system materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897. Contractor shall obtain required design data and identify requirements accommodated on submittal drawings.
- D. FM Approvals' Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification - Roof Corner and Perimeter Region: Class 1A-150.
 2. Fire/Windstorm Classification - Field of Roof: Class 1A-90.
- E. SPRI Wind Design Standard for Edge Systems: Provide edge systems tested in accordance with ANSI/SPRI/FM 4435/ES-1 Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems and capable of resisting design pressures.
- F. Fire-Test-Response Characteristics: Provide roofing system materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: ASTM E 108, Class A, for application and roof slopes indicated.

2.4 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Membrane Roofing System: ASTM D 6878, internally fabric or scrim reinforced membrane.

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1. Manufacturers and Products:
 - a. Basis of Design: Sika; Adhered System
 - b. Carlisle SynTec Inc.; Sure-Weld TPO.
 - c. Firestone Building Products Co.; UltraPly TPO.
 - d. Johns Manville, Inc.; JM TPO-60 mil.
2. Membrane Thickness: 60 mils , nominal.
3. Exposed Face Color: As selected by Architect from manufacturer's standard colors.

2.5 PROTECTION MEMBRANE AT DECORATIVE PAVER OR DECORATIVE STONE ASSEMBLY

- A. TPO Protection Membrane: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet, 45 mils minimum thickness.

2.6 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Membrane Flashing: Manufacturer's standard sheet flashing membrane, of recommended thickness and compatible with roofing membrane, of same color as roofing membrane, and appropriate for Project roofing application.
- C. Clad Sheet Metal Flashing: Manufacturer's standard clad stainless steel flashing, minimum 24 gauge, of same color as roofing membrane
- D. Pipe / Stack Flashing: Pre-molded flexible membrane pipe collar with aluminum ring bonded to base as recommended by roofing system manufacturer.
- E. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- F. Roof Flashing Adhesive: Manufacturer's standard elastomeric contact adhesive for flashing details.
- G. Fluid Applied, Reinforced Liquid Flashing: Manufacturer's standard two-component polymethyl-methacrylate-based liquid flashing.
 1. Basis of Design: Sika Sarnafil Inc.; Liquid Flashing.
- H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- I. Metal Termination Bars: ASTM A 666, Type 304 formed stainless steel or extruded alloy 6063 aluminum bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in thick; predrilled at 8 in centers; with corrosive resistant fasteners. No plastic bars allowed.

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- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
 - 1. All fasteners, anchors, nails, straps, bars and other concrete or wood fasteners shall be stainless steel.
- K. Roof Anchor System: Manufacturer's standard stainless steel connectors for roof mounted components. Contractor shall provide engineering for anchor quantity, locations and attachment to building structure as required to comply with performance requirements.
 - 1. Basis of Design: Sika Sarnafil Inc.; SikaRoof Anchor System.
- L. Miscellaneous Accessories: Preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- M. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
- N. Sealant Pockets (aka Pitch Pans) at Roof Penetrations: Sealant pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to drawings for allowable penetration details.
- O. Roof Stenciling: Paint shall be manufacturer's standard non-skid deck paint. Application shall be according to paint manufacturer's written directions. Provide abrasive additive to maintain the deck's non-skid surface.

2.7 CONCRETE MOISTURE BARRIER / VAPOR RETARDER

- A. Concrete Moisture Barrier/Vapor Retarder: Products and systems formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates prior to installation of roofing materials. Concrete moisture barrier shall be recommended and approved in writing by roofing system manufacturer.

2.8 SUBSTRATE BOARDS FOR VAPOR RETARDER

- A. Substrate Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
 - 1. Manufacturers and Products:
 - a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
 - b. USG; SECUROCK Gypsum-Fiber Roof Board.
 - 2. Thickness: Minimum 1/2 in

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2.9 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Minimum 40-mil- (1.0-mm-) composite consisting of self-adhering rubberized asphalt and laminated film backing, maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m). Provide primer when recommended by vapor retarder manufacturer.
 - 1. Basis of Design: Carlisle Syntec Systems; VapAir Seal 725 TR Air and Vapor Barrier/Temporary Roof.

2.10 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer. Comply with requirements of referenced standards, selected from manufacturer's standard sizes and of thicknesses. Provide accessories recommended by insulation manufacturer for intended use and compatible with roofing membrane.
 - 1. Provide insulation thickness required to maintain minimum aged R-value as indicated on the Drawings.
 - 2. Insulation board thickness of individual insulation layers to be 2.6 in maximum.
 - 3. Insulation board size to be 4 ft by 4 ft maximum.
 - 4. Provide factory, tapered insulation boards where indicated for sloping to drains. Fabricate with 1/4 in per 12 in (1:48) taper, unless otherwise indicated.
 - 5. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 2, coated polymer bonded glass-fiber mat facers on both major surfaces.
 - 1. Compressive Strength: 20 psi (138 kPa).

2.11 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Cold Fluid-Applied Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Bead-applied, low-rise, two-component urethane adhesive.
 - a. Basis of Design (Product Standard): OMG Inc.; Olybond 500.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.12 FLEXIBLE WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 in thick, as recommended by roofing system manufacturer.

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1. Size: Approximately 36 by 60 inches (914 by 1524 mm).
2. Color: As selected by Architect.

2.13 DECORATIVE PAVERS

- A. Decorative Pavers and Pedestals: Refer to Division 07 Section Roof Paver and Pedestal Assemblies.
- B. Protection Membrane: As indicated in "Protection Membranes" above; type and weight as recommended by roofing system manufacturer for application.

2.14 FLASHING AND SHEET METAL

- A. Flashing and Sheet Metal: Refer to Division 07 Section Sheet Metal Flashing and Trim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions, including concrete moisture content, have been corrected in a manner complying with roofing manufacturer recommendations and Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thickness of insulation.
 3. Cast-in-Place Concrete or Composite Metal Deck Substrates:
 - a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - b. Concrete Moisture Testing: Perform one or both of the following tests as recommended by roofing manufacturer. Proceed with installation only after concrete substrates pass testing.
 - 1) Concrete Internal Relative Humidity: Not more than 75 percent, or as recommended by NRCA and roofing system manufacturer, when tested according to ASTM F2170.
 - a) Test Frequency: Perform three test probes for the first 1000 sq. ft. (93 sq. m) and one test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.
 - b) Submit test reports within 24 hours of performing tests.
 - 2) Manufacturer Concrete Moisture Test: Roofing manufacturer standard moisture test with measurements or results acceptable to roofing manufacturer.

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- c. Concrete Moisture Barrier/Vapor Retarder: For concrete substrates not meeting moisture test standards specified above, install concrete moisture barrier/vapor retarder to concrete substrate in accordance with manufacturer's written instructions.
 - d. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Substrate Surface Temperature at Cold Fluid-Applied Insulation Adhesive: Confirm that concrete substrate or substrate board surface temperature is a minimum 50 deg F prior to application of adhesive.

3.2 INSTALLATION OF ROOFING, GENERAL

- A. General: Comply with recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency, if applicable.
 - 1. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- C. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified in other sections.
- E. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.4 INSTALLATION OF SUBSTRATE BOARDS

- A. Fasten substrate boards to top flanges of steel deck according to recommendations in FMG Approvals' RoofNav and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
- B. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches (610 mm) in adjacent rows.
 - 1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
 - 2. Tightly butt substrate boards together.
 - 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Vapor Retarder: Install according to roofing system manufacturer's written instructions.
- B. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Continuously seal side and end laps with tape.
- C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into single-ply roofing.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

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- B. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 in or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer
- C. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
 - 1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.
 - a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - c. Trim insulation so that water flow is unrestricted.
 - d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. Trim insulation so that water flow is unrestricted. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 - 1) Install tapered insulation under area of roofing to conform to slopes indicated.
 - e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - g. Adhere each layer of insulation to substrate using the following adhesive setting methods in accordance with manufacturer recommendations and performance requirements.
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- D. Installation Over Cast-In-Place Concrete or Composite Metal and Concrete Decks:
 - 1. Adhere base layer of insulation to concrete roof deck in accordance with manufacturer recommendations and performance requirements.
 - 2. Adhere upper layers of insulation in accordance with manufacturer recommendations and performance requirements.

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3.7 INSTALLATION OF COVER BOARDS

- A. Install roof cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 in in each direction. Loosely butt roof cover boards together.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to insulation using the following adhesive setting methods in accordance with manufacturer recommendations and performance requirements.
 - a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - b. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 - 5. Score boards, if necessary, to conform to substrate irregularities. Comply with manufacturer's installation recommendations to insure proper adhesion and adhesive set.

3.8 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations and perimeter of roofing.
- F. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

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- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.9 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Seams: Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Heat weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.10 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 - 1. Provide 6-inch (76-mm) clearance between adjoining pads.
 - 2. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- B. Walkway Locations: Locations as indicated on Drawings and as follows:
 - 1. Perimeter of each rooftop unit.
 - 2. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - 3. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - 4. Top and bottom of each roof access ladder.
 - 5. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - 6. As required by roof membrane manufacturer's warranty requirements.

3.11 PROTECTION MEMBRANE INSTALLATION AT DECORATIVE STONE AND DECORATIVE PAVER OVERBURDEN ASSEMBLY

- A. Loose-Laid Protection Membrane:
 - 1. Loose-lay protection membrane over roofing membrane in accordance with manufacturer's recommendation.
 - 2. Do not apply bonding adhesive to splice area of protection membrane.
 - 3. Roll protection membrane in place in accordance with manufacturer's recommendations.
 - 4. Adhere protection membrane at edges and other locations in accordance with manufacturer's recommended locations and adhesive.

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- B. Clean seam areas, overlap protection membrane, and hot-air weld side and end laps of protection membrane according to manufacturer's written instructions.
- C. Decorative Pavers and Pedestals: Refer to Division 07 Section Roof Paver and Pedestal Assemblies.

3.12 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Cold Fluid-Applied Insulation Adhesive Manufacturer's Inspection: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Test Cuts: The cold fluid-applied insulation adhesive manufacturer shall perform field quality control test cuts of the cold fluid-applied insulation adhesive installation.
- C. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control, including infrared inspections on installed roof assemblies. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C1153.
 - a. Perform tests before overlying construction is placed.
 - b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
 - c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.
 - 2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

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- E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- F. Roofing system will be considered defective if it does not pass tests and inspections.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 REPAIR, CLEANING, AND PROTECTION

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Flashing and sheet metal including but not limited to the assemblies listed below along with supplementary items necessary for installation:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed roof-drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.
 - 4. Formed wall and embedded flashing.
 - 5. Formed equipment support flashing.
 - 6. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
 - 2. Refer to Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 3. Refer to Division 7 Section for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 4. Refer to Division 7 Section "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.2 DELEGATED ENGINEERING REQUIREMENTS FOR COPINGS AND ROOF EDGE FLASHINGS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:

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1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
 2. Include underlayment materials and sealants.
- B. Shop Drawings: For sheet metal flashing and trim.
 1. Include plans, elevations, sections, and attachment details.
 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Embedded Flashing: Large-scale details for each element of flashing system showing layout, profiles, methods of joining, and anchorage details; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials, and other special applications.
 8. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 9. Include details of roof-penetration flashing.
 10. Include details of special conditions.
 11. Include details of connections to adjoining work.
 - a. Include isometric details of saddles, end dams, and other complex flashing conditions.
- C. Samples for Verification Purposes: Submit for items listed below; provide samples made from 12 in lengths of full-size components including fasteners, cover joints, accessories, and attachments.
 1. Sheet Metal Flashing: 12 in long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

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2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 in long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 1. Provide sealant and underlayment manufacturers certification that their products are compatible with each other, including adhesion.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
- C. Delegated Engineering Calculations: Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
 1. Submit FM Approvals Listing in "RoofNav" for approved for windstorm classification. Identify materials with name of fabricator and design approved by FM Approvals.
- E. Warranty:
 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Manufacturer/shop-fabricator with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
 1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be NRCA listed or shall provide other evidence acceptable to Architect as able to fabricate required details as tested and approved.
- B. Installer Qualifications:

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1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
- C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing materials and fabrications away from uncured concrete and masonry.
- D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit flashing and sheet metal work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- C. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

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1.11 WARRANTY

- A. **Installer's Warranty:** Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to repair or replace components of all sheet metal flashing assemblies that exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
1. **Warranty Period:** 2 years from date of Substantial Completion.
- B. **Factory Applied Finish Warranty:** Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
1. **Coverage includes but is not limited to the following:**
- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. **Warranty Period:** Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. **Available Manufacturers and Products:** Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
1. **Manufacturers:**
- a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. OMG Edge Systems.
 - d. Keystone Flashing Company, Inc.
 - e. Petersen Aluminum Corporation.

2.2 MATERIALS, GENERAL

- A. **Single Source Responsibility:** Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. **General Performance:** Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

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1. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure.
 2. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Material Compatibility: Provide flashing and sheet metal materials that are compatible with one another and specified roofing system under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.
- C. Structural Loads: Installed sheet metal flashing materials and fabrications shall withstand loads within limits of allowable working stresses of the materials involved under conditions indicated, including but not limited to, requirements established by authorities having jurisdiction and applicable building codes.
1. Wind Loads: As indicated on Drawings.
 2. Other Loads: As indicated on Drawings.
- D. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- E. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
1. Design Pressure: Refer to Structural Loads.
- F. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification. Identify materials with name of fabricator and design approved by FM Approvals.
1. Class: Match FM Approvals classification for roofing system.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.4 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
1. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

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- a. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
- b. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.
- 2. Color: As scheduled or as indicated in Design Selections.
- 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 , dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).

2.5 UNDERLAYMENT MATERIALS

- A. Material Compatibility: Provide underlayment materials that are compatible with substrates and specified roofing system under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.
- B. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
 - 3. SBS-Modified Asphalt Adhesive based Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
 - b. GCP Applied Technologies; Ice and Water Shield HT.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
 - 4. Butyl Adhesive based Manufacturers and Products:
 - a. GCP Applied Technologies; Ultra.
 - 5. Primer: Provided by underlayment manufacturer.
 - 6. Underlayment Sealing Tape: Provided by underlayment manufacturer.
 - 7. Sealant: Approved by underlayment manufacturer, compatible with both adhesive and facer of underlayment material.
- C. Slip Sheet: If recommended by manufacturer to separate sheet metal from underlayment; rosin-sized building paper, 3 lb/100 sq. ft. minimum.

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2.6 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, stainless steel draw bands, solid shims and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Manufacturer's recommended wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed neoprene sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Rubberized-Asphalt Flexible Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 in.
 - 1. Manufacturers and Products:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - c. GCP Applied Technologies; Perm-A-Barrier Wall Flashing.
 - d. Heckmann Building Products, Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - e. Hohmann & Barnard, Inc.; Textroflash.
 - f. W.R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
 - g. Polyguard Products, Inc.; Polyguard 400.
 - 2. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- E. Self-Adhering Metal Sheet Membrane Flexible Flashing: Composite flashing product consisting of flexible 2 mil Type 304 or Type 316 stainless steel sheet, butyl adhesive, interlayer, and siliconized release liner.
 - 1. Manufacturers and Products:
 - a. York Flashing; Self-Adhering Stainless Steel 304 SA or 316 SA.
 - b. GE Silicone, Inc.; Elemex SS Flashing.
 - c. VaproShield, Inc.; Vapro-SS Flashing SA.

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2. Accessories: Provide sealants and seaming materials produced by flashing manufacturer.
- F. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 in wide and 1/8 in thick.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- H. Sealant for Use at Concealed Joints: Sealant shall be compatible with underlayment materials at interfaces. Contractor's option, one of the following:
 1. Butyl: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
 2. Silicone: ASTM C 920, single-component, neutral cure silicone sealant.
 - a. Basis of Design: Dow Corning; 758 Silicone Weather Barrier Sealant.
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, or cold-applied asphalt emulsion complying with ASTM D 1187; compounded for 15 mils dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.7 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 3. Obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
 6. Provide one-piece, watertight saddles at corners, ends and transitions between flashing profiles. Saddles shall have 4-inch flanges and seams shall be mechanically fastened. Uncoated metals shall be fully soldered watertight.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 in in 20 ft on slope and location lines indicated on Drawings and within 1/8 in offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 ft with no joints within 24 in of corner or intersection.

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- D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Soldered Seams - Unfinished or Concealed/Embedded Metals: Fabricate nonmoving seams with flat-lock seams except at corners. Rivet soldered joints for strength and solder over rivets. Solder shall flow through and fill the joint.
 - 1. Corners: Shop fabricate, factory mitered corners with continuously welded or soldered seams. Fabricate corners with no joints within 24 in of corner or intersection.
- H. Sealant Seams - Prefinished Metals: Fabricate nonmoving seams with flat-lock seams except at corners. Form seams and seal with elastomeric sealant. Rivet joints where necessary for strength.
 - 1. Corners: Shop fabricate, factory mitered corners. Form seams and seal with elastomeric sealant. Fabricate corners with no joints within 24 in of corner or intersection.
- I. Copings 12 Inches Wide or Less: Form butted joints with expansion space and 12 in wide, concealed backup plate with double sealant on each side of joint.
- J. Copings Over 12 Inches Wide: Form joints of intermeshing hooked flanges, not less than 1 in deep, filled with sealant concealed within joints.
- K. Do not use graphite pencils to mark metal surfaces.

2.8 SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
 - 1. Fabricate from the Following Materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - a. Aluminum, Prefinished: 0.032 in thick.
 - 2. Corners: Factory mitered, mechanically clinched and sealed or soldered watertight.
 - 3. Joints: Lapped 4-inches, double seal with sealant.
 - 4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - 6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 - 7. Accessories:

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- a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
8. Finish: With manufacturer's standard color coating, unless indicated otherwise.

2.9 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96 in long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
1. Gutter Profile: As indicated on Drawings, according to cited sheet metal standard.
 2. Accessories: Wire-ball downspout strainer, Valley baffles.
 3. Gutters with Girth up to 15 in: Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - a. Aluminum, Prefinished: 0.032 in thick.
 4. Gutters with Girth 16 to 20 In: Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements:
 - a. Aluminum, Prefinished: 0.040 in thick.
 5. Corners: Factory mitered, mechanically clinched and sealed or soldered watertight.
 6. Joints: Lapped 4-inches in direction of water flow, double seal with sealant.
- B. Built-in Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96 in long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
1. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
 2. Accessories: Wire-ball downspout strainer.
 3. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - a. Stainless Steel: 0.025 in thick.
 4. Corners and Joints: Factory mitered, solder or weld watertight.
- C. Downspouts: Fabricate rectangular, unless indicated otherwise, downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows. Size as recommended by SMACNA.
1. Hanger Style: As indicated, according to SMACNA's "Architectural Sheet Metal Manual."
 2. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

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- a. Aluminum, Prefinished: 0.024 inch thick.
- D. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4 in wide wall flanges to interior, and base extending 4 in beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - 1. Stainless Steel: 0.025 in thick.
 - 2. Corners and Joints: Factory mitered, solder or weld watertight.
- E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - 1. Aluminum, Prefinished: 0.032 in thick.
 - 2. Corners and Joints: Factory mitered, solder or weld watertight.
- F. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
 - 1. Stainless Steel: 0.025 in thick.
 - 2. Aluminum: 0.040 in thick.
 - 3. Corners and Joints: Factory mitered, solder or weld watertight.

2.10 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96 in long, but not exceeding 12 ft long sections.
 - 1. Profile: As indicated on Drawings, according to SMACNA's "Architectural Sheet Metal Manual."
 - 2. Fabricate to dimensions required with 4 in wide flanges and base extending 4 in beyond cant or tapered strip into field of roof.
 - a. Provide scuppers at conductor heads.
 - b. Provide scuppers spaced 10 ft apart when discharging into gutters.
 - 3. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - a. Aluminum, Prefinished: 0.050 in thick.
 - 4. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
 - 5. Joints: Butted with expansion space and 12 in wide, concealed backup plate, double seal with sealant each side of joint.
- B. Copings: Fabricate in minimum 96 in long, but not exceeding 12 ft long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg or drill elongated holes for fasteners on interior leg as indicated on drawings.

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1. Profile: As indicated on Drawings, according to SMACNA's "Architectural Sheet Metal Manual."
 2. Fabricate from the Following Materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
 - a. Aluminum, Prefinished: 0.050 in thick.
 3. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
 4. Joints:
 - a. Copings 12 Inches Wide or Less: Form butted joints with expansion space and 12 in wide, concealed backup plate with double sealant on each side of joint.
 - b. Copings Over 12 Inches Wide: Form joints of intermeshing hooked flanges, not less than 1 in deep, filled with sealant concealed within joints.
- C. Roof Expansion-Joint Covers, 2 In and Less: Fabricate cap type expansion cover with continuous flanges to hold cap and serve as counter flashing. Form section not to exceed 12 ft in length and joint cap sections by standing seams held in place by cleats. Shop fabricate interior and exterior corners. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
1. Aluminum, Prefinished: 0.050 in thick.
 2. Joint Style: Standing seam and seal with sealant.
 3. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
- D. Manufactured Roof Expansion Joint Cover Systems:
1. Refer to Division 07 Section "Expansion Control" for manufactured roof expansion joint covers.
- E. Counterflashing: Manufactured units of heights to overlap top edges of base flashings by 4 in and in lengths not exceeding 12 ft designed to snap into through-wall-flashing receiver and compress against base flashings with joints lapped. Shop fabricate interior and exterior corners. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
1. Aluminum, Prefinished: 0.032 in thick.
 2. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
 3. Joints: Lapped 4-inches, double seal with sealant.
 - a. Offset counter-flashing joints 6-inches from flashing receiver joints.
- F. Flashing Receivers: Fabricate from same materials as counterflashing.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
1. Aluminum, Prefinished: 0.032 in thick.
- H. Pre-Engineered Roof Penetration Housing: Heavy gauge aluminum, pre-insulated, multi-penetration housing assembly with flanged curb and proprietary weather-tight silicone exit seals. Size and configuration as required for number and types of penetrations indicated.
1. Basis of Design: Roof Penetration Housings; Vault AWI Series and Exit Seals.

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2.11 EMBEDDED FLASHING FABRICATIONS

- A. Fabricate continuous flashings in sections 8 ft long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
 - 1. Fabricate from the following materials:
 - a. Stainless Steel: 0.025 in thick.
 - 2. Shop form flashing on a bending brake.
 - 3. Shape, trim and hand seam on bench as far as practical with proper tools.
 - 4. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.
 - 5. Form materials to shape indicated with straight lines, sharp angles and smooth curves.
 - 6. Fold and hem exposed edges of flashings.
- B. Flashing Joinery: Fabricate interior and exterior corners, intersections, and complex flashing conditions in shop, rather than in field, with properly folded, constructed and mechanically fastened continuous soldered joints. Field fabricated units are not permitted and will not be allowed

2.12 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Aluminum, Prefinished: 0.032 in thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 - 1. Stainless Steel: 0.025 in thick.
 - 2. Aluminum, Prefinished: 0.032 in thick.
 - 3. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.040 in thick.
- C. Miscellaneous Flashings:
 - 1. Fabricate to cross section indicated with clips and accessories required for secure watertight installation. Meet recommendations of SMACNA for fabrication details and metal thicknesses.
 - 2. Not-Exposed to Public View: Fabricate from the following materials:
 - a. Aluminum, Prefinished: 0.032 in thick.
 - 3. Concealed By other Construction: Fabricate from the following materials:
 - a. Stainless Steel: 0.025 in thick.
- D. Pre-Engineered Wall Penetration Panel: Heavy gauge aluminum, multi-penetration wall panel and proprietary weather-tight silicone exit seals. Size and configuration as required for number and types of penetrations indicated.
 - 1. Basis of Design: Roof Penetration Housings; Wall Vault WV Series and Exit Seals.

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2.13 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Pitch Pockets (aka Pitch Pans) at Roof Penetrations: Pitch pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to the drawings for allowable roof penetration details.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment:

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1. Install self-adhering sheet underlayment, wrinkle free.
 2. Prime substrate if recommended by underlayment manufacturer.
 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 4. Apply in shingle fashion to shed water, with end laps of not less than 6 in staggered 24 in between courses.
 5. Overlap side edges not less than 3-1/2 in.
 6. Roll laps and edges with roller.
 7. Cover underlayment within 14 days.
- B. If recommended by manufacturer, apply slip sheet, wrinkle free, before installing sheet metal flashing and trim at horizontal applications where sheet metal will remain exposed.
1. Install in shingle fashion to shed water.
 2. Lap joints not less than 4 inches (100 mm).

3.5 INSTALLATION OF SHEET METAL FLASHING AND TRIM

- A. General: Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - a. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 5. Install continuous cleats with fasteners spaced not more than 12 in apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 6. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 7. Torch cutting of sheet metal flashing and trim is not permitted.
 8. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

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3. Asphalt Roofing Cement: Bed flanges in thick coat of asphalt roofing cement where required by manufacturer of sheet metal flashing materials and fabrications for waterproof performance.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. When ambient temperature at time of installation is between 40 deg F and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 2. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 3. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Sealant Joints: Seal joints as required for watertight construction.
1. Use sealant-filled joints at lap joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
1. Pre-tin edges of sheets with solder to width of 1-1/2 in; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 2. Do not solder metallic-coated steel and aluminum sheet.
 3. Do not use torches for soldering.
 4. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 5. Mechanically fasten soldered joints.
 6. Stainless-Steel Soldering:
 - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
 - b. Promptly remove acid flux residue from metal after tinning and soldering.
 - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

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- H. Rivets: Rivet joints in uncoated metals.

3.6 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
1. Join sections with riveted and soldered joints or joints sealed with sealant.
 2. Provide for thermal expansion.
 3. Attach gutters at eave or fascia to firmly anchor them in position.
 4. Provide end closures and seal watertight with sealant. Slope to downspouts.
 5. Fasten gutter spacers to front and back of gutter.
 6. Anchor and loosely lock back edge of gutter to continuous cleat, eave or apron flashing.
 7. Anchor gutter with gutter brackets or straps spaced not more than 30 in apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
 8. Install gutter with expansion joints at locations indicated, but not exceeding, 50 ft apart. Install expansion-joint caps.
- C. Built-in Gutters:
1. Join sections with riveted and soldered joints or joints sealed with sealant.
 2. Provide for thermal expansion.
 3. Provide end closures and seal watertight with sealant. Slope to downspouts.
 4. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
 - a. Lap sides minimum of 2 in over underlying course. Lap ends minimum of 4 in.
 - b. Stagger end laps between succeeding courses at least 72 in. Fasten with roofing nails.
 - c. Install slip sheet over underlayment.
 5. Anchor and loosely lock back edge of gutter to continuous cleat.
 6. Install gutter with expansion joints at locations indicated, but not exceeding, 50 ft apart. Install expansion-joint caps.
- D. Downspouts:
1. Join sections with 1-1/2-in telescoping joints.
 2. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 in from walls. Locate hangers at top and bottom and at approximately 60 in o.c.
 3. Terminate downspouts as indicated on Drawings.
 - a. Provide elbows at base of downspout to direct water away from building.
 - b. Connect downspouts to underground drainage system.
- E. Splash Pans:
1. Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

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F. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Exterior Wall: Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
3. Exterior Wall and Conductor Head: Loosely lock front edge of scupper with conductor head.
4. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

G. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 in below scupper or gutter discharge.

H. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 in in direction of water flow.

3.7 INSTALLATION OF ROOF FLASHING

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers, unless indicated otherwise on Drawings.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

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- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 in over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 - 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 - 2. Extend counterflashing 4 in over base flashing.
 - 3. Lap counterflashing joints minimum of 4 in. Secure in waterproof manner by means of anchor and washer at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas centers unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with sealant and clamp flashing to pipes that penetrate roof.

3.8 INSTALLATION OF WALL FLASHING

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 in over top edge of base flashings.

3.9 EMBEDDED FLASHINGS

- A. General: Drawings may not necessarily indicate or describe full extent of Work required for completion of embedded flashing.
- B. Scheduled Locations: In addition to conditions shown on Drawings, install embedded flashings within cavity at following locations to direct downward flow of infiltrated water within cavity to exterior:
 - 1. Shelf angles with end dams at through-wall openings; and with lap joints.
 - 2. Lintels with end dams or laps.
 - 3. Jambs at through-wall openings, full height from sill to head.
 - 4. Penetrations, parapet terminations into adjacent walls and other wall terminations.
 - 5. Other obstructions.
- C. Preparation: Substrate surfaces shall be smooth and free from projections that could puncture flashing.
- D. Flashing Installation:
 - 1. Install sheet metal flashing true to line and levels indicated; minimize quantity of lap joints by using longest units possible.
 - 2. Set shaped sheet metal units in proper locations with outside hemmed edges flush with building face location indicated; attach cavity side flanges to sheathed steel stud wall with screw fasteners driven into studs.

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3. At continuous shelf angles, terminate horizontal flashings at through-wall openings with properly folded and constructed sheet metal end dams, with continuous soldered joints.
 4. At lintels, terminate horizontal flashings at end of lintel with properly folded and constructed sheet metal end dams, with continuous soldered joints.
 5. At lap joints of horizontal flashings, form neat and aligned joints by interlocking splice plate within hemmed edge of sheet metal flashing profile; apply sealant and rubberized asphalt flashing as indicated to create water-resistant joint.
 6. Set shaped sheet metal units at jambs of through-wall openings and lap inside of end dams at horizontal flashings below; coordinate installation with rigid cavity insulation, if applicable.
 7. Seal cavity edges of sheet metal flashings within cavity to sheathing with continuous rubberized asphalt flashing.
- E. Examination and Repair: Immediately prior to laying exterior veneer, examine exposed surfaces of flashing and seal penetrations and damaged areas with rubberized asphalt flashing material before covering with exterior veneer.
- F. Asphalt Mastic Dampproofing Application: Apply continuous layer of product, without pinholes or holidays, at locations as indicated on drawings. Apply at coverage rate instructed by manufacturer.
1. Repair voids and damage. Patch with additional layer of asphalt mastic dampproofing extending 6 in beyond repaired areas in all directions.

3.10 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 2. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 2. Pipe and install drain line to plumbing waste or drainage system.

3.11 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 in in 20 ft on slope and location lines indicated on Drawings and within 1/8 in offset of adjoining faces and of alignment of matching profiles.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

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1. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

3.13 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.14 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- B. Touchup Painting: Clean abraded or damaged areas of shop paint finish and paint exposed areas with the same material used for shop painting. Touchup finish is to match undamaged finish and extend into retained adjoining finish in a manner that will minimize evidence of touchup.
- C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

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SECTION 077200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Roof accessories and supplementary items necessary for installation of the following:
 - 1. Roof curbs.
 - 2. Equipment supports.
 - 3. Roof hatches.
 - 4. Heat and smoke vents.
 - 5. Rooftop pipe supports.
 - 6. Precast concrete splash blocks.
 - 7. Snow guards.
 - 8. Snow and ice melt systems.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate dimensions, loadings, and special conditions.
- C. Samples for Verification Purposes: Submit for each type of exposed finish required, prepared on Samples in manufacturer's standard sizes, and of same thickness and material indicated for the Work. If finishes involve normal color or shade variations, include sample sets showing the full range of variations expected.

1.3 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports - Snow and Ice Melt System: Written report of testing and inspection required by "Field Quality Control".
- B. Manufacturer's Project Acceptance Document - Snow and Ice Melt System: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- C. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

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1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications for Snow and Ice Melt System:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

- a. Architect.
- b. Contractor, including superintendent.
- c. Installer, including project manager and supervisor.
- d. If requested, Manufacturer's qualified technical representative.
- e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roof accessories to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, and date of manufacture.
- B. Protect roof accessories from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

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- C. Handle, store, and install roof accessories in a manner to avoid permanent deflection of roof deck.

1.8 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.9 WARRANTY

- A. Manufacturer's Warranty - Roof Hatches and Smoke Vents: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge to the Owner.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material defects for a period of 5 years from date of Substantial Completion.
- B. Manufacturer's Warrant - Snow and Ice Melt System: Furnish manufacturerTM's written material warranty signed by an authorized representative using manufacturerTM's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Standards: Comply with the following:
 - 1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
 - 2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

2.4 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, G90 coating designation.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792 / A 792M, AZ50 coated.
- C. Steel Tube: ASTM A 500, round tube.
- D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123 / A 123M.
- E. Galvanized Steel Pipe: ASTM A 53/A 53M, hot-dip galvanized according to ASTM A 123 / A 123M.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Treated Wood Nailers: As specified in Division 06 Section "Miscellaneous Rough Carpentry".
- C. Security Grilles: 3/4 in diameter, ASTM A 1011 / A 1011M steel bars spaced 6 in on center in one direction and 12 in on center in the other; factory finished as follows:
 - 1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling".
 - 2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
 - 3. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats under prolonged exposure.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils thickness per coat.

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- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153 / A 153M or ASTM F 2329.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- J. Underlayments:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6 mils thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3 lb/100 sf minimum, rosin sized.

2.6 ROOF CURBS

- A. Insulated Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers:
 - a. Custom Solution Roof and Metal Products.
 - b. Pate Company.
 - c. Roof Products, Inc.
 - d. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 in thick. Factory prime coating finish.
- D. Construction:
 - 1. Insulation: Manufacturer's standard.
 - 2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 3. Factory-installed treated wood nailer at top of curb, continuous around curb perimeter.

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4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 in unless otherwise indicated.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
8. Security Grille: Provide where indicated.

2.7 EQUIPMENT SUPPORTS

- A. Insulated Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.
 1. Manufacturers:
 - a. Custom Solution Roof and Metal Products.
 - b. Pate Company.
 - c. Roof Products, Inc.
 - d. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.079 in thick. Factory prime coating finish.
- D. Construction:
 1. Insulation: Manufacturer's standard.
 2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 3. Factory-installed continuous treated wood nailers 3-1/2 in wide at tops of equipment supports.
 4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 6. Fabricate equipment supports to minimum height of 12 in unless otherwise indicated.
 7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.8 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

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1. Manufacturers:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. Bilco Company.
 - d. Dur-Red Products.
 - e. J.L. Industries, Inc.
 - f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - g. Nystrom Building Products.
- B. Type and Size: As indicated on Drawings.
- C. Loads: Minimum 40 lbf/sf external live load and 20 lbf/sf internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 in thick.
- E. Construction:
 1. Insulation: Manufacturer's standard.
 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 5. Fabricate curbs to minimum height of 12 in unless otherwise indicated.
 6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 1. Provide two-point latch on lids larger than 84 in.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 in above finished roof deck.
 3. Material: Steel tube.
 4. Post: 1-5/8 in diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.
- H. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.28 requirements and authorities having jurisdiction.
 1. Height: 42 in above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 in in diameter or galvanized-steel tube, 1-5/8 in in diameter.

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3. Flat Bar: Galvanized steel, 2 in high by 3/8 in thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 in in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.

2.9 HEAT AND SMOKE VENTS

- A. Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 deg F and coordinated with fire-suppression and smoke-detection systems.
1. Manufacturers:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. Bilco Company.
 - d. Dur-Red Products.
 - e. J.L. Industries, Inc.
 - f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - g. Nystrom Building Products.
 2. Type and Size: As indicated on the Drawings.
 3. Loads: Minimum 40 lbf/sf external live load and 30 lbf/sf internal uplift load.
 - a. When release is actuated, lid shall open against 10 lbf/sf snow or wind load and lock in position.
 4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793 and are FMG Approved.
 5. Curb, Framing, and Lid Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 in thick.
 6. Construction:
 - a. Insulation: ManufacturerTM standard.
 - b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - c. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - d. Fabricate curbs to minimum height of 12 in, unless otherwise indicated.
 - e. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

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- f. Security Grille: Provide where indicated.
- 7. Hardware: Manufacturer's standard, corrosion resistant or hot-dip galvanized; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.

2.10 ROOFTOP PIPE SUPPORTS

- A. Rooftop Supports for Piping, Conduit, Cable Tray or Equipment: Installation without requiring roof penetrations, flashing, or damage to the roofing material. Support bases and pipe rollers made of an engineered thermoplastic with appropriate additives for UV protection. All structural steel components hot-dipped galvanized. Height-adjustable supports must be used where necessary. The support shall have a continuous bottom surface to provide even load distribution and minimize point loading of the roof membrane. Support base to have radiused edge to enhance compatibility with roof membranes.
 - 1. Load Capacity: Up to 1,500 lbs .
- B. The rooftop strut support shall provide a fixed-height mounting platform of 4 or 6 inches off of the roof and a usable strut length of up to 10 or 16 inches .
- C. The adjustable-height strut support shall allow elevations changes of up to 16 inches off of the roof and a usable strut length of up to 10 or 16 inches .
- D. The rooftop roller support shall provide roller capacity for up to nominal 6 inches steel pipe with a minimum 5-1/2 inches fixed height off of the roof.
- E. The adjustable-height roller support shall provide roller capacity for up to nominal 6 inches steel pipe and accommodate elevation changes of up to 16 inches off of the roof. The rollers shall be polymeric. The roller axle, fittings and other hardware shall be manufactured of hot-dipped galvanized steel.
- F. Basis of Design: ERICO International Corporation; ST Series, Strut-based Thermoplastic Supports.

2.11 PRECAST CONCRETE SPLASH BLOCKS

- A. Prefabricated units of reinforced Portland cement concrete, aggregates, admixtures, and water; shaped to divert water away from building. Minimum size: 12 in by 24 in by 3 in high. Weight: 50 lbs. Provide protection layer below splash block to protect roofing system.

2.12 SNOW GUARDS

- A. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without penetrating roofing system; complete with predrilled holes, clamps, or hooks for anchoring. Snow guards materials and mounting method shall be fully compatible with adjacent roofing system to avoid any damage or penetrations which may compromise the integrity of the system.
- B. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to panel surface of roofing system using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

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C. Manufacturers:

1. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
2. Berger Building Products.
3. Chemlink, Inc.
4. LMCurbs
5. Polar Blox.
6. Precision Molding Co., Inc.
7. Snoblox / Snojax Inc.
8. Sno-Gem, Inc.
9. TRA Mage Inc.
10. Zaleski Snow-Guards & Roofing Specialties

2.13 SNOW AND ICE MELT SYSTEMS

- A. Basis of Design: Bylin Engineered Systems; Roof Ice Melt "RIM2" Eave, Rake, and Valley Panels.
1. Description: Metal cover panels with 3 runs of heating cables at eaves and 2 runs of heating cables at valleys and rakes.
 2. Snow Load Accumulation Area Rating: Class 2.
 3. Metal Cover Material: 0.040 inches thick aluminum with Fluoropolymer finish, match sample accepted by Architect.
- B. Heating Cables: Manufacturer's standard heating cables specifically designed for snow and ice melting. The heating cable shall be capable of varying its heat output along its entire length. The heating cable shall be specifically listed by UL as electric roof and gutter de-icing and snow-melting equipment.
- C. Control Panel: Manufacturer's standard control system including control panel complete with branch circuit protection, ground fault protection, ambient temperature controller, temperature controllers, solid state relays, terminal blocks, switches, power on light, and all necessary accessories.
- D. Junction Box / Power Termination: The heating cable circuits shall be connected to the power wiring in an accepted junction box with accepted termination components.

2.14 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

2.15 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

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1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ROOF ACCESSORIES

- A. General: Install and securely anchor roof accessories directly to structural supporting deck or substrate (not on top of wood blocking) so they are capable of resisting indicated loads.
 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 2. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 3. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous paint or by other permanent separation as recommended by manufacturer.
 1. Underlayments: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.

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2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level, unless otherwise indicated.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Roof-Hatch Installation:
1. Install roof hatch so top surface of hatch curb is level, unless otherwise indicated.
 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 3. Attach safety railing system to roof-hatch curb.
 4. Attach ladder-assist post according to manufacturer's written instructions.
- F. Heat and Smoke Vent Installation:
1. Install heat and smoke vent so top perimeter surfaces are level.
 2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.
- G. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.
- H. Rooftop Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
1. Provide complete and adequate support of all piping and conduit, whether or not all required devices are shown.
 2. The use of wood for supporting piping is NOT permitted.
 3. Provide supports spaced so deflection of piping does not exceed 1/240 of span.
 4. Isolation Pads: Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and support. Set isolation pads in adhesive if required by manufacturer's instructions. Place supports on isolation pads.
- I. Precast Concrete Splash Blocks: Install splash block at outlet locations of downspouts. Set splash block over protection layer to protect roofing system.
- J. Stop-Type Snow Guards: Attach snow guards to roofing system with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate roofing system. Install snow guards in layout, spacing, and pattern indicated on the Drawings.
- K. Snow and Ice Melt Systems: Install in accordance with manufacturer's written installations at layout, spacing, pattern and locations indicated on the Drawings. Coordinate the complete snow and ice melt system installation with the gutter, roofing, and flashing installations.

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3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service - Snow and Ice Melt System: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Clean exposed surfaces according to manufacturer's written instructions.
- C. Clean off excess sealants.
- D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 078116

SPRAYED FIRE-RESISTIVE MATERIALS (SFRM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sprayed fire-resistive materials (SFRM) and supplementary items necessary for installation.

1.2 DEFINITIONS

- A. SFRM: Sprayed Fire-Resistive Materials.
- B. Concealed: Not visible; hidden by other construction.
- C. Exposed: Visible, not hidden by other construction.
- D. Direct Moisture: Exposed to wetness, surfaces normally soaked, saturated or regularly exposed to water and or moisture.

1.3 ACTION SUBMITTALS

- A. Fire-Rated Assembly Design Classification: Submit documentation issued by testing agency for each fire-rated assembly design selected.
- B. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - a. Sprayed fire-resistive materials.
 - b. Substrate primers.
 - c. Bonding agent.
 - d. Metal lath.
 - e. Reinforcing fabric.
 - f. Reinforcing mesh.
 - g. Sealer and topcoats when applicable.
- C. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.
 - 1. Framing plans and schedules indicating the following.
 - a. Extent of fire protection for each construction and fire-resistance rating.
 - b. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - c. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

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1) Requirements for steel surface preparation.

d. Treatment of sprayed fire-resistive material after application.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Product Certificates: For each type of sprayed fire-resistive material.
- B. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.
- C. Preconstruction Test Reports: For fire protection.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- E. Warranty:
 - 1. Provide manufacturer written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test reports indicating compliance with requirements for specified performance and test methods.
 - 1. Bond Strength: Test for cohesive and adhesive strength in accordance with ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 2. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
 - 3. If additional testing is required, schedule sufficient time for testing and analyzing results to prevent delaying the Work.

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1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - 1) Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.
 - 2) Review written patching plan detailing materials and methods used for patching fire-resistive materials damaged during construction.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply fire protection when ambient temperature, substrate temperature, and moisture conditions are within range established and recommended by manufacturer. Provide temporary protection and heat to maintain temperature for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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1.10 WARRANTY

- A. **Installer's Warranty:** Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Coverage of warranty includes but is not limited to the following:
 - a. Defects or deterioration.
 - b. Cracking, flaking, or spalling.
 - c. Peeling or delaminating from substrates.
 - d. Failure to remain bonded.
 - e. Erosion in excess of specified requirements.
 - f. Faulty application.
 2. **Warranty Period:** Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. **Acceptable Manufacturers and Products:** Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

- A. **Single Source Responsibility:** Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. **General Performance:** Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. **Assemblies:** Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.
1. Obtain fire protection for each fire-resistance design from single source.
- C. **Material Compatibility:** Primer and sprayed fire-resistive materials shall be compatible with one another and with substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and laboratory analysis.

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- D. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency or listing of other testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are considered unrestrained unless indicated otherwise.
- E. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 10 or less.
 - 2. Smoke-Developed Index: 10 or less.
- F. Asbestos: Provide products containing no detectable asbestos.

2.4 SPRAYED-FIRE RESISTIVE MATERIALS

- A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design.
 - 1. Products mixed with water at Project site to form a slurry or mortar before conveyance and application
- B. Bond Strength: Minimum cohesive and adhesive strength based on field testing in accordance with ASTM E736.
 - 1. Buildings more than 75 ft up to 420 ft in Height: 430-lbf/sq. ft..
- C. Density: Not less than density specified in the approved fire-resistance design, in accordance with ASTM E605.
 - 1. Low-Density – Gypsum Binder: 15 pcf (240k/cum).
 - 2. Medium-Density - Gypsum Binder: 18 pcf (288k/cum).
 - 3. Medium-Density – Cement Binder: 22 pcf (352k/cum).
 - 4. High-Density – Cement Binder: 40 pcf (640k/cum).
- D. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch.
- E. Combustion Characteristics: ASTM E136.
- F. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
- G. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
- H. Effect of Impact on Bonding: No cracking, spalling, delamination, per ASTM E 760.
- I. Air Erosion: Maximum weight loss of 0.025 grams per square foot in 24 hours according to ASTM E 859.
- J. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21.

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K. SFRM-02:

1. Interior Locations: Unless a higher bond strength SFRM is scheduled below.
 - a. Concealed conditions for Buildings more than 75 ft up to 420 ft in height.
 - b. Exposed conditions for Buildings up to 420 ft in height.
2. Low-Density; minimum bond strength of 430-lbf/sq. ft.:
 - a. Grace Construction Products; Monokote MK-10HB.
 - b. Isolatek International; Cafco 300HS.
3. Medium Density; minimum bond strength of 430-lbf/sq. ft.:
 - a. Carbolite Co., Fireproofing Products Div.; Pyrolite 22.
 - b. Grace Construction Products; Monokote Z106G.
 - c. Isolatek International; Cafco 400 AC.
 - d. Southwest Vermiculite Co., Inc.; Type 5MD.

L. SFRM-04 - Medium Density, Portland Cement Binder; minimum bond strength of 1000-lbf/sq. ft.:

1. Interior Locations: Unless a higher bond strength SFRM is scheduled below.
 - a. Exposed columns.
 - b. Exposed structure in mechanical/electrical rooms and elevator shafts.
 - c. Exposed conditions subject to abrasion or humidity.
2. Manufacturers and Products:
 - a. Carbolite Co., Fireproofing Products Div.; Pyrolcrete 239.
 - b. GCP Applied Technologies; Monokote Z106/HY.
 - c. Isolatek International; Cafco 400.
 - d. Southwest Fireproofing Products Co., Inc.; Type 7GP.

M. SFRM-05 - High-Density, Portland Cement Binder; minimum bond strength of 10000-lbf/sq. ft..

1. Interior or Exterior Locations:
 - a. Exterior conditions.
 - b. Exposed conditions subject to impact or direct moisture.
2. Manufacturers and Products:
 - a. Carbolite Co., Fireproofing Products Div.; Pyrocrete 40.
 - b. GCP Applied Technologies; Monokote Z146.
 - c. Isolatek International; Fendolite M-II.
 - d. Southwest Vermiculite Co., Inc.; 7HD.

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2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:
 - 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E736.
- C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, in accordance with fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.
- G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
- H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
 - 1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.
 - 2. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM.
- I. Patching Material: Product provided by fire-resistive materials manufacturer for patching damaged work.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 - 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Verify that concrete work on steel deck is complete before beginning Work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.
- D. Conduct tests in accordance with sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

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- B. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- C. Clean substrates of substances that could impair bond of fire protection.
- D. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
 - 1. If paint or primer is incompatible as determined by sprayed fire-resistive material manufacturer and must be removed or repaired, provide additional materials at no cost to the Owner.
- E. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.4 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection as applicable to specific conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Metal Decks:
 - 1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
 - 2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.
- E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.
- F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

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- G. Extend fire protection in full thickness over entire area of each substrate to be protected.
- H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.
- I. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.
- J. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- K. Cure fire protection in accordance with sprayed fire-resistive material manufacturer's written instructions.
- L. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- M. Finishes: Apply fire protection to produce finishes in accordance with manufacturer's written instructions for each finish selected.
 - 1. Spray-Textured Finish: Finish left as spray applied with no further treatment.
- N. Patching: Under the following conditions, remove sprayed fire-resistive materials and re-apply same sprayed fire-resistive materials as used for original application, or apply patching material:
 - 1. Portions damaged, abraded, or removed by subsequent building construction.
 - 2. Previously applied materials determined by testing and inspection agency to be noncompliant.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Special Inspections: Owner will engage a qualified special inspector to perform the special inspections:
 - 1. Test and inspect as required by the Building Code and Authorities Having Jurisdiction.
- C. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- D. Fireproofing will be considered defective if it does not pass tests and inspections.

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1. Remove and replace fireproofing that does not pass tests and inspections, and retest at Contractor's expense.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest at Contractor's expense.

E. Prepare test and inspection reports.

3.6 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.7 PROTECTION

- A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.
1. Prevent deterioration of fire-resistive materials due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.

3.8 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

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SECTION 078123

INTUMESCENT FIRE RESISTIVE MATERIALS (IFRM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Mastic and intumescent fire-resistive coatings and supplementary items necessary for installation.
 - 1. Finish Sample: Submit with proposal a preliminary sample of intumescent mastic fireproofing finish representing the quality and variations in appearance.

1.2 ACTION SUBMITTALS

- A. Fire-Rated Assembly Design Classification: Submit documentation issued by testing agency for each fire-rated assembly design selected.
- B. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - a. Mastic and intumescent fire-resistive coatings.
 - b. Substrate preparation and primers.
 - c. Reinforcing fabric.
 - d. Reinforcing mesh.
 - e. Topcoat.
- C. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Framing plans and schedules indicating the following:
 - a. Extent of fire protection for each construction and fire-resistance rating.
 - b. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - c. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 1) Requirements for steel surface preparation and primers.
 - d. Treatment of mastic and intumescent fire-resistive coating after application.
- D. Samples for Verification: For each fireproofing assembly design and for each color and texture specified, stepped samples, not less than 12 in (300 mm) square, prepared on sheet steel, including primers and topcoats.

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1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Product Certificates: For each type of mastic and intumescent fire-resistive coating.
- B. Evaluation Reports: For mastic and intumescent fire-resistive coating, from ICC-ES.
- C. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control Article.
- D. Warranty:
 - 1. Provide manufacturer written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of each type of fire protection and different substrate and each required finish.
 - a. Apply coatings by method that will be used for the Work to 48 in (1200 mm) long structural steel column or beam demonstrating final finish; including a patch of a damaged area and a steel-to-steel connection
 - 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 3. Obtain Architect's acceptance of mock-ups before starting installation.
 - 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 - 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

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1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - 1) Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Deliver, store and handle products to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- B. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's design classification marking applicable to Project, curing time, and mixing instructions for multi-component materials.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply fire protection when ambient temperature, substrate temperature, and moisture conditions are within range established and recommended by manufacturer. Provide temporary protection and heat to maintain temperature for 24 hours before, during, and for 24 hours after product application.

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- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes, but is not limited to, the following:
 - a. Defects or deterioration.
 - b. Cracking, flaking, or spalling.
 - c. Peeling or delaminating from substrates.
 - d. Failure to remain bonded.
 - e. Erosion more than specified requirements.
 - f. Faulty application.
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Albi Protective Coatings.
 - 2. Carboline Company, subsidiary of RPM International, Fireproofing Products Div
 - 3. Isolatak International
 - 4. Hilti, Inc

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5. Sherwin Williams.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.
1. Obtain fire protection for each fire-resistance design from single source.
- C. Material Compatibility: Primer, intumescent fire-resistive materials and topcoats shall be compatible with one another and with substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and laboratory analysis.
- D. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency or listing of other testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
1. Steel members are considered unrestrained unless indicated otherwise.
- E. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index:
 - a. Exposed-to-View or Concealed Spaces other than Return Air Plenums: 450 or less.
 - b. Return Air Plenums: 50 or less.
- F. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
- G. Asbestos: Provide products containing no detectable asbestos.

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2.4 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Exterior Applications - Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
1. Manufacturers and Products: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Albi Protective Coatings; Albi Clad 800.
 - b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Thermo-Lag E100 or E100S.
 - c. Isolatek International; Cafco SprayFilm-WB 4 / Isolatek WB 4 with Cafco SprayFilm Topseal.
 - d. Sherwin Williams; Firetex FX5090.
 2. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design.
- B. Interior Applications - Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.
1. Manufacturers and Products - Designated for interior general-purpose use by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Albi Protective Coatings; Albi Clad TF.
 - b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Firefilm III, AD Firefilm IV, Thermo-Sorb VOC or Thermo-Sorb 263
 - c. Hilti, Inc.; Fire Finish CFP-SP WB.
 - d. Isolatek International; Cafco SprayFilm-WB 3 or Cafco SprayFilm-WB 5.
 - e. Sherwin Williams; Firetex FX5120.
 2. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design.
- C. Interior or Exterior Applications - Shop Applied or Field Applied Epoxy Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of epoxy intumescent, and complying with indicated fire-resistance design.
1. Manufacturers and Products: Designated for interior or exterior general-purpose, high performance use by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Sherwin-Williams; Firetex FX9502.
- D. Basis of Design for Level of Finish: Carboline; Finish Level 4 High Quality Architectural Finish (Spray Applied, Back Rolled and Sanded Smooth).

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2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with mastic and intumescent fire-resistive coating and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by mastic and intumescent fire-resistive coating manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer. Include pins and attachment.
- E. Topcoat: Suitable for application over mastic and intumescent fire-resistive coating; of type approved or recommended in writing by mastic and intumescent fire-resistive coating manufacturer for each fire-resistance design.
 - 1. Color and Gloss: As scheduled or indicated in Design Selections.

2.6 STEEL FINISH

- A. Surface Preparation: Prepare metal surfaces to comply with intumescent mastic fireproofing manufacturer requirements.
 - 1. Steel Substrate before Priming: SSPC-SP 6 Commercial Blast Cleaning unless more stringent requirements are recommended by intumescent mastic fireproofing manufacturer.
 - 2. Galvanized Steel Substrate before Priming: SSPC-SP 7 Brush-off Blast Cleaning unless more stringent requirements are recommended by intumescent mastic fireproofing manufacturer.
 - 3. Primed Steel Substrate: SSPC-SP 2 Hand Tool Cleaning or SP 3 Power Tool Cleaning unless more stringent requirements are recommended by intumescent mastic fireproofing manufacturer.
- B. Priming: Apply primer in steel fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Conduct tests in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- C. Clean substrates of substances that could impair bond of fire protection.
- D. Prime substrates where included in fire-resistance design and where recommended in writing by mastic and intumescent fire-resistive coating manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
- E. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

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3.4 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- B. Comply with mastic and intumescent fire-resistive coating manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection as applicable to conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and mastic and intumescent fire-resistive coating manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- E. Spray-apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- F. Extend fire protection in full thickness over entire area of each substrate to be protected.
- G. Install body of fire protection in a single course unless otherwise recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- I. Cure fire protection in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Apply fire protection to produce the required finish.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

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1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Special Inspections: Owner will engage a qualified special inspector to perform the special inspections:
 1. Test and inspect as required by the Building Code and Authorities Having Jurisdiction.
- C. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- D. Fire protection will be considered defective if it does not pass tests and inspections.
 1. Remove and replace fire protection that does not pass tests and inspections, and retest at Contractor's expense.
 2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest at Contractor's expense.
- E. Prepare test and inspection reports.

3.6 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.7 PROTECTION

- A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.8 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

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SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes penetration firestopping systems for openings and penetrations through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency..
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

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1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
- B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- C. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.
- D. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.
- E. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.

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1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.
- B. Compatibility: Provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.
- C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials and approved by the qualified testing and inspection agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
- B. Fire-Test-Response Characteristics:
 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 2. Test per testing standards referenced. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency acceptable to authorities having jurisdiction.
 - 1) UL Fire Resistance Directory.
 - 2) Intertek Group Directory of Listed Building Products.
 - 3) FM Global Building Materials Approval Guide.

2.3 PENETRATION FIRESTOP SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 1. Classified in Underwriters Laboratories (UL) Fire Resistance Directory, Section XHEZ - Penetration Firestop System", and/or Section XHHW - Fill Void or Cavity Materials for specific project conditions.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479.
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479.

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1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistive shaft enclosures.
 - c. Penetrations located in construction containing fire-protection-rated openings.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.
- E. Penetrations in Fire-Resistance-Rated Smoke Barriers: In addition to penetration firestopping systems with L-Ratings determined per UL 1479, provide F-Ratings and T-Ratings determined per ASTM E 814 or UL 1479.
- F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.4 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

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- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
- K. Additional Application Requirements:
 - 1. Firestops exposed to view and/or are scheduled to receive finishes shall be paintable or capable of receiving finish materials.
 - 2. Firestops exposed to traffic, moisture, and physical damage shall be products that do not deteriorate when exposed to these conditions.
 - 3. Firestops for water piping penetrations, of any type, shall be moisture-resistant products.
 - 4. Firestops for floor penetrations with annular spaces exceeding 4 in or more in width and exposed to possible loading and traffic shall be products capable of supporting the floor loads involved either by installing floor plates or by other means.
 - 5. Firestops for penetrations involving insulated piping shall be products that do not require removal of insulation.
 - 6. Firestops for cable trays and future penetrations shall be reusable pillows or bags.
- L. Provide firestops within fire resistive walls and partitions containing flush mounted devices such as outlet boxes, electrical cabinets and mechanical cabinets mounted back to back and spaced less than 24 inches on center in accordance with UL Fire Resistance Directory "Wall Opening Protective Materials", Category CLIV.

2.5 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Surface Cleaning: Before installing fire-resistive penetration systems, clean penetrations immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements.
 - 1. Remove foreign materials from surfaces of openings, joints and penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.
- C. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

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3.4 INSTALLATION OF PENETRATION FIRESTOPS

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials for penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Tested System or Engineered Judgement Number.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

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3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- C. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
 - 1. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- D. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.7 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which opening and joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

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SECTION 078446

FIRE RESISTIVE JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes firestopping systems for joints at perimeter and through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

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1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Compatibility and Adhesion Testing: Manufacturer of fire stopping material shall be responsible for testing samples of materials that will contact or affect firestopping materials.
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
 - 2. Perform tests under environmental conditions replicating those that will exist during installation.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain fire-resistant joint sealants manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
- B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- C. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- C. Coordinate sizing of joints to accommodate joint firestopping systems.
- D. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.
- E. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

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PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.
 - 1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.
- B. Compatibility: Provide firestopping systems that are compatible with one another and the substrates forming openings, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.
- C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gasses.
- B. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory.
 - 2) Intertek Group in its Directory of Listed Building Products.
 - 3) FM Global in its "Building Materials Approval Guide.

2.3 JOINT FIRESTOPPING SYSTEMS.

- A. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 1. F-Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

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- B. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
 - 1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.
 - 1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.
- F. Joints, required for control of movement, at intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping with ratings determined by ASTM E 2837.
- G. Perimeter Fire Containment System: Provide systems for establishment of a fire resistive barrier at the portion of perimeter exterior wall (spandrel) that is adjacent to edge of structural floor or roof slabs, which provides and maintains a resistance to the passage of fire from one floor to the floor above. Provide fire resistive rating with movement capabilities equaling or exceeding the rating of the adjacent floor or roof assembly, as determined by ASTM E 2307.
 - 1. Integrity Rating: Measure of system's ability to withstand fire exposure without permitting passage of flame through openings or occurrence of flaming on any element of the unexposed surface of the fill material or floor or on the interior surface of the wall above the fill material.
 - 2. Expansion and Contraction: Perimeter fire containment systems shall accommodate movement of the exterior wall due to thermal expansion and contraction.

2.4 TOP-OF-WALL JOINT FIRESTOPPING

- A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:
 - 1. ASTM C 612, Type 1A and 1B.
 - 2. Nominal density of 4 lb/cu. ft.
 - 3. ASTM E119 Fire rating indicated, but not less than 2 hours.
- B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.
- C. Fire Resistive Sealants: Intumescent single-component, water based, high solids, elastomeric sealants. Nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant.

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2.5 PERIMETER FIRE CONTAINMENT SYSTEM - EDGE OF SLAB

- A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:
 - 1. ASTM C 612, Type 1A and 1B.
 - 2. Nominal density of 4 lb/cu. ft.
 - 3. ASTM E119 Fire rating indicated, but not less than 2 hours.
- B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.

2.6 PERIMETER FIRE CONTAINMENT SYSTEM - GLAZED ALUMINUM FRAMING SYSTEMS

- A. Curtainwall Insulation and Mullion Cover: Semi-rigid board insulation produced by combining slag-wool or rock-wool fibers with thermosetting resin binders, aluminum foil scrim backing, and complying with the following:
 - 1. ASTM C 612, Type 3.
 - 2. Nominal density of 8 and 4 lb/cu. ft. as required by test assembly.
 - 3. ASTM E 119 fire rating as indicated, but not less than 2 hours.
- B. Safing Material: Semi-rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders, unfaced, and complying with to the following:
 - 1. ASTM C 612, Type 1A and 1B.
 - 2. Nominal density of 4 lb/cu. ft.
 - 3. ASTM E 119 fire rating as indicated, but not less than 2 hours.
- C. Coating Material: Manufacturer's standard fill material or spray applied product for sealing top of safing material.
- D. Impaling Pins: 12 gage steel pins swaged to galvanized steel angles for screw attachment to glazed aluminum wall system aluminum framing.
- E. Reinforcing Angles: Galvanized steel angles of size, thickness, and finish suitable for application.
- F. Curtainwall Insulation Tape: Manufacturer's standard pressure sensitive aluminum foil faced tape product for taping curtainwall insulation joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions

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3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove foreign materials from surfaces of joints that could interfere with adhesion of firestopping.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.
- C. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION - GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.4 INSTALLATION OF FIRE-RESISTANT JOINT SEALANTS

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

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- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLATION OF FIRE SAFING PROTECTION

- A. Top of Wall: Install safing insulation to fill gap between top of wall and floor slab above. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit.

3.6 INSTALLATION OF PERIMETER FIRE CONTAINMENT SYSTEM

- A. Edge of Slab:
1. Edge of Slab: Install safing insulation to fill gap between edge of structural floor/roof slab and back of exterior wall on safing clips spaced as needed to support insulation but not further apart than 24 in o.c. unless not required by tested system. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit or install vertically as required by tested assembly.
 2. Install coating material or smoke seal compound to cover fill material and seal opening.
- B. Glazed Aluminum Framing Systems:
1. Install system to extend the required vertical distance above and below the structural floor/roof slab but not less than to next horizontal mullion.
 2. Attach impaling pins to glazed aluminum wall framing, using screws, at corners and around perimeter of glazed unit. Install curtainwall insulation material over impaling pins so that the edges are tight fitting against the aluminum frame and the face of material will be flush with the aluminum frame. Secure units with clinch shields over impaling pins. Locate horizontal seams in the curtainwall insulation material, 6 in from top of joint and provide supporting angles as required.
 3. Install safing material in the joint between the interior face of aluminum frame (and face of curtainwall insulation material) and the edge of the structural floor or roof slab. Compression fit safing material 50 percent, or as required by tested assembly, into spaces between floor slab and mounting angles. Provide safing clips to support safing material if required by tested system. Install coating material or smoke seal over safing material flush with top of floor/roof slab.
 4. Install mullion covers centered over horizontal and vertical aluminum frames within barrier area using the same impaling pins as used to attach the curtainwall insulation material. Secure covers with clinch shields over impaling pins.
 5. Install curtainwall insulation tape to seal all meeting edges of insulation with tape centered over the junction of adjacent insulation and all meeting edges of insulation and framing members so that approximately 2 in of tape covers each edge of the adjacent material.

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3.7 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Tested System or Engineered Judgment Number.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- C. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
1. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- D. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.
- E. Where required, inspection of fire resistive joint firestopping shall be performed in accordance with ASTM E 2393, "Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers" or other recognized standard.

3.9 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which joints occur.

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- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

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SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Joint sealants, backing materials, and supplementary items necessary for installation.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Samples for Verification Purposes: Samples for each kind and color of joint sealants in 1/2 in wide joints formed between two 6 in long strips of material matching appearance of exposed surfaces adjacent to joint sealants.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation, primers and backers.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.
- C. Warranties:
 - 1. Provide manufacturer's and installer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

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1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Sealant, Waterproofing and Restoration Institute (SWRI) Validation Certificate: Each sealant shall be validated by SWRI Sealant Validation Program.
- C. Mock-Ups: Before beginning Work of this Section, install joint sealants in mock-ups of the various assemblies specified in other Sections indicated to receive joint sealants specified in this Section. Mock-ups shall include each form of product and color required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1.5 PRECONSTRUCTION TESTING

- A. Pre-Construction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint urethane and silicone sealants:
 - 1. General Requirements: Test materials forming joint substrates and joint sealant backings for compatibility and adhesion with joint sealants.
 - 2. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 3. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 - 4. Specimen Quantity: Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 - a. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. Reports: Interpret test results and certify reports indicating requirements for primers and substrate preparation needed.
 - a. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primer.
- B. Pre-Construction Stain Testing: Submit samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:
 - 1. General Requirements: Test materials forming joint substrates for resistance to staining caused by joint sealants.

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2. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with substrates, including stone and stone masonry.
3. Specimen Quantity: Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 - a. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. Reports: Interpret test results and certify reports indicating whether joint sealants stain substrate materials.
 - a. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

- A. Ambient Conditions: Install joint sealants within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance.
 1. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

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- B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

- A. Manufacturer's Warranty for Urethane Sealants: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material Defects for a period of 5 years from date of Substantial Completion.
- B. Manufacturer's Warranty for Silicone Sealants: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material Defects for a period of 20 years from date of Substantial Completion.
- C. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the products to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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- B. Compatibility: Joint sealants, backings, and other related materials shall be compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.
- C. Sealant Color: As scheduled or as indicated in Design Selections.

2.3 EXTERIOR ELASTOMERIC SEALANTS

A. Exterior Pourable Urethane Sealant:

- 1. Product Quality Standard: ASTM C 920, Type M, Grade P, Class 25, Use T.
- 2. Description: Multi-component, pourable, moisture curing, polyurethane sealant; rated for incline when used on sloped surfaces.
- 3. Joint Movement Capability: Plus 25 percent, minus 25 percent.
- 4. Primers: Product provided by sealant manufacturer if required by conditions.
- 5. Manufacturers and Products:
 - a. Sika Corp.; Sikaflex SL 2.
 - b. Pecora Corp.; Urexpan NR-200.
 - c. Sika Corp., Construction Products Div.; Sikaflex 2c SL.
 - d. Tremco Commercial Sealants & Waterproofing; THC-900/THC-901 or Vulkem 445SSL.

B. Exterior Non-sag Silicone Sealant:

- 1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 50 or 100/50.
- 2. Description: Single component, non-sag, neutral cure, non-staining as determined by pre-construction stain testing, and non-bleeding, silicone sealant.
- 3. Joint Movement Capability:
 - a. Class 50: Plus 50 percent, minus 50 percent.
 - b. Class 100/50: Plus 100 percent, minus 50 percent.
- 4. Primers: Product provided by sealant manufacturer if required by conditions.
- 5. Manufacturers and Products:
 - a. Class 50:
 - 1) Dow; DOWSIL 795 Silicone Building Sealant.
 - 2) Momentive Performance Materials, GE Silicones; Silpruf SCS2000.
 - 3) Pecora Corp.; 864NST.
 - 4) Sika Corp., Construction Products Div.; Sikasil WS-295.
 - 5) Tremco Commercial Sealants & Waterproofing; Spectrem 3.
 - b. Class 100/50:
 - 1) Dow; DOWSIL 790 Silicone Building Sealant.
 - 2) Momentive Performance Materials, GE Silicones; Silpruf LM SCS2700.
 - 3) Pecora Corp.; 890NST.
 - 4) Sika Corp., Construction Products Div.; Sikasil WS-290.
 - 5) Tremco Commercial Sealants & Waterproofing; Spectrem 1.

C. Exterior Air and Water Barrier Silicone Sealant:

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1. Description: One part, neutral cure silicone sealant, designed for adhering to low energy surfaces commonly found on sheet air and water barriers.
2. Manufacturers and Products:

- a. Basis of Design: Dow Corning; Dowsil 758 Silicone Weather Barrier Sealant.

D. Exterior Non-Sag Urethane Sealant for Precast Concrete Seating Bowl:

1. ASTM C 920, Type M, Grade NS, Class 25.
2. Two-part, non-sag, polyurethane rubber sealant. Joint movement capability of +50 percent, -50 percent
3. Acceptable manufacturers and product:
 - a. BASF; MasterSeal NP 2 (Formerly Sonolastic NP 2).
 - b. Pecora Corp.; Dynatrol II.
 - c. Sika Corp., Construction Products Div.; Sikaflex 2c NS
 - d. Tremco Inc.; Dymeric 240 FC.

2.4 INTERIOR ELASTOMERIC SEALANTS

A. Interior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25.
2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
3. Manufacturers and Products:
 - a. Refer To drawings for Interior Design Selections.

B. Interior Non-sag Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:
 - a. Refer To drawings for Interior Design Selections.

C. Interior Non-sag Acrylic Latex Sealant:

1. Product Quality Standard: ASTM C 834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent
4. Manufacturers and Products:
 - a. Refer To drawings for Interior Design Selections.

D. Sprayed Foam Insulating Gap Filler:

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1. Description: Low pressure, one-component, expanding, open-cell latex-based insulating foam gap filler; applied with professional hand-held dispensing gun; CFC and HCFC free.
2. Performance Requirements: Class 1 Fire-Retardant per ASTM E 84.
3. Manufacturers and Products:

a. Refer To drawings for Interior Design Selections.

- E. Acoustical Sealants: As specified in Division 09 Section "Gypsum Board Assemblies" and Interior Design Selections.
- F. Fire Resistive Sealants: As specified in Division 07 Section "Fire Resistive Joint Firestopping" and Interior Design Selections.

2.5 JOINT SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Use closed cell (Type C) sealant backing rod at formed sealant joints for typical conditions unless otherwise recommended by sealant manufacturer.
2. Use open cell (Type O) sealant backing rod at interior line of sealant for double sealed condition unless otherwise recommended by sealant manufacturer.

- B. Cylindrical Sealant Backings:

1. Product Quality Standard: ASTM C 1330, Type C, Type O, Type B; as approved in writing by joint-sealant manufacturer for joint application indicated.
2. Description: Extruded polyethylene, polyurethane, or polyolefin in either closed cell structure (Type C), open cell structure (Type O), or bicellular structure with surface skin (Type B) as defined by ASTM Terminology C 717.
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Manufacturers and Products:

a. Type C:

- 1) Sika Corp.; MasterSeal 920.
- 2) Nomaco Inc.; Green Rod or HBR.

b. Type O:

- 1) Backer Rod Mfg. Inc.; Denver Foam.
- 2) Nomaco Inc.; Foam-Pak II.

c. Type B:

- 1) Sika Corp.; MasterSeal 921.
- 2) Nomaco Inc.; Dual-Rod or Sof-Rod.

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- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials, or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 PREFORMED SILICONE SHEETS AND TRANSITIONS

- A. Preformed Cured Silicone Sheet and Transition Strips: Preformed silicone strip and molded pieces designed for flashing and transition applications, including closures between building envelope systems and spanning joints with large and/or dynamic movement.
 - 1. Manufacturers and Products:
 - a. Dow; DOWSIL Silicone Transition System.
 - b. Momentive Performance Materials, Inc. / GE Silicones; UltraSpan.
 - c. Pecora; Sil-Span.
 - d. Sika Corp.; Sika Silbridge 400 Transition Sheet.
 - e. Tremco Commercial Sealants and Waterproofing; Proglaze Engineered Transition Assembly.

2.7 ACCESSORIES

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Non-porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.
- D. Weep Hole Baffles: PVC-coated, reticulated open cell polyurethane foam, 30 - 40ppi sized for installation at 30 to 50 percent compression.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to receive products and systems and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

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1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:
 1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form-release agents from concrete.
 4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 5. Substrate material allowed by sealant's ASTM C 920 Use Classification.
- C. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer, or as required by pre-construction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.4 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Joint Sealant Backings: Install type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear backings.

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3. Remove absorbent sealant backings that have become wet or damaged before sealant application and replace with dry materials.
 4. Install closed cell backer rod at exterior joints unless indicated otherwise on Drawings.
 - a. Use open cell backer rod at interior line of sealant for double sealed conditions.
 5. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.
- D. Joint Sealants: Install at same time as backings using proven techniques that comply with following:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 4. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - a. Remove excess sealant from surfaces adjacent to joints.
 - b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - c. Use masking tape to protect surfaces adjacent to recessed tooled joints.
 5. Install joint sealants in accordance with ASTM C 1193 as applicable to materials, applications, conditions indicated, and with the following profile configurations:
 - a. Fillet: Figure 5.
 - b. Bridge: Figure 6.
 - c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.
- E. Sprayed Foam Insulating Gap Filler: Apply sprayed foam insulating gap filler within exterior wall assemblies using professional hand-held dispensing gun in accordance with manufacturer's written instructions.
1. Prior to installation of wall finish systems, apply sprayed foam insulating gap filler to gaps, cracks, cavities, openings, and voids in exterior wall back-up, including annular space around piping, ducts, conduits, wiring, and electrical outlets to seal off potential air drafts.
 2. After sprayed foam sealant is applied, make flush with face of adjacent wall by using method recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

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1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 2. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
- C. Field Adhesion Testing: Field test urethane and silicone sealant adhesion to joint substrates as follows:
 1. General Requirements: Before installation, field test urethane and silicone sealant adhesion to joint substrates as follows
 - a. Locate test joints where indicated or, if not indicated, as directed by Architect.
 - b. Conduct field tests for each kind of urethane and silicone sealants and joint substrates indicated.
 - c. Notify Architect 7 days in advance of dates and times when test joints will be erected.
 2. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform one test for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 3. Test Methods: Joint sealant manufacturer's technical representative shall conduct following tests:
 - a. When Joint Substrates are Identical: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521:
 - 1) Install 24 in long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
 - 2) Make horizontal knife cut across width of sealant joint from one substrate to other substrate.
 - 3) Make 2 vertical cuts at both sides of substrates, downward starting at horizontal cut, approximately 3 in long.
 - 4) Grasp 3 in long piece of sealant tab firmly 1 in from its bonded edge and pull at not less than 90 degree angle.
 - 5) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in gauge length before releasing from substrate adhesively.

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- b. When Joint Substrates are Different: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521:
 - 1) Install 24 in long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
 - 2) Make first horizontal knife cut across width of sealant joint from one substrate to other substrate.
 - 3) Make one vertical cut along one side of substrate, downward starting at horizontal cut, approximately 3 in long.
 - 4) Make second horizontal knife cut across width of sealant joint from one substrate to other substrate at opposite end of 3 in long first cut.
 - 5) Grasp 3 in long piece of sealant flap firmly and pull at not less than 90 degree angle.
 - 6) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in gauge length before releasing from substrate adhesively.
 - 4. Reports: Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- D. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements

3.6 CLEANING

- A. Remove excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

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3.7 PROTECTION

- A. Protect during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

3.8 JOINT SEALANT SCHEDULE

- A. Exterior Elastomeric Sealant Applications:
 - 1. Exterior Pourable Urethane Sealant:
 - a. Moving joints in exterior concrete walks and drives.
 - 2. Exterior Non-sag Silicone Sealant:
 - a. Moving joints on exterior side of exterior walls.
 - b. Gaps between building materials and components created by items penetrating the primary drainage surface of the exterior building envelope.
 - c. Joints between dissimilar materials on exterior side of exterior walls.
 - 3. Exterior Air and Water Barrier Sealant:
 - a. Exterior moving and non-moving joints sealed to weather barrier materials.
 - 4. Exterior Non-Sag Urethane Sealant:
 - a. Moving joints at precast concrete seating bowl:
- B. Interior Elastomeric Sealant Applications:
 - 1. Interior Non-sag Silicone Sealant:
 - a. Non-moving joints in moist or damp areas which are susceptible to mildew.
 - b. Non-moving joints in toilet rooms.
 - 2. Interior Non-sag Urethane Sealant:
 - a. Building joints on interior side of exterior walls where joint movement is anticipated.
 - 3. Interior Non-sag Acrylic Latex Sealant:
 - a. Non-moving joints where another type of sealant is not otherwise specified or scheduled.
 - b. Minimal moving joints due to temperature change.
- C. Sprayed Foam Insulating Gap Filler Applications:
 - 1. Exterior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations beneath weather-resistant coverings.

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2. Interior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations.

END OF SECTION

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SECTION 079513

EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Expansion control assemblies and supplementary items necessary for installation.
 - 1. Floor, wall, and ceiling interior expansion joint covers.
 - 2. Wall exterior expansion joint covers.
 - 3. Roof / membrane expansion joint covers.
- B. Related Requirements:
 - 1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 DEFINITIONS

- A. Minimum and Maximum Joint Widths: The extreme joint widths anticipated for an expansion joint.
- B. Nominal Joint Width for Thermal Movement: The anticipated width of an expansion joint at local mean temperature.
- C. Movement Capability: The plus or minus percentage of change relative to the nominal joint width.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation. Distinguish between shop and field-assembled work.
 - 1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
 - a. Provide factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

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2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how factory-fabricated transitions, terminations and other components interconnect and terminate.
- C. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.
- D. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information:
 1. Manufacturer and model number for each joint system.
 2. Joint system location cross-referenced to Drawings.
 3. Nominal joint width.
 4. Movement capability.
 5. Classification as thermal or seismic.
 6. Materials, colors, and finishes.
 7. Product options.
 8. Fire-resistance ratings.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranty:
 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 MOCKUPS

- A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

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1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- B. Store packaged materials to protect them from elements or physical damage.

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1.9 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate installation of exterior expansion joint assemblies to ensure that transitions are watertight.

1.11 WARRANTY

- A. Manufacturer's Warranty for Roofing and Waterproofing Membrane Expansion Joint Systems: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor defects for a period of 20 years from date of Substantial Completion.
 - a. Includes transitions and terminations of expansion joint systems.
- B. Installer's Warranty for Roof Expansion and Waterproofing Membrane Expansion Joint Systems: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
 - a. Includes transitions and terminations of expansion joint systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

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- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Exterior and Roof Joint Assemblies: Provide moisture barrier and drainage system as required to maintain continuity and watertightness of exterior building enclosure.
 - 2. Fire-Resistance-Rated / Smoke Barrier Joint Assemblies: Provide fire barrier as required to maintain fire-resistance rating and integrity of smoke barrier assemblies.
 - 3. Acoustically Rated Joint Assemblies: Provide acoustical barrier as required to maintain acoustical performance of acoustically rated partitions. Refer to Drawings for partition types and STC ratings.
- B. Structural Loads and Movement: Engineer products and systems to withstand loads and movement within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind sway, seismic, and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
 - 1. Expansion Joint Design Criteria: Comply with ASTM E 1399 Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
 - a. Type of Movement: Thermal and Wind sway.
 - 1) Nominal Joint Width: As indicated on Drawings.
 - 2) Minimum Joint Width: As indicated on Drawings.
 - 3) Maximum Joint Width: As indicated on Drawings.
 - b. Seismic Movement:
 - 1) Joint Movement: As indicated on Drawings.

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2. Load Capacity: Vehicular and Pedestrian Design Load and Load Contact Area as recommended by joint manufacturer in accordance with IBC Table 1607.1.
- C. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- D. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency acceptable to authorities having jurisdiction.
 1. Fire-Resistance Rating: Provide manufacturer's standard fire barrier assembly, not less than that indicated on Drawings and adjacent construction.
- E. Accessibility Requirements for Floor Expansion Joint Systems: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)" and ICC A117.1.

2.5 ARCHITECTURAL JOINT SYSTEMS, GENERAL

- A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where joint changes direction or abuts other materials.
 2. Include factory-fabricated closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.

2.6 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

- A. Floor-to-Floor Joint Systems: Manufacturers and Products:
 1. Type 04:
 - a. Construction Specialties, Inc. (C/S Group); GFT Series.
 - b. InPro Corporation JointMaster; 120 Series.
 - c. MM Systems Corporation; FSNE Series. (Basis of Design)
 - d. Sika Corp.; Watson Bowman Acme CWF Series.
- B. Floor-to-Wall Joint (Corner) Systems: Manufacturers and Products:
 1. Type 07:
 - a. Construction Specialties, Inc. (C/S Group); GFT Series.
 - b. InPro Corporation JointMaster; 120 Series.
 - c. MM Systems Corporation; FSNE Series. (Basis of Design)
 - d. Sika Corp.; Watson Bowman Acme LPF Series.
- C. Wall-to-Wall (Corner) Joint Systems: Manufacturers and Products:
 1. Type 30:

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- a. Architectural Art Mfg., Inc.; R Series.
- b. InPro Corporation JointMaster; 114 Series.
- c. MM Systems Corporation; VSWL Series. (Basis of Design)
- d. Sika Corp.; Watson Bowman Acme CWW Series.

D. Ceiling-to-Wall (Corner) Joint Systems: Manufacturers and Products:

1. Type 27:

- a. Architectural Art Mfg., Inc.; J Series.
- b. InPro Corporation JointMaster; 101 Series.
- c. MM Systems Corporation; FSWPL Series. (Basis of Design)
- d. Sika Corp.; Emseal Wabo CorridorWrap.

2.7 WALL EXTERIOR EXPANSION JOINT COVERS

A. Exterior Preformed Foam Wall Joint Seals: Manufacturer's standard joint seal consisting of pre-compressed hydrophobic foam backer seal impregnated with a nondrying, water-repellent agent and factory pre-coated silicone cover to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

- 1. Basis-of-Design Product; Johns Manville; Expand-O-Flash. Watertight Expansion Joint.
- 2. Manufacturers and Products:
 - a. Construction Specialties, Inc. (C/S Group); VF Series.
 - b. InPro Corporation; 1200 Series Foam Seal.
 - c. Sika EMSEAL; Seismic Colorseal Series. Watertight Expansion Joint.
- 3. Application: As indicated on Drawings.
- 4. Color: As selected by Architect from manufacturer's standards.

2.8 FLEXIBLE GUTTER AND DRAIN TUBE SYSTEM

A. Description: Manufacturer standard secondary moisture control and collection system consisting of flexible, reinforced neoprene gutter profile that satisfies the required design movement and compresses without damage during full joint closure. Gutter profile shall contain and drain excess amounts of collected moisture through a drain tube that exhibits similar flexibility. System secures to underside of concrete slab substrate by utilizing anchored retainer profile.

- 1. Basis of Design: Sika Corp.; Watson Bowman Acme WaboGutterFlex, Model USG; total joint opening sizes as required to meet specific joint movement criteria.
- 2. Gutter Profile Materials: 0.062 in thick single ply fabric reinforced neoprene sheet. Width of profile shall be governed by joint type and movement requirements.
- 3. Drain Tube: 1-1/2 in inside diameter by 1/8 in thick wall clear PVC flexible tubing. Length shall be as required for final connection.
- 4. Transition Element: Premolded 0.060 in thick EPDM tapered profile with pre-taped flange and adhesive for proper bonding to underside of gutter profile.
- 5. Retainer Profile: 3/16 in thick aluminum 5052-H32 alloy, mill finish, preformed to receive a continuous bead of edge sealant and pre-drilled for anchors at 16 in on center.
- 6. Edge Sealant: Manufacturer recommended one-part polyurethane moisture cure sealant.

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- 7. Anchors: Manufacturer's standard 1/4 in diameter by 1-3/4 in long countersunk flathead concrete screw anchor. Carbon steel anchor shall receive factory fluoropolymer coating.
- B. Locations: Exterior floor, roof, plaza deck and parking deck joint cover assemblies.

2.9 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.
- C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- D. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- E. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.10 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Mill Finish for Floor Covers: AA-M10 (Mechanical Finish: as fabricated; no other applied finish unless buffing is required to removed scratches, welding, or grinding produced in fabrication process).
- E. Clear Anodic Finish for Wall and Ceiling Covers: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.

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2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.12 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
 1. Provide at exterior joint assemblies and where indicated on Drawings.
- B. Fasteners and Anchors: Manufacturer's recommended standard or stainless steel fasteners and attachment devices: suitable for application and load capacity. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.
- C. Roofing Cement: ASTM D 4586, Type II.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and to remain watertight as recommended by manufacturer.
 1. Refer to Division 7 Section Joint Sealants.
- E. Mineral-Fiber Blanket Insulation: ASTM C 665.
 1. Refer to Division 7 Thermal Insulation.
- F. Silicone Extrusions: Classified according to ASTM D 2000, UV stabilized, and do not propagate flame.
- G. Epoxy Grout Fill:
 1. General: Use epoxy grout fill in accordance with manufacturer's application limitations, precautions, and directions for use, including but not limited to surface preparation, mixing, placing, curing, and compatibility with substrate conditions.
 2. Description: Multi-component, high strength epoxy grout.
 3. Manufacturers and Products:
 - a. BASF Construction Chemicals; MasterFlow 648.
 - b. Laticrete; L&M EpoGrout 758 Epoxy Structural Grout.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
 - 1. Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.
- C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.4 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

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2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.
 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 4. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted unless specifically allowed by the manufacturer in writing for this installation.
 5. Locate anchors at interval recommended by manufacturer, but not less than 3 in from each end and not more than 24 in on center.
- C. Elastomeric Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.
1. Install each length of seal immediately after removing protective wrapping.
 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- G. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- H. Moisture Barrier: Provide moisture barrier and drainage at exterior joints and where indicated on Drawings. Provide drainage fittings and connect to drains.
- I. Roof Expansion Assemblies: Extend assemblies over curbs, parapets, cornices, gutters, valleys, fasciae, and other elements in the construction profile, with factory-fabricated intersections and transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.

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1. Install factory-fabricated transitions between roof expansion assemblies and building architectural joint systems to provide continuous, uninterrupted, watertight construction.
 2. Splice roof expansion assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.
 3. Provide uniform profile of roof expansion assembly throughout length of each installation; do not stretch polymeric sheets.
 4. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.
 5. Bed anchorage flanges in roofing cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer but not less than 6 in on center.
- J. Flexible Gutter and Drain Tube System: Install in accordance with manufacturer written instructions.
1. Flexible gutter profile shall be continuous along length of joint.
 2. Seal and anchor flexible gutter system to substrate. Refer to manufacturer instructions for capping ends.
 3. Drain tube assemblies shall be spaced at approximately 25 ft center to center along length of joint or as indicated on the Drawings.
 4. Attach drain tube assembly. Using hand roller, apply direct pressure to flange ensuring full contact and proper adhesion.

3.5 CONNECTIONS AND TRANSITIONS

- A. Prefabricated Joint Transition Assemblies: Coordinate transitions and terminations of expansion joint covers between each type of application and installation. Provide factory-fabricated units at all joint transitions and terminations, including but not limited to waterproofing, exterior walls, soffits, and roof expansion joint cover assemblies.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

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3.7 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that expansion joint assemblies are without damage or deterioration at time of Substantial Completion.
 - 1. Where construction traffic is anticipated, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

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SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Custom hollow metal doors and frames and supplementary items necessary for installation:
 - 1. Interior custom hollow-metal doors and frames.
 - 2. Exterior custom hollow-metal doors and frames.
- B. Related Requirements:
 - 1. Division 08 Section Door Hardware for door hardware for hollow-metal doors.
 - 2. Division 13 Section Radiation Protection for lead-lined, hollow-metal doors and frames.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803.
- B. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.
- C. Interior: Areas located in conditioned spaces.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Door core materials and construction.
 - 3. Factory priming or finishing specifications.
 - 4. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 - 2. Elevations of each door type.
 - 3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 5. Locations of reinforcement and preparations for hardware.
 - 6. Details of each different wall opening condition.

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7. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
8. Details of anchorages, joints, field splices, and connections.
9. Details of accessories.
10. Details of moldings, removable stops, and glazing.
11. Clearances.

C. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Oversize Construction Certification: Documentation for assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

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- C. Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80 and NFPA 101.
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAl) certification.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- C. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
- C. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.
- D. Thermally Rated Exterior Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.
- E. Exterior Door Air Infiltration: Maximum air leakage of 0.20 cfm/sf (0.09 L/s per sq m) when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sf (75 Pa).

2.3 INTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

- A. Interior Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A.
 - 1. Locations:
 - a. Interior doors and frames.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - d. Door Edge Construction: Seamless, continuously welded with no visible seam.
 - 1) End Channels: Close top and bottom edges with continuous flush channels, minimum thickness of 0.053 inch, fabricated from same material as face sheets and spot welded to face sheets.
 - e. Core Construction: Steel stiffened.
 - 1) Welded Vertical Steel Stiffeners: Manufacturer's standard vertical steel stiffener extending full-door height, spot welded to face sheets. Fill spaces between stiffeners with mineral-fiber insulation.

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- f. Fire-Rated Core Construction: Manufacturer's standard vertical steel stiffener core for fire-rated doors.
- 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch, except 0.067 inch for openings exceeding 4 feet wide.
 - b. Sidelite and Transom Frames: Fabricated from same material as adjacent door frame.
 - c. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.
 - 1) Knocked down frame construction not permitted.
- 4. Exposed Finish: Prime.

2.4 EXTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

- A. Exterior Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A.
 - 1. Locations:
 - a. Exterior doors and frames.
 - b. All doors and frames in central energy plants.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60 or A60 coating.
 - d. Door Edge Construction: Seamless, continuously welded with no visible seam.
 - 1) End Channels: Close top and bottom edges with continuous flush channels, minimum thickness of 0.053 inch, fabricated from same material as face sheets and spot welded to face sheets.
 - e. Top Edge Closures: Seal joints against water penetration.
 - f. Bottom Edge Closures: Provide weep hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core Construction: Steel stiffened.
 - 1) Welded Vertical Steel Stiffeners: Manufacturer's standard vertical steel stiffener extending full-door height, spot welded to face sheets. Fill spaces between stiffeners with mineral-fiber insulation.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum G60 or A60 coating.
 - b. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

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- 1) Knocked down frame construction not permitted.

4. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Borrowed Lite Frames: Fabricate from same materials, construction, and finish as door frame assemblies.
- B. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.
 1. Knocked down frame construction not permitted.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

- A. Jamb Anchors:
 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 in (1.10 mm) thick.
 - b. Masonry Type: Adjustable Z-clip type or T-shaped anchors to suit frame size, not less than 0.042 in (1.10 mm) thick, with corrugated or perforated straps not less than 2 in (50 mm) wide by 10 in (250 mm) long.
 2. Quantity and Location:
 - a. Stud-Wall Type: Locate anchors not more than 18 in from top and bottom of frame. Space anchors not more than 32 in on centers and as follows:
 - 1) Three anchors per jamb up to 60 in high.
 - 2) Four anchors per jamb from 60 to 90 in high.
 - 3) Five anchors per jamb from 90 to 96 in high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 in or fraction thereof above 96 in high.
 - 5) Two anchors per head for frames above 42 in wide and mounted in metal-stud partitions.

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- b. Masonry Type: Locate anchors not more than 18 in from top and bottom of frame. Space anchors not more than 32 in on centers and as follows:
 - 1) Two anchors per jamb up to 60 in high.
 - 2) Three anchors per jamb from 60 to 90 in high.
 - 3) Four anchors per jamb from 90 to 120 in high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 in or fraction thereof above 120 in high.
- 3. Postinstalled Expansion Anchor for In-Place Concrete or Masonry: Countersunk, flat or oval head exposed screws and bolts, Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor; fabricated from same material as frames and welded to bottom of jambs and mullions, minimum thickness 0.0428 in (1.10 mm), terminate bottom of frames at top of finish floor.
 - 1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
- C. Floor Anchors for Concrete Slabs with Underlayment/Topping: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls and other exterior locations, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.8 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating. Thickness indicated is for uncoated steel.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
 - 1. Available Manufacturers:
 - a. Construction Materials, Inc.
 - b. Heckman Building Products, Inc.
 - c. Hilti Corp.
 - d. ITW Ramset/Red Head.

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- e. Powers Fasteners.
 - f. Simpson Strong Tie Anchor Systems.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Division 08 Section Glazing.

2.9 FABRICATION

- A. General Requirements: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Factory fit and assemble units in manufacturer's plant.
- 1. Manufacturing Standards: ANSI/NAAMM-HMMA 861.
- B. Hollow-Metal Doors: Fabricate doors not less than 1-3/4 in (44 mm) thick, seamless hollow metal construction unless otherwise indicated. Construct doors with smooth surfaces and without visible joints or seams on exposed faces.
- C. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- D. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
- 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
- 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware. Minimum Reinforcing Thickness for Door Hardware:
 - a. Hinges and Pivots: 0.167 in (4.2 mm) thickness by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge.
 - b. Locks, Strikes, Flush Bolts and Closers: 0.093 in (2.3 mm) thickness.
 - c. Surface Mounted Hold Open Arms and Panic Devices: 0.093 in (2.3 mm) thickness.

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- d. Other Surface Applied Hardware: 0.067 in (1.7 mm) thickness.
- 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- 3. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections
- F. Glazed Lites: Provide continuous frame for glazed openings between face sheets; miter corners, weld frame to face sheets, and grind smooth. Provide stops and moldings around glazed lites. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Provide stops and moldings around glazed lites, flush with face of door, and with square stops unless otherwise indicated.
 - a. Use same materials as door face sheet for frame and loose stop for flush glazing
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed formed frame on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - a. Do not overlap frame molding on face of door.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.10 STEEL FINISHES

- A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products for recommendations for cleaning, treating, priming, and when specified, finishing.
- B. Uncoated Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, Solvent Cleaning; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, Power Tool Cleaning, or SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
- C. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with primer. Clean welds, mechanical connections, abraded areas and apply galvanizing repair paint.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and other surfaces; comply with SSPC-Paint 20.
- D. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- E. Field Applied Coatings: Comply with Division 09 Section Painting for substrate preparation and painting requirements.

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2.11 LOUVERS

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
- B. Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support recommended by manufacturer. Provide louvers with minimum of 50% free air area unless indicated otherwise.
- C. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

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3.4 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with NAAMM-HMMA 840.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 - 3. Floor Anchors: Secure with post-installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Sound Rated Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 5. Exterior Walls: Solidly fill space between frames wall construction with mineral-fiber insulation unless indicated otherwise.
 - 6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - a. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 7. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 8. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
 - 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
 - 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

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- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.6 ADJUSTMENTS AND REPAIRS

- A. Final Adjustments: Remove and replace defective hollow metal work, including work that is warped, bowed, or otherwise unacceptable.
- B. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
 - 1. Inspect hollow metal frames located in wet areas and bathrooms; prepare and reprime damaged areas to prevent rusting and bleed through.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

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SECTION 081216

INTERIOR ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes interior aluminum frames for doors and glazing installed in gypsum board partitions and supplementary items necessary for installation.
- B. Related Section:
 - 1. Division 08 Section "Interior Storefront" for interior aluminum storefront installations.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:
 - 1. Include elevations, sections, and installation details for each wall-opening condition.
 - 2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Include locations of reinforcements and preparations for hardware.
 - 4. Include details of anchorages, joints, field splices, connections, and accessories.
 - 5. Include details of moldings, removable stops, and glazing.
 - 6. Include details of conduits and preparations for power, signal, and control systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Framing Member and Finish: 12 inches long. Include trim.
 - 2. Corner Fabrication: 12 by 12 in long, full-size window corner, including full-size sections of extrusions with factory-applied color finish.
- D. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum frames to include in maintenance manuals.

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1.4 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Store frames under cover at Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.
 - 1. Dual Lock Partition Systems, Inc.; Avalon International Aluminum.
 - 2. Frameworks Manufacturing Inc.; a Div. of ASSA ABLOY.
 - 3. Fry Reglet Architectural Systems.
 - 4. RACO Interior Products, Inc.
 - 5. Western Integrated Materials, Inc.
 - 6. Wilson Partitions.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Frames: Frames for fire-rated door assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Frames for Smoke- and Draft-Control Assemblies: Tested according to UL 1784 and installed in compliance with NFPA 105.
 - a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg.

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2.4 INTERIOR ALUMINUM DOOR FRAMES AND GLAZING FRAMES

- A. Aluminum Framing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 in thick.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
 - 1. Fire-Protection Rating: Fabricate aluminum frame assemblies to provide fire protection rating as scheduled.
- C. Glazing Frames: Extruded aluminum, for glazing thickness indicated.
- D. Ceiling Tracks: Extruded aluminum.
- E. Trim: Extruded aluminum, not less than 0.062 in thick, with removable snap-in casing trim, glazing stops, and door stops without exposed fasteners.
- F. Frame and Trim Finish:
 - 1. Color: As scheduled or indicated in Design Selections.

2.5 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals.
- C. Smoke Seals for Fire-Rated Installations: Intumescent strip or fire-rated gaskets.
 - 1. Color: As selected by Architect from manufacturer standard colors.
- D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated.
- E. Glass and Glazing: Comply with requirements in Division 08 Section Glazing.
- F. Door Hardware: Comply with requirements in Division 08 Section Door Hardware.

2.6 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.
- B. Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as required by fire-rated label for assembly.

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- C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
 - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- D. Fabricate components to allow secure installation without exposed fasteners.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Finish Selections: As scheduled or indicated in Design Selections.

2.8 ALUMINUM FINISHES

- A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.
- B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.

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2. Accepted submittals.
3. Contract Documents.

- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.
1. Fire-Rated and Smoke-Control Assemblies: At fire-protection-rated openings, install interior aluminum frames according to NFPA 80 and NFPA 105.
- B. Install frame components in the longest possible lengths; components up to 96 in long must be one piece.
1. Frames Supported by Suspended Ceiling: Fasten to suspended ceiling grid on maximum 48 in centers, using sheet metal screws or other fasteners approved by frame manufacturer.
 2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
 3. Secure clips to extruded main-frame components and not to snap-in or trim members.
 4. Do not leave screws or other fasteners exposed to view when installation is complete.
- C. Glass: Install glass according to Division 8 Section Glazing and aluminum-frame manufacturer's written instructions.
- D. Doors: Install doors aligned with frames and fitted with required hardware.
- E. Door Hardware: Install according to Division 8 Section Door Hardware and aluminum-frame manufacturer's written instructions.

3.5 ADJUSTING

- A. Inspect installation, correct misalignments, and tighten loose connections.
- B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly, and lubricate as recommended by manufacturer.
- C. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.
- D. Touch up marred frame surfaces so touchup is not visible from a distance of 48 in. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

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3.6 FINISH SCHEDULE

A. Fluoropolymer Finish:

1. Color and Gloss: Match Architect's sample.

END OF SECTION

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SECTION 081416

SOLID CORE FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Solid core flush wood doors, finishing and supplementary items necessary for installation.
 - 1. Five-ply flush wood veneer-faced doors for transparent finish.
 - 2. Five-ply flush wood doors for opaque finish.
 - 3. Factory finishing flush wood doors.
 - 4. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Division 06 Section Interior Architectural Woodwork for requirements for veneers from the same flitches for both flush wood doors and wood paneling.
 - 2. Division 08 Section Glazing for glass panels in flush wood doors.
 - 3. Division 13 Section Radiation Protection for lead-lined flush wood doors.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Door core materials and construction.
 - 3. Door edge construction, light frames, and trim for openings.
 - 4. Door face type and characteristics.
 - 5. Door trim for openings.
 - 6. Factory-machining criteria.
 - 7. Factory priming or finishing specifications.
 - 8. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of frame for each frame type, including dimensions and profile.
 - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.

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5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory primed or finished and application requirements.

C. Samples for Verification:

1. Transparent and Opaque Finish Doors: Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Light Frames: Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- B. Warranty:
 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80 and NFPA 101.
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAl) certification.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.

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- C. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration.
- D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4-inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors and frames.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Algoma Hardwoods, Inc.
 - 2. Eggers Industries.
 - 3. Marshfield Door Systems, Inc.
 - 4. Mohawk Flush Doors, Inc.; a Masonite Company.
 - 5. Oshkosh Architectural Door Company.

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6. VT Industries Inc.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
 - 1. Obtain flush wood doors and wood paneling from single manufacturer when doors are indicated to blueprint match paneling.

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.4 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Use only materials that comply with referenced standards and other requirements specified.
- B. Quality Standard: In addition to requirements specified, comply with AWI "Architectural Woodwork Standards."
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
 - 2. Performance Grade by Location:
 - a. ANSI/WDMA I.S. 1A Heavy Duty: Typical locations, unless indicated otherwise below.
 - b. ANSI/WDMA I.S. 1A Extra Heavy Duty: Locations include classrooms, public toilets, janitor's closets, assembly spaces, exits, patient rooms, and where indicated on Drawings.
- C. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- D. Solid Core Doors, General:
 - 1. Edge Construction:

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- a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a) Screw-Holding Capability: Extra Heavy Duty, 550 lbf; Heavy Duty, 475 lbf in accordance with WDMA T.M. 10.
 - b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a) Screw-Holding Capability: Extra Heavy Duty, 550 lbf; Heavy Duty, 475 lbf in accordance with WDMA T.M. 10.
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: Extra Heavy Duty, 550 lbf; Heavy Duty, 475 lbf in accordance with WDMA T.M. 10.
2. Core for Non-Fire-Rated Doors:
- a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and as follows:
 - a) 5-inch top-rail blocking.
 - b) 5-inch bottom-rail blocking.
 - c) 5-by-10-inch lock blocks.
 - 2) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices.
 - b. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Door Face: Extra Heavy Duty, 550 lbf; Heavy Duty, 475 lbf.
 - 2) Screw Withdrawal, Vertical Door Edge: Extra Heavy Duty, 550 lbf; Heavy Duty, 475 lbf.
3. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

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- a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware and as follows:
 - 1) 5-inch top-rail blocking.
 - 2) 5-inch bottom-rail blocking.
 - 3) 5-inch midrail blocking, in doors indicated to have armor plates.
 - 4) 5-by-10-inch lock blocks or 5-inch midrail blocking, in doors indicated to have exit devices.
 - 5) 5-by-10-inch lock blocks.
- 4. Solid Core Door Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 SOLID-CORE FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

- 1. Architectural Woodwork Standards Grade: Premium, with Grade AA wood veneer faces.
- 2. Faces: Single plywood veneer not less than 1/50 inch thick.
- 3. Species and Cut: As scheduled or indicated in Design Selections.
 - a. Match between Veneer Leaves: Book or Slip match as indicated
 - b. Assembly of Veneer Leaves on Door Faces: Center-balance or Balance match as indicated
 - c. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - d. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
 - e. Transom Match: Continuous match.
 - f. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in "Interior Architectural Woodwork."
- 4. Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces; sanded eased edges.
- 5. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.
 - a. Top Edges Exposed to View: Match exposed vertical edges.

2.6 SOLID-CORE FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Solid-Core Five-Ply:

- 1. Architectural Woodwork Standards Grade: Premium.
- 2. Faces: MDO.

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- a. Apply MDO to standard-thickness, closed-grain, hardwood face veneers.
- 3. Finish Selection: As scheduled or indicated in Design Selections.
- 4. Vertical Edges: Any closed-grain hardwood; sanded eased edges.
- 5. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.
 - a. Top Edges Exposed to View: Match exposed vertical edges.

2.7 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species and finish as door faces.
 - 2. Profile: Flush rectangular beads.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
 - 4. Glass: Comply with Division 08 Glazing.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
 - 1. Glass: Comply with Division 08 Glazing.

2.8 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 2. Comply with NFPA 80 requirements for fire-rated doors.
 - a. Do not trim stiles and rails in excess of limits permitted for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
- C. Seal edges of doors, edges of cutouts, and mortises with sealer coat after fitting and machining.
- D. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.

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2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Glazing.
3. Louvers: Factory install louvers in prepared openings.

2.9 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 2. Finish faces, all four edges, edges of cutouts, and mortises.
 3. Stains and fillers may be omitted on edges of cutouts, and mortises.
- B. Factory finish doors, unless indicated otherwise.
- C. Transparent Finish:
 1. Architectural Woodwork Standards Grade: Same grade for finish as specified for doors.
 2. Architectural Woodwork Standards System-5, Varnish, Conversion.
 3. Staining, Effect and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.
- D. Opaque Finish:
 1. Architectural Woodwork Standards Grade: Same grade for finish as specified for doors.
 2. Architectural Woodwork Standards System-5, Varnish, Conversion.
 3. Color and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.

3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

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3.3 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Hardware: For installation, see Division 8 Section Door Hardware.
- C. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- D. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.
 - 3. Install fire-rated doors and frames in accordance with NFPA 80.
 - 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
 - 1. Clearances:
 - a. Head, Jambs and Pairs of Doors: Provide 1/8-inch maximum at heads, jambs, and between pairs of doors.
 - b. Between Bottom of Door and Top of Threshold: Where threshold is shown or scheduled, provide 1/4-inch maximum from bottom of door to top of threshold unless otherwise indicated.
 - c. Between Bottom of Door and Top of Finished Floor Material - No Threshold: Provide 3/4-inch maximum from bottom of door to top of finished floor material unless otherwise indicated on Drawings.
 - d. Between Bottom of Door and Top of Finished Floor Material - No Threshold and Bottom of Door is more than 38 inches above the Finished Floor: Provide 3/8-inch maximum from bottom of door to top of finished floor material or comply with manufacturer's door labeling procedure.
- F. Factory-Finished Doors: Restore finish before installation when fitting or machining is required at Project site.

3.4 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

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B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80.
2. Egress Door Inspections: When applicable, inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and when applicable, NFPA 101.

3.5 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 081426

HOLLOW CORE WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Hollow core wood doors, finishing and supplementary items necessary for installation.
 - 1. Hollow-core flush wood veneer-faced doors for transparent finish.
 - 2. Hollow-core flush wood doors for opaque finish.
 - 3. Wood door frames.
 - 4. Factory finishing doors.
 - 5. Factory fitting doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Door core materials and construction.
 - 3. Door edge construction.
 - 4. Door face type and characteristics.
 - 5. Door frame construction.
 - 6. Factory-machining criteria.
 - 7. Factory priming and finishing specifications.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door and frame location, type, size, and swing.
 - 2. Door elevations, dimension and locations of hardware.
 - 3. Details of frame for each frame type, including dimensions and profile.
 - 4. Dimensions and locations of blocking for hardware attachment.
 - 5. Dimensions and locations of mortises and holes for hardware.
 - 6. Clearances and undercuts.
 - 7. Doors to be factory primed or finished and application requirements.
- C. Samples for Verification:
 - 1. Transparent and Opaque Finish Doors: Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

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D. INFORMATIONAL SUBMITTALS

1. Warranty:

- a. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.3 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration.
- D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.6 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period for Interior Doors: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Masonite.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Basis of Design: Masonite; Interior Residential Hollow Core Doors.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A
 - 1. Performance Grade:
 - a. ANSI/WDMA I.S. 1A Standard Duty: Typical locations.
- B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

2.4 HOLLOW-CORE WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors, Hollow-Core Veneer-Faced:
 - 1. ANSI/WDMA I.S. 1A Grade: Custom.
 - 2. Species and Cut: As scheduled or indicated in Design Selections.
 - 3. Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces; sanded eased edges.
 - 4. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.
 - a. Top Edges Exposed to View: Match exposed vertical edges.
 - 5. Construction: Standard hollow core.
 - 6. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. 5-by-18-inch lock blocks.

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2.5 HOLLOW-CORE WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Hollow Core:

1. ANSI/WDMA I.S. 1A Grade: Custom.
2. Faces: Hardboard or MDF.
 - a. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
 - b. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
3. Vertical Edges: Any closed-grain hardwood.
4. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.
 - a. Top Edges Exposed to View: Match exposed vertical edges.
5. Construction: Standard hollow core.
6. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. 5-by-18-inch lock blocks.

2.6 WOOD DOOR FRAMES

A. Interior Frames:

1. ANSI/WDMA I.S. 1A Grade: Match grade indicated for doors.
2. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
3. Wood Moisture Content: Comply with requirements of referenced quality standard.
4. Profile: Single rabbet unless indicated otherwise on Drawings.

B. Construction: Solid lumber, particleboard, or medium density fiberboard (MDF) with veneered exposed surfaces.

2.7 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in frames, to verify dimensions and alignment before factory machining.

C. Seal edges of doors, edges of cutouts, and mortises with sealer coat after fitting and machining.

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2.8 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on edges of cutouts, and mortises.
- B. Factory finish doors, unless indicated otherwise.
- C. Transparent Finish:
 - 1. ANSI/WDMA I.S. 1A Grade: Same grade for finish as specified for doors.
 - 2. ANSI/WDMA I.S. 1A TR-4 Conversion Varnish.
 - 3. Staining, Effect and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.
- D. Opaque Finish:
 - 1. ANSI/WDMA I.S. 1A Grade: Same grade for finish as specified for doors.
 - 2. ANSI/WDMA I.S. 1A OP-4 Conversion Varnish.
 - 3. Color and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.

3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

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3.3 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Hardware: For installation, see Division 8 Section Door Hardware.
- C. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- D. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
 - 1. Clearances:
 - a. Head, Jambs and Pairs of Doors: Provide 1/8-inch maximum at heads, jambs, and between pairs of doors.
 - b. Between Bottom of Door and Top of Threshold: Where threshold is shown or scheduled, provide 1/4-inch maximum from bottom of door to top of threshold unless otherwise indicated.
 - c. Between Bottom of Door and Top of Finished Floor Material - No Threshold: Provide 3/4-inch maximum from bottom of door to top of finished floor material unless otherwise indicated on Drawings.
- F. Factory-Finished Doors: Restore finish before installation when fitting or machining is required at Project site.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Access doors and frames and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Ceiling Coordination Drawings for Access Doors at Ceilings: Furnish reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other. Indicate method of attaching door frames to surrounding construction.
- D. Samples for Verification Purposes: For each door face material, at least 3 in by 5 in in size, in specified finish.
- E. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for vertical access doors and frames.
 - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.

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- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Metal Doors and Frames:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. Dur-Red Products.
 - d. J. L. Industries, Inc.
 - e. Karp Associates, Inc.
 - f. Larsen's Manufacturing Company.
 - g. Maxam Metal Products, Ltd.
 - h. Milcor Inc.
 - i. Nystrom, Inc.
 - j. Williams Brothers Corporation of America.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36 / A 36M.
 - 1. ASTM A 123 / A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153 / A 153M, for galvanizing steel and iron hardware.

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- B. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008 / A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924 / A 924M.
- D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning", to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning", or SSPC-SP 8, "Pickling".
 - 2. Surface Preparation for Metallic-Coated (Galvanized) Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- E. Drywall Beads: Edge trim formed from 0.0299 in zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.
- F. Plaster Beads: Casing bead formed from 0.0299 in zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.4 STAINLESS-STEEL MATERIALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Finish: Directional No. 4 Satin Finish.

2.5 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Non-rated Flush Access Doors and Frames with Exposed Trim:
 - 1. Locations:
 - a. Masonry wall surfaces.
 - b. Ceramic tile wall surfaces.
 - 2. Fabricated from one of the following as scheduled at the end of this Section.
 - a. Steel sheet.
 - b. Metallic-coated (galvanized) steel sheet.

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- c. Stainless-steel sheet.
 - 3. Door: Minimum 0.075 in thick sheet metal, set flush with exposed face flange of frame.
 - 4. Frame: Minimum 0.060 in thick sheet metal with 1-1/4 in wide, surface-mounted trim.
 - 5. Hinges: Continuous piano.
 - 6. Lock: Key-operated cylinder.
 - 7. Size: 12 in by 12 in unless otherwise indicated.
 - 8. Basis of Design: Nystrom Building Products, Model NT.
- B. Non-rated Flush Access Doors and Trimless Frames:
- 1. Locations: Wall and ceiling surfaces as scheduled.
 - a. Gypsum board wall and ceiling surfaces.
 - b. Plaster wall and ceiling surfaces.
 - 2. Fabricated from one of the following as scheduled at the end of this Section.
 - a. Steel sheet.
 - b. Metallic-coated (galvanized) steel sheet.
 - c. Stainless-steel sheet.
 - 3. Door: Minimum 0.075 in thick sheet metal, set flush with surrounding finish surfaces.
 - 4. Frame: Minimum 0.060 in thick sheet metal with drywall bead flange.
 - 5. Hinges: Continuous piano.
 - 6. Lock: Key-operated cylinder.
 - 7. Size: 12 in by 12 in unless otherwise indicated.
 - 8. Basis of Design: Nystrom Building Products, Model NW or NP as applicable.
- C. Non-rated, Flush, Gasketed Draft Stop Access Doors and Trimless Frame:
- 1. Locations: Gypsum board monolithic ceiling surfaces as scheduled.
 - 2. Fabricated from: Steel sheet.
 - 3. Door: Minimum 0.075 in thick sheet metal, set flush with surrounding finish surfaces.
 - 4. Frame: Minimum 0.060 in thick sheet metal with drywall bead flange.
 - 5. Hinge: Concealed piano hinge or spring-loaded, concealed-pin type pivoting rod hinge.
 - 6. Lock: Key-operated cylinder.
 - 7. Size: 12 in by 12 in unless otherwise indicated.
 - 8. Options: Gasketing installed.
 - 9. Basis of Design: Nystrom Building Products; Model DWK.
- D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim:
- 1. Locations:
 - a. Masonry wall surfaces.
 - b. Ceramic tile wall surfaces.
 - 2. Fabricated from one of the following as scheduled at the end of this Section.
 - a. Steel sheet.
 - b. Metallic-coated (galvanized) steel sheet.
 - c. Stainless-steel sheet.

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3. Fire-Resistance Rating: Not less than 1-1/2 hours.
4. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 in.
6. Frame: Minimum 0.060 in thick sheet metal with 1 in wide, surface-mounted trim.
7. Hinges: Continuous piano.
8. Automatic Closer: Spring type.
9. Latch: Self-latching device operated by flush key with interior release.
10. Size: 12 in by 12 in unless otherwise indicated.
11. Basis of Design: Nystrom Building Products, Model IT.

E. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames:

1. Locations:
 - a. Gypsum board wall and ceiling surfaces.
 - b. Plaster wall and ceiling surfaces.
2. Fabricated from one of the following as scheduled at the end of this Section.
 - a. Steel sheet.
 - b. Metallic-coated (galvanized) steel sheet.
 - c. Stainless-steel sheet.
3. Fire-Resistance Rating: Not less than 1-1/2 hours.
4. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 in.
6. Frame: Minimum 0.060 in thick sheet metal with drywall bead.
7. Hinges: Continuous piano.
8. Automatic Closer: Spring type.
9. Latch: Self-latching device operated by flush key with interior release.
10. Size: 12 in by 12 in unless otherwise indicated.
11. Basis of Design:
 - a. Gypsum Board: Nystrom Building Products, Model IW.
 - b. Plaster: Nystrom Building Products, Model IP.

2.6 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. Gypsum Board Locations: For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.

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2. Plaster Locations: For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 3. Provide mounting holes in frames for attachment of units to metal framing.
 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.4 INSTALLATION OF ACCESS DOORS AND FRAMES

- A. Frames with Masonry Anchors: Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

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3.5 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.6 ACCESS DOOR SCHEDULE

- A. Provide access doors where indicated on the drawings and as follows:
 - 1. Steel Access Doors:
 - a. Concealed valves and controls for plumbing and HVAC.
 - b. Fire dampers above non-accessible ceilings.
 - c. Motor operated doors and grilles above non-accessible ceilings.
 - d. Other locations not scheduled below.
 - 2. Gasketed Draft Stop Access Doors:
 - a. Ceilings in Restricted Areas of healthcare facilities, monolithic ceilings as required by code and as indicated on drawings. These areas include but are not limited to: operating rooms, central sterile areas, sub sterile areas, isolation rooms and clean utility rooms.
 - 3. Fire-Rated Steel Access Doors:
 - a. Rated walls and ceilings.
 - 4. Metallic-Coated (Galvanized) Steel Access Doors:
 - a. Exterior locations.
 - 5. Stainless Steel Access Doors:
 - a. Ceramic tile and other damp locations.

END OF SECTION

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SECTION 083323

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Overhead coiling doors and supplementary items necessary for installation.

1.2 DEFINITIONS

- A. Operation Cycle: One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
1. Include manufacturer's specifications for materials, finishes, construction details, dimensions of individual components, profiles for curtain components, installation instructions, and recommendations for maintenance.
 2. Power Operated Units: Include rated capacities, operating characteristics, and electrical characteristics. Include nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
 3. Fire-Rated or Smoke-Rated Units: For fire-rated or smoke-rated overhead coiling doors, include description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams for Power Operated Units: For power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for Verification Purposes: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Door Curtain Slats: 12 in square.
 2. Bottom Bar: 6 in long.
 3. Guides: 6 in long.
 4. Brackets: 6 in square.
 5. Hood: 6 in square.

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1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Smoke- and Draft-Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sf of door opening at 0.10 in wg for both ambient and elevated temperature tests.
- C. Electrical Components, Devices, and Accessories for Power Operated Units: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:

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- a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 3 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. The Cookson Company.
 2. Cornell Iron Works, Inc.
 3. McKeon Rolling Steel Door Company, Inc.
 4. Overhead Door Corporation.
 5. Raynor Garage Doors.
 6. Wayne-Dalton Corporation.
 7. Windsor Republic Doors.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS FOR EXTERIOR DOORS

- A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.
- B. Structural Test Performance: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - a. Standard Wind Load Design Pressures: Plus and minus 20 PSF unless indicated otherwise.
- C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283 or DASMA 105.

2.4 DOOR ASSEMBLIES

- A. Exterior Service Doors:
1. Operation Cycles: Door components and operators capable of operating for not less than 20,000 cycles.
 2. Door Curtain Material:
 - a. Insulation.

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B. Interior Service Doors, Fire-Rated:

1. Operation Cycles: Door components and operators capable of operating for not less than 20,000 cycles.
2. Door Curtain Material:
 - a. Galvanized Steel.

2.5 OVERHEAD COILING DOOR MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 - a. Curtain Sound Rating: STC-28, ASTM E 90.
 - b. System Sound Rating: STC-21 installed, ASTM E 90.
 - c. Curtain Thermal Performance: R-Value: 7.7 minimum, U-Value: 0.13.
 - d. Air Infiltration: Less than 1.00 cfm/sq.ft., ASHRAE 90.1 and IECC.
 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Endlocks: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
1. Exterior Doors: Provide windlocks.
- C. Bottom Bar: Manufacturer's standard consisting of two angles, each not less than 1-1/2 in by 1-1/2 in by 1/8 in thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
- D. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- E. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain and a continuous bar for holding windlocks.

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2.6 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that project beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Material: Match hood material with that of door curtain slat material and as follows:
 - a. Galvanized Steel: Nominal 0.028 in thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653 / A 653M.
 - 2. Locations: Provide at door units where coiled curtain and operating mechanisms are exposed and not concealed in ceiling or soffit.
 - 3. Fire-Rated and Smoke-Rated Doors: Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware".
- B. Safety Interlock Switch for Power Operated Doors: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Smoke Seals for Fire-Rated and Smoke-Rated Doors: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
 - 1. At door head, use 1/8 in thick, replaceable, continuous sheet secured to inside of hood.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8 in thick seals of flexible vinyl, rubber, or neoprene.
- C. Push/Pull Handles for Manual Doors: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
 - 1. Provide pull-down straps or pole hooks for doors more than 84 in high.
- D. Automatic-Closing Device for Fire-Rated or Smoke-Rated Coiling Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:

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1. Building fire-detection and -alarm systems and manufacturer's standard door-holder-release devices. Resetting of spring tension or mechanical dropouts shall not be required. Upon restoration of power or clearing of the alarm signal, doors shall immediately reset by opening with the push button.

a. Basis of Design: Overhead Door Corp; Fire-Rated Rolling Service Door 631

2.9 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in/ft. of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.
- C. Crank-Hoist Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 30 lbf force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.11 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-rewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.

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2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head hoist-type door operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain-hoist and floor level disconnect.
- D. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, UL listed electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, without exceeding nameplate ratings or considering service factor. Size as recommended by manufacturer.
 1. Speed: Not less than 8 inches per second and not more than 12 inches per secondUsage Classification: Heavy Duty, 25 or more cycles per hour and more than 90 cycles per day.
 2. Type: Polyphase, medium-induction type.
 3. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 4. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
 5. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
 6. Exterior-Grade Units: Provide totally enclosed, non-ventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure for exterior location.
 7. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 8. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open", "Close", and "Stop". Locate on interior side adjacent to door.
 1. Exterior-Grade Units: Full-guarded, standard-duty, surface-mounted, weatherproof type; NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

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- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- L. Self-Opening Mechanism: Automatic release mechanism triggered by smoke detector, emergency push-button station, fire alarm or power failure. When activated, the door self opens by means of a fail-safe operator to the fully open position without the need of power operation or battery backup systems. When the emergency push-button is reset, and the alarm is cleared and power is restored, the door will operate normally.

2.12 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 ALUMINUM FINISHES

- A. Color Anodic Finish for Exterior Units: AAMA 611, AA-M12C22A42/A44, Class 1, 0.018mm or thicker.

2.14 GALVANIZED STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - 1. Color and Gloss: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF OVERHEAD COILING DOORS

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Fire-Rated and Smoke-Rated Doors: Install doors in corresponding fire-rated frames according to NFPA 80.
- E. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

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3.6 STARTUP SERVICE AND DEMONSTRATION

- A. Engage manufacturers qualified technical representative to perform startup service and to train Owner's maintenance personnel as specified below.
 - 1. Perform installation and startup checks according to manufacturers written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Fire-Rated and Smoke-Rated Doors:
 - a. Test door opening when activated by detector or fire-alarm system as required. Reset door-opening mechanism after successful test.
 - b. Test automatic self-opening mechanism when activated by smoke detector, emergency push-button station, fire alarm or power failure. Reset self-opening mechanism after successful test.
- B. Engage manufacturers qualified technical representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors. Include procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.

3.7 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

END OF SECTION

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SECTION 084110

INTERIOR STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Interior storefront (interior glazed aluminum partitions) and supplementary items necessary for installation.
- B. Related Section:
 - 1. Division 08 Section "Interior Aluminum Frames" for aluminum frames used for doors and glazing installed in gypsum board partitions.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.4 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. EFCO Corporation, a Pella Company.
 2. Kawneer North America; an Alcoa Company.
 3. Oldcastle BuildingEnvelope.
 4. YKK AP America Inc.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
1. Kawneer North America; an Alcoa Company; Trifab VG 450, 1-3/4 in face, 4-1/2 in depth, glass in center.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

2.3 PERFORMANCE REQUIREMENTS

- A. Structural Loads: Provide glazed aluminum partition systems capable of withstanding uniform load of 5 lbs per sq. ft. based on testing manufacturer's standard system in assemblies similar to those indicated for this Project.
1. Deflection of framing members normal to wall plane is limited to 1/175 of clear span for spans up to 13 ft 6 in and to 1/240 of clear span plus 1/4 in for spans greater than 13 ft 6 in or an amount that restricts edge deflection of individual glazing lites to 3/4 in whichever is less.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 / B 209M.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
 3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
 4. Structural Profiles: ASTM B 308 / B 308M.
 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

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- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 GLAZING

- A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".

2.6 FABRICATION

- A. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- B. Framing Members: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 6. Fabricate for flush glazing (without projecting stops).
- C. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
 - 1. Provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
 - 1. Color Selections: As scheduled or as indicated in Design Selections.
- B. Baked Enamel or Powder Coated Finish at Interior Surfaces: At Contractor's option, provide baked enamel or powder coated finish at interior surfaces complying with AAMA 2604 except with a minimum dry film thickness of 1.2 mils (0.03 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Selection: Match exterior mullions unless indicated otherwise.

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- C. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 EXAMINATION

- A. Examine substrate surfaces to receive glazed aluminum partitions and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.5 INSTALLATION OF GLAZED ALUMINUM PARTITIONS

- A. General:
1. Do not install damaged components.

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2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 3. Rigidly secure non-movement joints.
 4. Install anchors with separators and isolators to prevent impediments to movement of joints.
 5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
 6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- B. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.
- C. Install glazing as specified in Division 08 Section "Glazing".

3.6 ERECTION TOLERANCES

- A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 in in 12 ft 1/4 in over total length.
 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 in.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 in
- Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in.

END OF SECTION

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SECTION 084213

ALUMINUM ENTRANCE DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Aluminum framed entrance door systems and supplementary items necessary for installation.
 - 1. Standard entrance doors.
 - 2. Standard thermal entrance doors.
 - 3. Terrace doors.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.

1.2 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- C. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of aluminum entrance door hardware, as well as procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

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1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- B. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals.
- B. Entrance Door Hardware Maintenance:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope to this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope to this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope to this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
 - 1. Accessible Doors: Unless indicated otherwise, smooth surfaced for width of door in area within 10 in above floor or ground plane.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials according to manufacturer's written instructions.

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- B. Prevent damage to framing, glass and glazing materials from abrasion, soiling, contamination, wetting or condensation, temperature changes, direct exposure to sun, or other causes.
 - 1. Use crating, stacking and storage procedures that prevent damage to finishes and gaskets.
- C. Stack vertically or on edge prevent water accumulation on or within materials, using wood or plastic shims between components to provide water drainage and air circulation.
- D. Cover materials with suspended tarpaulins or plastic to provide air circulation.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - c. Water penetration through fixed glazing and framing areas.
 - d. Failure of operating components.
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
- C. Factory Applied Finish Warranty for High-Performance Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

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1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: From installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
 1. Include 24-hour-per-day, 7-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. C.R. Laurence - US Aluminum.
 2. Dawson Doors.
 3. EFCO Corporation, a Pella Company.
 4. Kawneer North America; an Alcoa Company.
 5. Oldcastle BuildingEnvelope.
 6. Tubelite.
 7. YKK AP America Inc.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 ALUMINUM ENTRANCE DOOR SYSTEMS

- A. Standard Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 1-3/4 in overall thickness, with minimum 0.125 in thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets, fillet welded or incorporate concealed tie rods.
 - 2. Door Design: Medium stile; 3-1/2 in nominal width at vertical stiles.
 - a. Basis of Design: Kawneer; 350 Standard Entrances, Medium Stile.
 - 3. Glazing Stops and Gaskets: Unless indicated otherwise, square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door.
- B. Standard Thermal Entrance Doors: Manufacturer's standard glazed, thermally broken entrance doors for manual-swing operation.
 - 1. Door Construction: 2-1/4 in overall thickness, with minimum 0.125 in thick, extruded-aluminum tubular rail and stile members, thermally-broken. Mechanically fasten corners with reinforcing brackets, fillet welded or incorporate concealed tie rods.
 - 2. Door Design: Medium stile; 3-1/2 in nominal width at vertical stiles.
 - a. Basis of Design: Kawneer; 350T Thermal Entrances, Medium Stile.
 - 3. Glazing Stops and Gaskets: Unless indicated otherwise, square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door.
- C. Terrace Doors: Manufacturer's thermally broken terrace doors for manual-swing operation, integral frame and sill system with integral hardware.
 - 1. Door Construction: 2-1/4 in overall thickness, with minimum 0.125 in thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets, fillet welded.
 - 2. Door Design: Nominal 3-1/2 in nominal width at vertical stiles.
 - a. Basis of Design: Kawneer; 2000T Terrace Doors, Outswing Configuration with Low Profile Sill.
 - 3. Glazing Stops and Gaskets: Unless indicated otherwise, square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door.
 - 4. Integral Door Hardware: Provide manufacturer standard integral hardware to operate, tightly close and secure terrace doors and frames.
 - a. Butt Hinges: Provide manufacturer's standard mortised, top, bottom and intermediate aluminum 3-way adjustable butt hinges.

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- b. Door Control: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, anticipated frequency of use and accessibility requirements.
- c. Locking: Stainless steel multipoint locking gearbox consisting of swing hooks, latch lock and dead bolt activated by a lever handle.
- d. Operating Trim: Lever handle with escutcheon, keyed cylinder (if applicable) and accessibility compliant "paddle type" lock turn acceptable to Authorities Having Jurisdiction.
 - 1) Finish: Solid brass with polished chrome finish unless indicated otherwise.
- e. Threshold: Provide manufacturer's standard thermally broken threshold with removable threshold cover, cutouts coordinated for operating hardware, and anchors.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209 / B 209M.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
 - 4. Structural Profiles: ASTM B 308 / B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 Door Hardware.
- B. General: Provide entrance door hardware for each entrance door, to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products and complying with BHMA standard referenced.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in 087100 Door Hardware.
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.

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2.6 GLAZING

- A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer for joint type.
 - 1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, neutral-curing silicone formulation compatible with system components with which it comes in contact; and recommended by weatherseal-sealant and curtain-wall manufacturers for this use.
 - a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
 - b. Color: Black, unless otherwise indicated.
 - 2. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.7 ACCESSORIES

- A. Automatic Door Operators: Section 087100 Door Hardware for Automatic Door Operators furnished separately from doors and frames.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Avoid using exposed fasteners. When unavoidable, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- D. Joint Sealants: For installation at perimeter of aluminum entrance doors, as specified in Division 07 Section "Joint Sealants".

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:

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1. Profiles that is sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing pockets as recommended by glass manufacturer for thickness and type of glass indicated.
 6. Fasteners, anchors, and connection devices that are concealed from view.
- D. Entrance Door Frames: Provide tubular and channel frame entrance door frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- F. Entrance Door Hardware Installation: Factory-install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.
- D. Finish Selections: As scheduled or indicated in Design Selections.

2.10 ALUMINUM FINISHES

- A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

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- B. High-Performance Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ALUMINUM ENTRANCE DOORS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.

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- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Install joint filler behind sealant as recommended by sealant manufacturer.
- I. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.
- J. Install entrance doors to produce smooth operation and tight fit at contact points.
- K. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.5 INSTALLATION OF GLAZING

- A. Install glazing as specified in Division 08 Section "Glazing".

3.6 ERECTION TOLERANCES

- A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 in in 12 ft; 1/4 in over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 in.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 in.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in.

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3.7 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
- B. Aluminum-framed entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. Accessible Doors: Adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 in from the latch, measured to the leading door edge.

3.9 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as doors and frames are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.
- B. Replace doors and frames that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 084229

AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Automatic entrance door systems and supplementary items necessary for installation for the following:
 - 1. Swinging automatic entrances.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- C. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".
- D. Safety Device: Device that, to avoid injury, prevents a door from opening or closing.
- E. For Automatic Door Terminology, Refer to BHMA A156.10 for definitions of terms.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:

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1. **Product Variations:** In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. **Allowable Adjustments:** Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. **Product Data:** Manufacturer's technical literature for each product and system indicated.
 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. **Shop Drawings:** Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
 2. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
 - a. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
 4. Indicate locations of activation and safety devices.
 5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- C. **Samples for Verification:** For each type of exposed finish required, in manufacturer's standard sizes.
 1. Include Samples of hardware and accessories involving color or finish selection.

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1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Include emergency-exit features of automatic entrances serving as a required means of egress.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified structural engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- E. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.
 - 1. AAADM Inspection Compliance Form completed and signed by certified AAADM Inspector prior to doors being placed in operation as proof of compliance with ANSI A156.10.
 - 2. Include a copy of wiring diagrams and elevation drawings for automatic entrance doors.
 - 3. Include complete operational descriptions of automatic entrance doors.
 - 4. Submit instructions to be followed in care, cleaning and maintaining components of automatic entrance system.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

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- a. Installer with Company Certificate issued by AAADM indicating that installer has a Certified Inspector on staff.
- B. Power Operated Door Standard: BHMA A156.10, "American National Standard for Power Operated Pedestrian Doors".
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.
- E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 - 3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sliding automatic entrance glass doors and other exposed elements in padded blankets or other approved protective wrapping.
- B. Protect finish surfaces from damage during handling and installation.

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1.10 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.11 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
 - 1. Ensure that wall assemblies, including flashing, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for sliding automatic entrance doors with hardware required for rest of Project.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.
- E. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.

1.12 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. 'Defects' is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 year from date of Substantial Completion.
- B. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. 'Defects' is defined to include but not limited to deterioration or failure of finish to perform as required.
 - 1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.

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- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- 1. Besam Entrance Solutions; an ASSA ABLOY Group company.
 - 2. Dormakaba; a division of DORMA Group North America.
 - 3. Horton Automatics; a division of Overhead Door Corporation.
 - 4. Nabco Entrances, Inc.
 - 5. Record-USA.
 - 6. Stanley Access Technologies.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified for this Project, as determined by testing manufacturer's standard automatic door entrance systems, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
- 1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 - 2. Other Loads: As indicated on Drawings.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
- 1. Live Load Deflection: Accommodate differential vertical deflection of floors:

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- a. Deflection: As indicated on Drawings.
- D. Seismic Performance: Withstand the effects of earthquake motions determined in accordance with local building code and authorities having jurisdiction.
- E. Energy Performance: Certified or labeled by manufacturer for energy performance ratings in accordance with NFRC.
 - 1. Thermal Transmittance (U-Factor): U-factor as determined in accordance with NFRC 100.
 - a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.
 - 2. Solar Heat Gain Coefficient (SHGC): Solar Heat Gain Coefficient as determined in accordance with NFRC 200.
 - a. Maximum SHGC: As indicated on Drawings, comply with building energy performance model for this project.
 - 3. Air Leakage:
 - a. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of (6.4 L/s x sq. m) of fixed entrance-system area when tested according to ASTM E283 at a minimum static-air-pressure difference of (75 Pa).
 - 4. Condensation Resistance: Condensation resistance as determined in accordance with NFRC 500.
 - a. No condensation allowed under design conditions indicated.
- F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.
- G. Operating Temperature Range: Provide automatic entrances that operate within minus 20 to plus 122 deg F.
- H. Opening-Force: Comply with requirements of authorities having jurisdiction.
 - 1. Power-Operated Doors: Not more than 50 lbf required to manually set door in motion if power fails, and not more than 15 lbf required to open door to minimum required width.
 - 2. Power-Operated Swinging Doors: Not more than 30 lbf required to manually open door if power fails.
 - 3. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for a breakaway door or panel to open.
- I. Entrapment Prevention Force:

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1. Power-Operated Swinging Doors: Not more than 40 lbf required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf required to prevent stopped door from moving in direction of closing.
- J. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 SWINGING AUTOMATIC ENTRANCES

- A. General: Provide manufacturer's standard automatic entrances, including doors, framing, headers, door operators, controls, and accessories required for a complete installation.
- B. Swinging, Power-Operated Automatic Entrance:
 1. Basis of Design:
 - a. Horton Automatics; HD-Swing Series 4500 with Direct Drive Top Pivot.
 2. Configuration, Pair: Pair of swinging doors
 - a. Traffic Pattern: Two way.
 - b. Mounting: Between jambs.
 - c. Mounting: Surface.
 3. Operator Features:
 - a. Power opening and spring closing.
 - b. Adjustable opening and closing speeds.
 - c. Adjustable hold-open time between zero and 30 seconds.
 - d. Adjustable backcheck and latching.
 - e. Obstruction recycle.
 - f. Automatic door re-open if stopped while closing.
 - g. On-off/hold-open switch to control electric power to operator.
 4. Controls: Activation and safety devices in accordance with BHMA standards.
 - a. Activation Device, Motion Sensor: Mounted on ingress side of door header to detect pedestrians in activating zone and to open door.
 - b. Activation Device, Switch: Push-plate switch or Touchless switch as indicated on each side of door to activate door operator.
 - c. Safety Device, Presence Sensor: Mounted on door header to detect pedestrians in presence zone and to prevent door from closing.
 5. Finish: Framing, doors and header with finish as scheduled or indicated in Design Selections.

2.5 ENTRANCE COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 in thick and reinforced as required to support imposed loads.
 1. Nominal Size: As indicated on Drawings.

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- B. Stile and Rail Doors: Manufacturer's standard 1-3/4 in thick, glazed doors with minimum 0.125 in thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
 - 1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and manufacturer's standard preformed gaskets.
 - 2. Rail Design: As indicated on Drawings.
 - 3. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.
- C. Sidelite(s): Manufacturer's standard 1-3/4 in deep sidelite(s) with minimum 0.125 in thick, extruded-aluminum tubular stile and rail members matching door design and finish.
 - 1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
 - 2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.
- D. Headers: Fabricated from minimum 0.125 in thick, extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
- F. Signage: Affixed to both sides of each door as required by BHMA A156.10 for type of door and its operation.
 - 1. Application Process: Decals or door manufacturer's process approved by the Architect. Provide sign materials with instructions for application after glazing is installed, if applicable.

2.6 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B221.
 - 2. Sheet: ASTM B209.
- B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.
- C. Expanded Aluminum Mesh: Expanded and flattened aluminum sheet in accordance with the geometry of ASTM F1267.
- D. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section Glazing.
- E. Sealants and Joint Fillers: As recommended by manufacturer for joint type. Comply with Division 07 Section Joint Sealants.

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- F. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107/C1107M; of consistency suitable for application.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.7 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
 - 1. Door Operator Performance: Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
 - 2. Adjustment Features: Operators shall be fully field adjustable without removing doors, including but not limited to the following:
 - a. Adjustable speed, including opening, closing, back check, and latch check. Operator closing speed shall be adjustable to not exceed one foot per second closing speed.
 - b. Adjustable time delay for length of time door remains open.
 - c. Automatic door re-open when stopped while closing. Operator shall include an electronic sensing device that will reverse door and prevent closing. Reversing device shall be field adjustable.
 - 3. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet DC motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.
 - a. On/Off Feature: Provide on/off/hold-open switch to control electric power to operator, located inside header.
- C. Power-Operated Swinging Doors:
 - 1. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by their plastic housings; adjustable to provide detection-field sizes and functions required by BHMA A156.10.
 - a. Provide capability for switching between bidirectional and unidirectional detection.
 - b. For one-way-traffic entrances, sensor on egress side shall not be active when doors are fully closed.
 - 2. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors remain active at all times.
 - 3. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams are not active when doors are fully closed.

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- D. Key Switch for Security Use: Recess-mounted, door control switch with key-controlled actuator; enclosed in minimum 2 in by 4 in junction box. Provide faceplate engraved with letters indicating switch functions.
 - 1. Face-Plate Material: Stainless steel.
 - 2. Functions: On-off, maintained contact.
 - 3. Mounting: As indicated on Drawings or as directed by Architect.
- E. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.
- F. Opening-Width Control for Sliding Doors: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

2.8 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.
 - 1. Refer to Division 08 Section "Door Hardware" for hardware items other than those indicated to be provided by automatic entrance door manufacturer.
- B. Breakaway Device for Power-Operated Doors: Provide breakaway device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Interrupt powered operation of door operator while in breakaway mode.
 - 1. Include detent devices at each breakaway panel to control breakaway force.
 - a. Panel Closer: Factory-installed concealed hydraulic door closer.
 - b. Limit Arms: Limit swing to 90 degrees, spring loaded with adjustable friction damping.
- C. Push Bars: As selected by Architect from manufacturer's full range of full-door-width, single push bars.
- D. Pull Handles: As selected by Architect from manufacturer's full range of pull handles and plates.
- E. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
 - a. Provide adjustable astragal with double weather strip on strike rails.
 - b. Provide adjustable nylon sweeps on bottom of sliding doors.
- F. Thresholds for Swinging or Folding Doors: BHMA A156.21, extruded-aluminum raised thresholds; with beveled edges with a slope of not more than 1:2 and a maximum height of 1/2 in. Provide cutouts as required for door operating hardware.

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- G. Finger Guards for Swinging or Folding Doors: Manufacturer's standard collapsible neoprene or PVC gasket.

2.9 ACCESSORIES

- A. Guide Rails: Fabricated from bars, minimum 30 inches high, material and finish to match doors unless otherwise indicated; positioned and projecting from face of door jamb for distance as indicated, but not less than that required by BHMA A156.10 for type of door and direction of travel; with filler panel.
1. Filler Panel: Expanded aluminum mesh.
 2. Mounting: Jamb and floor.

2.10 FABRICATION

- A. General: Fabricate automatic entrance door assembly components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
1. Form aluminum shapes before finishing.
 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrance door units as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 3. Form profiles that are sharp, straight, and free of defects or deformations.
 4. Provide components with concealed fasteners and anchor and connection devices.
 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
 6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within system to the exterior.
 7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
 8. Allow for thermal expansion of exterior units.

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- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
 - 1. Swinging or Folding Doors Exterior Doors: Provide compression weather stripping at fixed stops. At locations without fixed stops, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. Finger Guards for Swinging or Folding Doors: Anchor gasketing into frame at hinge jamb of each pivoted door.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
 - 1. Operator components shall be factory assembled in header, adjusted and tested. No field wiring or operator adjustment shall be needed other than connection to on-site power. Displacement of sliding doors shall turn off power to operator.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual".
- F. Hardware: Factory-install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
- G. Controls:
 - 1. General: Factory-install devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
- H. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

2.11 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.
- C. Match Adjacent Aluminum Framing: Finish automatic door entrance components to match adjacent glazed aluminum framing system as specified in Division 08 Section "Glazed Aluminum Framing System".
- D. Finish Selections: As indicated or scheduled in Design Selections.

2.12 ALUMINUM FINISHES

- A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

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- B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

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3.4 INSTALLATION OF AUTOMATIC ENTRANCES

- A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
 - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Swinging Entrances: Set headers, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 2. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 3. Level recesses for recessed thresholds using nonshrink grout.
- C. Door Operators: Connect door operators to electrical power distribution system.
 - 1. Access-Control Devices: Connect access-control devices to access-control system.
- D. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- E. Guide Rails at Swinging or Folding Doors: Install rails according to ANSI/BHMA A156.10 including Appendix A, manufacturer written instructions, and as indicated.
- F. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide weathertight installation.
 - 1. Set thresholds or bottom-guide track system, framing members, and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- G. Signage: Apply signage on both sides of each door and breakaway sidelite, as required by cited BHMA standard for direction of pedestrian travel.
- H. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.5 INSTALLATION TOLERANCES

- A. Maximum deviation of 1/8-inch per 12 feet of length of any member or 1/4 inch in total length of line from established vertical or horizontal.
- B. Maximum offset of 1/16 inch for true alignment between two consecutive members in line and end to end.

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3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- D. Automatic entrances will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
 - 1. Inspection Report: Submit report in writing to Architect and Contractor within 24 hours after inspection.

3.7 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust exterior doors for tight closure.
- B. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 CLEANING AND PROTECTION

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
- B. Limit construction traffic during remainder of construction period to ensure automatic entrance doors are without damage or deterioration at time of Substantial Completion.

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3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sliding automatic entrance doors.

1. Refer to Division 01 Section "Closeout Procedures".

3.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.

- B. Continuing Maintenance Proposal: From installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

END OF SECTION

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SECTION 084313.13

FIRE-RESISTANCE-RATED GLAZED ALUMINUM FRAMING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fire-resistance-rated framing system, glazing and supplementary items necessary for installation.:
 - 1. Fire-resistance-rated glazed framing system.
 - 2. Fire-protection-rated glazing.
 - 3. Fire-resistance-rated glazing.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.
- B. Fire-Resistance-Rated Glazing: Glazing that prevents spread of fire and smoke and radiant heat; used in rated wall and door applications 60 minutes and above without size limitations.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Show details of each type of glazing in conjunction with the appropriate framing system; indicate type of glass, sizes, shapes, glazing material, and quantity. Include details indicating glazing thickness, bite on glass, glass edge clearance, and depth of rabbet.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
 - 1. Glass Samples: For each type of glass product; 12 inches (300 mm) square.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

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- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 QUALITY ASSURANCE

- A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
 - 4. Certification: Qualified glazing contractor certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication
- B. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers.

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1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

- 1. Warranty Period: 5 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Tempered Glazing Units with Clear Intumescent Interlayer: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of tempered glazing units with clear intumescent interlayer is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is air bubbles within units, or obstruction of vision by contamination or deterioration of intumescent interlayer.

- 1. Warranty Period: 5 years from date of Substantial Completion.

- C. Installer Warranty: Furnish installer written workmanship warranty signed by an authorized representative using installer standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

- 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

- 1. Technical Glass Products; Fireframes Clearview Systems.

- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

- 1. Manufacturer and Product – Framing System: Technical Glass Products; narrow profile Fireframes fire-rated frames, depth as scheduled.

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2. Manufacturer and Product – Glazing System: Technical Glass Products; butt-glazed Pilkington Pyrostop, types as scheduled.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

2.3 MANUFACTURERS

- A. Source Limitations for Glass and Glazing: For each glass type, product and installation method, obtain from single source from single manufacturer.

2.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.
- D. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.
 1. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.

2.5 FRAMING MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 1. Sheet and Plate: ASTM B 209 / B 209M.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
 3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
 4. Structural Profiles: ASTM B 308 / B 308M.
 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Internal Steel Reinforcement for High Spans: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

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1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
- C. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials

2.6 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
1. Acceptable Products: Complying with CSPC 16 CFR 1201, Category II.
 - a. Submit label location and size for Owner approval prior to fabrication. Glass having labels in locations not pre-approved shall be removed and replaced with glass having labels in the correct location at no cost to Owner.
- C. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".

2.7 FIRE-RESISTANCE-RATED GLAZING

- A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing in accordance with ASTM E119 or UL 263.
- B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that glazing is approved for use in walls, and fire-resistance rating in minutes.
- C. Fire-Resistance-Rated Framing and Doors: Fire-resistance-rated glazing with 60-, 90-, and 120-minute ratings requires framing and doors from glass supplier, tested as an assembly complying with ASTM E119 or UL 263.

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- D. Fire-Resistance-Rated Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear or ultraclear float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.
- E. Fire-Resistance-Rated Tempered Glazing Units with Clear Intumescent Interlayer: Glazing units made from two or more lites of uncoated, fully tempered, clear or ultraclear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent polymer; complying with 16 CFR 1201, Category II.

2.8 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
 - 1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 FABRICATION OF FRAMING

- A. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- B. Framing Members: Fabricate components that, when assembled, have the following characteristics:

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1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 4. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

2.11 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.12 ALUMINUM FINISHES

- A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
1. Finish Selections: As scheduled or as indicated in Design Selections.
- B. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- D. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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1. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Examine substrate surfaces to receive glazed aluminum partitions and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- D. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.4 INSTALLATION OF FRAMING SYSTEM

- A. General:
 1. Do not install damaged components.
 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 3. Rigidly secure non-movement joints.
 4. Install anchors with separators and isolators to prevent impediments to movement of joints.

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5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
 6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- B. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

3.5 INSTALLATION OF GLAZING

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites with proper orientation so that coatings face fire side or protected side in accordance with manufacturer recommendation.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.6 ERECTION TOLERANCES

- A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

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1. Location and Plane: Limit variation from true location and plane to **1/8 in (3 mm)** in **12 ft (3 mm in 3.7 m)**; **1/4 in (6 mm)** over total length.
 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to **1/16 in (1.5 mm)**.
 - b. Where surfaces meet at corners, limit offset from true alignment to **1/32 in (0.8 mm)**.
- B. Diagonal Measurements: Limit difference between diagonal measurements to **1/8 in (3 mm)**.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.8 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.9 FIRE-RESISTANCE-RATED GLAZING SCHEDULE

- A. Glass Type FRGL-1: 120-minute fire-resistance-rated glazing complying with ASTM E119 or UL 263 in a tested assembly of glass and framing with **450 deg F (250 deg C)** temperature-rise limitation; fire-resistance-rated tempered glazing units with clear intumescent interlayer.
1. Basis of Design: SuperLite II-XL 120.
- B. Glass Type FRGL-2: 120-minute fire-resistance-rated glazing complying with ASTM E119 or UL 263 in a tested assembly of glass and framing with **450 deg F (250 deg C)** temperature-rise limitation; fire-resistance-rated laminated glass with intumescent interlayers.

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1. Basis of Design: SuperLite II-XLM 120.

3.10 ARCHITECTURAL METAL FINISH SCHEDULE

- A. Color and Gloss:
- B. Color and Gloss: Match sample accepted by Architect.
- C. Color Anodic Finish:
 1. Color: Light bronze.
 2. Color: Medium bronze.
 3. Color: Dark bronze.
 4. Color: Black.
- D. AMFXX
 1. Manufacturer:
 2. Product Series:

3.11 Color Name and Number

END OF SECTION

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SECTION 084400

GLAZED ALUMINUM FRAMING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glazed aluminum framing systems and supplementary items necessary for installation.
 - 1. Field fabricated stick system, aluminum curtain wall and window wall systems.
 - 2. Factory fabricated unitized system, custom aluminum curtain wall and window wall systems.
- B. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.

1.2 DEFINITIONS

- A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
 - 1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.
 - 2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
 - 1. Glazed Aluminum Framing Systems shall be installed to provide a fully sealed building upon completion.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified structural engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified structural engineer.

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- C. Delegated Engineering Professional Qualifications: Structural engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Prepared by manufacturer, not installer.
 - a. Shop drawings not prepared by manufacturer shall include manufacturer's written approval on shop drawings.
 - b. Shop drawings shall contain seal of a structural engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
 - 2. Include typical unit elevations at 1/2 in scale and details at full scale.
 - 3. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 4. Indicate where and how the system deviates from Contract Documents.
 - 5. Provide material properties and other information needed for structural analysis including computations, prepared, signed and sealed by a structural engineer licensed to practice in the jurisdiction where the project is located.
 - a. Calculations shall include but not limited to the following:
 - 1) Section properties for framing members.
 - 2) Analysis of framing members.
 - 3) Analysis of anchors and embedded anchors in concrete structure.

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- 4) Analysis of stress in structural silicone.
 - 5) Analysis of glass thicknesses and strength.
6. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
 7. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
 8. Include full-size isometric details of typical and special conditions within the system, showing the following:
 - a. Mullion details, including reinforcement and stiffeners.
 - b. Joinery details, including concealed welds.
 - c. Anchorage.
 - d. Expansion provisions.
 - e. Glazing details.
 - f. Flashing and drainage details.
 - g. Weather-stripping and weather seals within curtain wall framing.
 - h. Thermally improved details.
 - i. Perimeter weather seals and structural seals.
 - j. Interface with other building construction.
 - k. Identification and detail of perimeter fire containment system.
 - l. Window cleaning provisions.
 - m. De-glazing and re-glazing procedures.
 - 1) Unless indicated otherwise, framing and glass shall be designed to be re-glazed from the exterior using original glass size and gaskets without modification to framing. Comply with manufacturer recommended re-glazing procedure.
 - n. Attachment details, including thickness of curtain wall components, designed to receive lightning protection system.
 9. Submit insert/embed drawings including layout and enlarged details. Include detail and engineering calculations for field modifications due to location and/or omitted inserts/embeds.
 10. Window System Operators for Operable Window Vent Systems: Show locations, mounting, and details for installing operator components and controls.
- C. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.
1. Exposed Finishes: 12 in (300 mm) long sections of extrusions or formed shapes, 6 in squares of sheet or plate, each finish type and color.
 2. Sealants and Gaskets: 12 in minimum length for sealant or gasket glazed joint, each type and color.
 3. Joinery, including concealed welds.
 4. Anchorage.
 5. Expansion provisions.
 6. Glazing, including sealants and gaskets, each type and color.
 7. Flashing and drainage.
 8. Include fabrication sample of any unusual condition.

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1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified structural engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Energy Performance Certificates: For glazed aluminum framing systems, accessories, and components.
 - 1. Basis for Certification: Certified by manufacturer for energy performance ratings as determined in accordance with NFRC.
- D. U-Value and Condensation Evaluation: Determine wall system U-Value and provide condensation evaluation using NFRC approved version of Lawrence Berkeley National Laboratory THERM software for simulations. Submit isothermal condensation results, including isothermal graphics, for temperature limits of wall system components.
- E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
 - 1. Anchors and Fasteners: Tested and qualified for use in accordance with ICC-ES or other product approval acceptable to authorities having jurisdiction.
- F. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- G. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
 - 1. Structural-Sealant Glazing: For structural-sealant glazing, include ASTM C 1401 recommendations for post-installation-phase, quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope to this Project.

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2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope to this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
 - a. Subcontractor Responsibility: Work included in this Technical Section shall be performed by a qualified single subcontractor solely responsible for engineering, fabrication and installation of the Work.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".
- C. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements when indicated.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will be in contact with sealants and for each condition.
 1. Test a minimum five production-run samples each of metal, glazing, and other material.
 - a. Include all adjacent materials with watertight seals to curtain wall systems.
 2. Prepare samples using techniques and primers required for installed assemblies.
 3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
 4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

1.9 MOCKUPS

- A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.

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2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.10 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - 1) Review construction tolerances for structural frame and construction surveying requirements.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials according to manufacturer's written instructions.
- B. Prevent damage to framing, glass and glazing materials from abrasion, soiling, contamination, wetting or condensation, temperature changes, direct exposure to sun, or other causes.
1. Use crating, stacking and storage procedures that prevent damage to finishes and gaskets.

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1.12 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.13 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.14 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Thermal stresses transferring to building structure.
 - c. Glass breakage.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Deterioration of metals and other materials beyond normal weathering.
 - g. Water penetration through fixed glazing and framing areas.
 - h. Air infiltration exceeding performance requirements.
 - i. Failure of operating components.
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.
- C. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
 - 1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Kawneer North America; an Alcoa Company.
 2. Oldcastle BuildingEnvelope.
 3. Lessard
 4. National Enclosure Company
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 1. Curtain Wall System:
 - a. Basis of Design: Kawneer 1600UT Wall.
 2. Window Wall System:
 - a. Basis of Design: Kawneer 1600UT Wall.
 3. Unitized Framing System:
 - a. Basis of Design: Kawneer 2500UT Unitwall

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Failure includes the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Thermal stresses transferring to building structure.
 - c. Glass breakage.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Deterioration of metals and other materials beyond normal weathering.

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- g. Water penetration through fixed glazing and framing areas.
 - h. Air infiltration exceeding performance requirements.
 - i. Failure of operating units
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
 - 1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 - 2. Other Loads: As indicated on Drawings.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
 - 1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
 - b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.
 - 2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
 - b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.
 - c. Connections shall permit movement in the plane of the panel for inter-story drift and shall be properly designed sliding type connections using slotted or over-sized holes, or connections permitting movement by bending of steel or other connections providing equivalent sliding and ductile capacity.
 - 1) Connector bodies shall have sufficient ductility and rotational capacity to prevent fracture of concrete or brittle failure near welds.
 - 2) Fasteners embedded in concrete shall be attached to reinforcing steel or otherwise terminated to effectively transfer forces to the reinforcing steel in accordance with applicable Building Code requirements.
- D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- E. Deflection of Framing Members: At design wind load in accordance with the Building Code.
 - 1. Deflection Normal to Wall Plane: Edge deflection of individual glazing lites limited to 1/175 for glass edge lengths up to 13 feet 6 inches, and limited to 1/240 plus 1/4 inch for glass edge lengths greater than 13 feet 6 inches and less than 40 feet, when designed in accordance with AAMA TIR A11-15 and tested in accordance with ASTM E 330/E330M-14.
 - a. Exceptions:

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- 1) Where a sealant joint occurs between a framing member and a relatively stiff building element, framing member deflection not more than 1/2 of nominal joint width, or less if required by sealant manufacturer.
 - b. Span is defined as the distance between anchor center line.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 in.
 - a. Operable Units (Doors or Windows): Provide a minimum 1/16 in clearance between framing members and operable units.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than $2L/175$ where L is the cantilever length.
 4. Deflection of Framing System Interior Trim: Center deflection of interior trim shall not exceed 1/4 in when subjected to a 250 pound vertical concentrated load. No permanent deformation allowed when load is removed.
 - a. Window sill extension trim.
 - b. Slab edge covers.
- F. Structural Test Performance: Test according to ASTM E 330/330M as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- G. Water Penetration under Static Pressure for Storefront System: Test in accordance with ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sf.
- H. Water Penetration under Static Pressure for Curtain Wall and Window Wall Systems: Test in accordance with ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf.
- I. Water Penetration under Dynamic Pressure for Curtain Wall and Window Wall Systems: Test in accordance with AAMA 501.1 as follows:

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1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf.
- J. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
1. Provide drainage to exterior of wall for water entering at joints or glazing reveals, condensation occurring within assemblies, secondary water from adjacent wall systems and similar conditions.
 - a. Provide internal gutters and weep system to collect and drain water leakage and condensation to the exterior.
 - 1) Stick framed curtain wall systems and punched windows shall have an isolated gutter cavity at each glass perimeter such that leakage is confined to and weeped from the opening where leakage originated.
 - 2) Unitized curtain walls shall have continuous spliced gutters at horizontal stack joints with sealed end caps at termination conditions.
 - 3) Window wall shall have a continuous gutter and weep holes at the glass sill and a continuous gutter at the glass head that drains directly to exterior or directs leakage from spandrel above to the window sill.
 - b. Provide continuous subsill below windows with interlocking mullions.
 - c. Coordinate gutter and weep systems with drainage provisions with adjacent construction.
 - d. Coordinate connection of drainage members at columns, spandrel beams and other areas with limited access.
 - e. The use of carbon steel components for gutter and drainage assemblies is prohibited; provide stainless steel or aluminum components.
- K. Energy Performance: Certified or labeled by manufacturer for energy performance ratings in accordance with NFRC.
1. Thermal Transmittance (U-Factor) - Fixed Vision Glazing and Framing Areas: U-factor as determined in accordance with NFRC 100.
 - a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.
 2. Thermal Transmittance (U-Factor) - Fixed Spandrel Glazing, Metal Panels and Framing Areas: U-factor as determined in accordance with NFRC 100.
 - a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.
 3. Solar Heat Gain Coefficient (SHGC) - Fixed Glazing and Framing Areas: Solar Heat Gain Coefficient as determined in accordance with NFRC 200.
 - a. Maximum SHGC: As indicated on Drawings, comply with building energy performance model for this project.

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- 4. Air Leakage - Glazed Aluminum Wall and Storefront:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sf at a minimum static-air-pressure differential of 6.24 lbf/sf when tested in accordance with ASTM E 283.
- 5. Condensation Resistance: Condensation resistance as determined in accordance with NFRC 500.
 - a. Fixed Glazing and Framing Areas: No condensation allowed under design conditions indicated.
- L. Building Maintenance Equipment: Engineer units supporting building maintenance equipment to resist pull-out and horizontal shear forces transmitted from equipment.
- M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.
 - a. Fabrication, assembly and erection procedures shall take into consideration the ambient temperature range at the time of each operation.
- N. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209 / B 209M.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
 - 4. Structural Profiles: ASTM B 308 / B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Internal Reinforcement: Shapes and sizes to suit installation meeting delegated engineered performance requirements, as indicated on Shop Drawings.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36 / A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008 / A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011 / A 1011M.
 - 4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

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2.5 GLAZED ALUMINUM FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Structural Thermal Barriers: Provide thermally improved system in compliance with energy model and condensation performance requirements.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
 - 1. Shims:
 - a. Structural Connections: Series 300 Stainless Steel; ASTM A 36 or ASTM A 283 hot-dipped galvanized steel.
 - 1) Dynamic Connections: Molybdenum disulfide filled nylon lubricated pads or washers.
 - b. Non-Structural Connections: U-shaped polystyrene.
 - c. Static Non-Load Transfer Connections: Korolath high-impact polystyrene pads.
 - 2. For connections where shim height is greater than twice the bolt diameter, provide steel or aluminum shims.
 - a. Plastic shims are acceptable only in locations where shim height is less than twice the bolt diameter or fully bearing locations where there is no bending induced into the bolt anchor.
 - 3. Mechanically restrain shims in dynamic connections to remain in place.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials. Domestically manufactured only.
 - 1. Manufacturers and Products - Self Drilling, Self Tapping Screws:
 - a. Elco; Drill-Flex Structural Self-Drilling Screws.
 - b. Hilti; Kwik-Flex Structural Self-Drilling Screws.
 - 2. Manufacturers and Products - Series 300 Stainless Steel Fasteners:
 - a. Elco; Bi-Flex 300 SS with Stalgard.
 - b. Elco; Alumi-Flex 302 SS with Stalgard.
 - c. SFS; Bi-Met 300.
 - 3. Use Series 300 Stainless Steel fasteners for joining framing members and fasteners located in wet areas including fasteners penetrating the waterline and covered with sealant.
 - 4. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 5. Reinforce members as required to receive fastener threads.
 - 6. Use concealed fasteners; exposed fasteners are not allowed.

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- a. At locations where exposed fasteners are unavoidable and approved by Architect, use exposed fasteners with countersunk Phillips screw heads finished to match framing system.
- 7. Storefront: Furnish heavy duty aluminum sill pan with integral welded or fastened and structurally sealed end dams, typical.
- D. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer. Domestically manufactured only.
 - 1. Concrete and Masonry Inserts:
 - a. Product Quality Standards: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 / A 123M or ASTM A 153 / A 153M requirements.
 - b. Manufacturers:
 - 1) Basis of Design: Halfen.
 - 2) Hilti.
 - 3) Jordahl.
 - 4) Unitstrut.
 - 2. Post Installed Expansion Anchors:
 - a. Product Quality Standards: Tested and qualified for use in accordance with ACI 355.2, ACI 318 and ICC-ES AC193 for cracked, uncracked and seismic concrete recognition.
 - 1) Material and Finish: Stainless steel ASTM F 593 Group 1 (Alloy 304/316), mechanically deposited ASTM B 695 or hot-dip zinc coating ASTM A 153 Class C. Thickness not less than 0.0002 inches.
 - b. Acceptable Manufacturers:
 - 1) Dewalt.
 - 2) Hilti.
 - 3) ITW.
 - 4) Simpson.
 - c. Not Acceptable: Chemical type anchors for overhead dead load connectors.
 - 3. Threaded Concrete Anchors:
 - a. Product Quality Standards: Tested and qualified for use in accordance with ACI 355.2, ACI 318 and ICC-ES AC193 for cracked, uncracked and seismic concrete recognition.
 - 1) Material and Finish: Carbon steel with corrosion resistant coating, not less than 1000 hours of salt spray resistance according to ASTM B 117; 300 Series Stainless Steel, non-magnetic.
 - 2) Anchor Thickness: 3/8 inch minimum.

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- b. Acceptable Manufacturers:
 - 1) Dewalt.
 - 2) Elco.
 - 3) Hilti.
- c. Condition of Use: Shall not be used in overhead dead load connections supporting sustained load in tension.
- E. Concealed Flashing: Dead-soft, 0.018 in thick stainless steel, ASTM A 240 / A 240M of type recommended by manufacturer.
- F. Framing System Gaskets and Sealants: Refer to Division 08 Section "Glazing."
 - 1. EPDM Gaskets: EPDM shall be isolated from direct contact with silicone; including but not limited to the secondary perimeter silicone seal of insulating glass units.
 - a. Provide silicone gaskets where gaskets are in contact with silicone sealant.
- G. Glazed-In Aluminum-Faced Composite Wall Panels: Comply with Division 07 Section "Composite Metal Wall Panels."
- H. Terra Cotta Mullions: Refer To Division 07 Section "Terra Cotta Panels".

2.6 SUN CONTROL DEVICES

- A. Sunshades: Assemblies consisting of manufacturer's standard outrigger brackets and fascia .
 - 1. Basis of Design: As scheduled or indicated in Design Selections. Refer To Separate Specification Section.

2.7 GLAZING

- A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section Glazing.
 - 1. Glass Types: As scheduled or indicated in Design Selections.
- B. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, non-migrating types compatible with sealants and suitable for joint movement and assembly performance requirements. Comply with Division 08 Section "Glazing".
 - 1. Silicone Sealant Compatibility: When in direct contact with silicone sealants, gaskets, spacers and setting blocks shall be heat cured silicone rubber based material which is chemically compatible and with sufficient hardness for the purpose intended and approved in writing by the glazing and curtain wall manufacturers.
- C. Glazing Sealants: As recommended by manufacturer for joint type.

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1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 50, neutral-curing silicone formulation compatible with system components with which it comes in contact; and recommended by weatherseal-sealant and curtain-wall manufacturers for this use.
 - a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
 - b. Color: Black, unless otherwise scheduled or indicated in Design Selections Summary.
2. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.8 SHADOW BOX BACK PAN

- A. Shadow Box Back Pan: Provide factory-formed metal pans fabricated from single sheets of metal formed into profile for installation indicated. Maintain air space between pan and interior surface of glass; ventilate air space when recommended by manufacturer. Provide continuous seal at pan joints and pan perimeter.
 1. Material: Smooth aluminum sheet, ASTM B 209, 0.125 in thick.
 2. Curtain Wall Insulation: Minimum 2-inch thickness.
 3. Accessories: Spacers, cold formed framing, furring, brackets, clips, hangers and components required for complete installation
 4. Finish: As scheduled or as indicated in Design Selections.

2.9 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of glazed aluminum framing systems, as specified in Division 07 Section "Joint Sealants".
- B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils thickness per coat.
- C. Perimeter Fire-Containment System for Curtain Wall Spandrel Conditions: Safing insulation and curtain wall insulation as specified in Division 07 Section "Fire-Resistive Joint Systems".
- D. Thermal Insulating Materials: As specified in Division 07 Section Thermal Insulation.
- E. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.
- F. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.
- G. Linings, Spacers and Sleeves: At dynamic or moving joints, provide type and materials recommended by manufacturer to provide a fully sealed penetration.

2.10 FABRICATION

- A. Do not expose unfinished or cut edges to view.

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- B. Shop weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Welds shall be of adequate strength and durability, with jointing tight, flush, smooth and clean. Weld behind finished surfaces so as to cause no distortion and/or discoloration on the finished side. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 1. Field welding aluminum is not allowed.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that is sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing packets as recommended by glass manufacturer for thickness and type of glass indicated.
 - 6. Fasteners, anchors, and connection devices that are concealed from view.
 - 7. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum framing systems to exterior.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. For Factory-Assembled and Glazed Frame Units:
 - 1. Rigidly secure non-movement joints.
 - 2. Seal joints watertight unless otherwise indicated.
 - 3. Factory-install glazing to comply with requirements in Division 08 Section "Glazing".
 - 4. Structural-Sealant Units: Prepare surfaces that will contact structural-sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Concealed members may be mill finish, providing that they cannot be seen through the glass, do not contact any structural silicone or are not continually exposed to water immersion.

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- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.
- E. Selections: As scheduled or as indicated in Design Selections.

2.12 ALUMINUM FINISHES

- A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.
- B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
 - 1. Furnish inserts for setting in concrete forming, and similar work required to support glazed aluminum wall system.
 - 2. Field measure and verify governing dimensions, including floor elevations, floor-to-floor heights, minimum clearance between wall system and structural frames and other permissible dimensional tolerances in building frame.
 - a. Survey all embeds and floor elevations to confirm correct location above established benchmarks.

3.4 INSTALLATION OF GLAZED ALUMINUM FRAMING SYSTEMS

- A. General:
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure non-movement joints.
 - 4. Install anchors with separators and isolators to prevent impediments to movement of joints.
 - 5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
 - 6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - 7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- B. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum framing systems to exterior.
- C. Set continuous sill members and flashing in full sealant bed and install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers. Maintain minimum clearance of 1 in between inside face of framing system and outside face of building structure.
- E. Comply with Division 08 Section Glazing for glass and glazing requirements.
- F. Perimeter Fire-Containment System for Curtain Wall Spandrel Conditions: Clean debris from behind framing during erection and provide temporary closures to prevent accumulation of debris. Install spandrel insulation and firestopping securely anchored to prevent dislocation. Comply with requirements of Division 07 Section Fire-Resistive Joint Systems.

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- G. Back Pans: Install with EPDM spacers and maintain air space between pan and interior surface of glass. Seal joints in pan and at perimeter of pan.
1. Ventilate air space between shadow box back pan and interior surface of glass when recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:
1. Plumb: 1/8 in per 10 ft; 1/4 in per 40 ft.
 2. Level: 1/8 in per 10 ft; 1/4 in per 40 ft.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 in wide, limit offset from true alignment to 1/16 in.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 in wide, limit offset from true alignment to 1/8 in.
 - c. Where surfaces are separated by reveal or protruding element of 1 in wide or more, limit offset from true alignment to 1/4 in.
 4. Location and Plane: Limit variation from plane to 1/8 in per 12 ft; 1/2 in over total length.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
1. Refer to Division 01 Section Field Test for Air and Water Leakage.
- C. Special Inspections: Anchors and fasteners will be subject to testing and inspecting when applicable in accordance with the Building Code and current ICC-ESR.
- D. Glazed aluminum framing systems will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

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3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as framing systems are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace framing systems panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 087100 —

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - b. Sliding doors.
 - c. Folding doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Sections:

1. Division 06 Section "Interior Architectural Woodwork" for cabinet door hardware provided as part of architectural woodwork.
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Flush Wood Doors" .
4. Division 12 Sections for cabinet door hardware provided as part of casework.
5. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.
6. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security system.
7. Division 28 Section "Digital, Addressable Fire-Alarm System" for connections to building fire-alarm system.
8. Division 28 Section "Zoned (DC Loop) Fire-Alarm System" for connections to building fire-alarm system.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
 1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.

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- b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
- a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page. Provide a "vertical" schedule. Horizontal schedules will be returned "not approved".
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - 5) Fastenings and other pertinent information.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer] [and] [Architectural Hardware Consultant].
- B. Product Certificates: For electrified door hardware, from the manufacturer.
 - 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

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- C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
 - 1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

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- H. Pre-installation Conference: Conduct conference at the project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.

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- b. Faulty operation of doors and door hardware.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1.
 - 1. Products listed in sets are Ives (IVE) 5BB1 series.
 - 2. Equal products from the following manufacturers will also be acceptable:
 - a. Hager
 - b. Stanley
 - c. McKinney

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2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
 - 1. Products listed in sets are Ives (IVE).
 - a. Equal products from any B.H.M.A. member will also be acceptable.

2.4 PIVOT SETS

- A. Furnish $\frac{3}{4}$ " offset pivot sets for lead lined doors.
 - 1. Products listed in sets are Ives (IVE) 7000 series.
 - a. Equal products from any B.H.M.A. member will also be acceptable.

2.5 ELECTRIC POWER TRANSFERS

- A. Concealed power transfer pivots with ten conductors and two conductors as required to transfer power from the frame to the door.
 - 1. Products listed in sets are Von Duprin (VON) EPT-CON Series.
 - a. Equal products from any B.H.M.A. member will also be acceptable provided that a 180-degree swing of opening can be achieved.

2.6 WIRE HARNESSES

- A. Furnish wire harness connectors for all electric strikes, electrified locks, electric exit device latches, exit device electric trim, including latch monitoring.
- B. Furnish wire harness extension to power supply as indicated in hardware sets.
- C. Furnish wire harness (length as required) with connectors for electrified locks and latches as mentioned above.

2.7 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
 - 1. Products listed in sets are Schlage (SCH) L9000 series with 02A Lever trim as indicated in hardware sets; functions as listed in hardware sets. (No substitutions)
 - 2. Provide strikes with extended lips where required to protect trim from being marred by latch bolt.
 - 3. Provide strike lips which do not project more than 1/8" beyond door-frame trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.
 - 4. Electrified locks shall be furnished with wire harness connectors.

2.8 EXIT DEVICES

- A. Exit devices shall be UL listed panic exit hardware. All exit devices for fire rated opening shall be UL labeled fire exit hardware.

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- B. Functions: As indicated in door hardware schedule for wood, hollow metal and aluminum doors.
 - 1. Products listed in sets are Von Duprin (VON) 98 series.
 - 2. Furnish lever design to match mortise locks and latches.
 - 3. Electrified exit device latches and locking trim shall be furnished with wire harness connectors.

2.9 FLUSH BOLTS

- A. Manual and automatic type:
 - 1. Products listed in sets are Ives (IVE) FB Series.
 - 2. Equal products from the following manufacturers will also be acceptable:
 - a. ABH
 - b. Rockwood

2.10 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Products listed in sets are LCN 4040XP Series.

Review the door frame and plan details to determine the proper length of arm and the degree of swing. State the degree of door swing in the Hardware Schedule. Provide accessories such as drop and adapter plates, panel adapters, thick-hub shoes, blade stop spacers, and shoe supports as required to install door closers correctly.

2.11 LOW ENERGY OPERATORS

- A. Refer to door and frame details and furnish single or double header as indicated in sets.
- B. Where listed, furnish LCN 4642 / 4631 Series. (No Substitutions).
- C. Where listed, furnish Besam SW200i Series.
 - a. Stanley M-Force will also be accepted.

2.12 PUSH & PULL PLATES

- A. Fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
 - 1. Products listed in sets are Ives (IVE) 8000 series.
 - a. Hager
 - b. Rockwood

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- c. Trimco

2.13 MECHANICAL STOPS AND HOLDERS

- A. Wall Stops: BHMA A156.16.
 - 1. Products listed in sets are Ives (IVE).
 - a. Equal products from any B.H.M.A. member will also be acceptable.

2.14 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
 - 1. Products listed in sets are Glynn-Johnson (GLY).
 - a. Equal products from any B.H.M.A. member will also be acceptable.

2.15 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
- B. Provide size and quantity as indicated in hardware sets.
 - 1. Products listed in sets are Ives (IVE).
 - a. Hager
 - b. Rockwood
 - c. Trimco

2.16 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Products listed in sets are National Guard Products (NGP).
 - 2. Comparable product by one of the following manufacturers will also be acceptable:
 - a. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - b. Reese Enterprises, Inc.
 - c. Zero International.

2.17 THRESHOLDS

- A. Cope at jambs.
- B. Furnish full wall opening width when frames are recessed.
- C. Cope in front of mullions if thresholds project beyond the door faces.
- D. Furnish with non-ferrous stainless-steel screws and lead anchors.

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- E. Install fasteners per installation instructions and secure tightly for proper alignment with top of threshold.
- F. All thresholds shall be sealed with industry standard caulk and set in a full bed of mastic.
- G. Products listed in sets are National Guard Prodcuts (NGP).
 - 1. Comparable product by one of the following manufacturers will also be acceptable:
 - a. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - b. Reese Enterprises, Inc.
 - c. Zero International.

2.18 DOOR POSITION SWITCHES

- A. Provide concealed switches.
 - 1. Furnished by the security contractor.
 - 2. Coordinate manufacturer and model with security contractor when prepping doors and frames.

2.19 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames[; use threaded-to-the-head wood screws for wood doors and frames].
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.

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- 2) Closers to doors and frames.
- 3) Surface-mounted exit devices.
- 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
- 4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
- 5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.20 CYLINDERS & KEYING

- A. Provide a mortise or rim cylinder housing for every device capable of being locked. Furnish cams and tailpieces as required by locking device.
- B. Provide a Best Cornax, 7-pin, small format interchangeable core key system with MJK keyway factory keyed per the owner's instructions for all locking cylinders.
- C. Furnish mastekeyed cores as directed by the Owner.
- D. Furnish two key blanks per core. The Wayne State Lock Shop will cut and stamp all keys in house.
- E. Contractor shall provide temporary construction keying system during construction period.
- F. Equip locks and cylinders to accommodate the Owner's key system.

2.21 MISCELLANEOUS

- A. Furnish items not categorized in the above descriptions but specified by manufacturers' names in the Hardware Sets.

2.22 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

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- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- G. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

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3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 HARDWARE SETS

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HW SET: 001

3	EA	HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	PRIVACY SET W/INDICATOR	L9040 02A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM ST-1630	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP

HW SET: 002

3	EA	HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	PRIVACY SET W/INDICATOR	L9040 02A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE

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HW SET: 003

2	EA	CONTINUOUS HINGE	112XY-EPT	710	IVE
2	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL3547AEO CON	695710	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL3547ANL-OP CON	695710	VON
1	EA	RIM CYLINDER	12E72	613	BES
2	EA	OFFSET DOOR PULL	8190EZHD-2-O	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH	695	LCN
1	EA	AUTO-EQUALIZER	4642 REGARM	695	LCN
1	EA	OVERHEAD STOP	900S	695	GLY
2	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	SET	ASTRAGAL SEAL	BY DOOR MFR.		B/O
1	SET	WEATHER SEAL	BY FRAME MFR.		B/O
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	SURFACE MOUNT BOX	10BOXJAMBST		BEA
1	EA	TOUCHLESS, JAMB MOUNT	10MS41-JA	630	BEA
1	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
1	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	SCHEDULED UNLOCKING	BY SECURITY CONTRACTOR		B/O
1	EA	REMOTE LOCK DOWN	PROGRAMMED BY OWNER		B/O

OPERATION: THE CARD READER AND THE ACCESS CONTROL SCHEDULE WILL UNLOCK BOTH DOORS FOR ENTRY AND ENABLE THE OUTSIDE ACTIVATION TO AUTOMATICALLY OPEN THE RHR DOOR FOR ENTRY. THE INSIDE ACTIVATION SWITCH IS ALWAYS OPERABLE FOR EGRESS. THE REMOTE LOCKDOWN WILL CUT POWER TO PREVENT ALL ELECTRONIC UNLOCKING. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT, LATCHBOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE LHR DOOR LEAF AND THE AUTOMATIC OPERATOR ON THE RHR DOOR LEAF.

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HW SET: 004

2	EA	CONTINUOUS HINGE	112XY	710	IVE
2	EA	PULL/PUSHBAR	9190HD-2-NO	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH	695	LCN
1	EA	AUTO-EQUALIZER	4642 REGARM	695	LCN
1	EA	OVERHEAD STOP	100S	695	GLY
1	EA	SURFACE MOUNT BOX	10BOXJAMBST		BEA
1	EA	TOUCHLESS, JAMB MOUNT	10MS41-JA	630	BEA
1	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
1	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O

OPERATION: THE ACTIVATION SWITCHES ON BOTH SIDES OF THE DOOR WILL AUTOMATICALLY OPEN THE DOOR FOR INGRESS/EGRESS. THE PUSH BAR WILL PERMIT FREE EGRESS AT ALL TIMES.

NOTE: LOCATE THE AUTOMATIC OPERATOR ON THE RHR DOOR LEAF.

HW SET: 005

2	EA	CONTINUOUS HINGE	112XY	710	IVE
2	EA	PULL/PUSHBAR	9190HD-2-NO	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH	695	LCN
1	EA	AUTO-EQUALIZER	4642 REGARM	695	LCN
1	EA	OVERHEAD STOP	100S	695	GLY
1	EA	SURFACE MOUNT BOX	10BOXJAMBST		BEA
1	EA	TOUCHLESS, JAMB MOUNT	10MS41-JA	630	BEA
1	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
1	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O

OPERATION: THE ACTIVATION SWITCHES ON BOTH SIDES OF THE DOOR WILL AUTOMATICALLY OPEN THE DOOR INGRESS/EGRESS. THE PUSH BAR WILL PERMIT FREE EGRESS AT ALL TIMES.

NOTE: LOCATE THE AUTOMATIC OPERATOR ON THE LHR DOOR LEAF.

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HW SET: 006

2	EA	CONTINUOUS HINGE	112XY-EPT	710	IVE
2	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL3547AEO CON	695710	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL3547ANL-OP CON	695710	VON
1	EA	RIM CYLINDER	12E72	695	BES
2	EA	OFFSET DOOR PULL	8190EZHD-2-O	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH	695	LCN
1	EA	AUTO-EQUALIZER	4642 REGARM	695	LCN
1	EA	OVERHEAD STOP	900S	695	GLY
2	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	SET	ASTRAGAL SEAL	BY DOOR MFR.		B/O
1	SET	WEATHER SEAL	BY FRAME MFR.		B/O
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	SURFACE MOUNT BOX	10BOXJAMBST		BEA
1	EA	TOUCHLESS, JAMB MOUNT	10MS41-JA	630	BEA
1	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
1	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	SCHEDULED UNLOCKING	BY SECURITY CONTRACTOR		B/O
1	EA	REMOTE LOCK DOWN	PROGRAMMED BY OWNER		B/O

OPERATION: THE CARD READER OR THE ACCESS CONTROL SCHEDULE WILL UNLOCK BOTH DOORS FOR ENTRY AND ENABLE THE OUTSIDE ACTIVATION TO AUTOMATICALLY OPEN THE LHR DOOR FOR ENTRY. THE INSIDE ACTIVATION SWITCH IS ALWAYS OPERABLE FOR EGRESS. THE REMOTE LOCKDOWN WILL CUT POWER TO PREVENT ALL ELECTRONIC UNLOCKING. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT, LATCHBOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE RHR DOOR LEAF AND THE AUTOMATIC OPERATOR ON THE LHR DOOR LEAF.

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HW SET: 007

2	EA	CONTINUOUS HINGE	112XY-EPT	710	IVE
2	EA	POWER TRANSFER	EPT-10 CON	695	VON
2	EA	ELR PANIC HARDWARE	LX-RX-CD3547AEO	~~695~~ 710	VON
2	EA	MORTISE CYLINDER	1E74	613	BES
2	EA	OFFSET DOOR PULL	8190EZHD-2-O	695	IVE
2	EA	SURFACE CLOSER	4040XP.SCUSH	695	LCN
2	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	SET	ASTRAGAL SEAL	BY DOOR MFR.		B/O
1	SET	WEATHER SEAL	BY FRAME MFR.		B/O
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O

OPERATION: THE REQUEST TO EXIT, LATCHBOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 008

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU PANIC HARDWARE	RX-LD98L M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 009

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU FIRE EXIT HARDWARE	RX-98L-F M996L-FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 010

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	FIRE EXIT HARDWARE	RX-9875L-F M996L FSE CON	626	VON
1	EA	MORTISE CYLINDER	1E74	626	BES
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB SERIES	628	IVE
2	EA	SURFACE CLOSER	4111 SCUSH ST-1496	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 011

1	EA	CONTINUOUS HINGE	224XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL35ANL-OP CON	~~695~~ 710	VON
1	EA	RIM CYLINDER	12E72	613	BES
1	EA	OFFSET DOOR PULL	8190EZHD-2-O	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	695	IVE
1	SET	SEALS	700SDKB	DKB	NGP
1	EA	DRIP CAP	16DKB	DKB	NGP
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT, LATCH BOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 012

1	EA	CONTINUOUS HINGE	224XY	710	IVE
1	EA	PULL/PUSHBAR	9190HD-2-NO (SPLIT FINISH)	630/695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

NOTE: FURNISH THE PUSHBAR WITH 695 FINISH AND THE PULL WITH 630 FINISH.

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HW SET: 013

1	EA	CONTINUOUS HINGE	224XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	ELR FIRE EXIT HARDWARE	LX-RX-QEL35ANL-F CON	~~695~~ 710	VON
1	EA	RIM CYLINDER	12E72	613	BES
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	695	IVE
1	SET	SEALS	700SDKB	DKB	NGP
1	EA	DRIP CAP	16DKB	DKB	NGP
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	425DKB	DKB	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE ELECTRIC LATCH SHALL BE CONNECTED TO THE FIRE ALARM SYSTEM TO DISABLE POWER TO ENSURE THE DOOR REMAINS LATCHED DURING A FIRE ALARM EVENT. THE REQUEST TO EXIT, LATCH BOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 014

1	EA	CONTINUOUS HINGE	224XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX-LX 02A 24VDC	643E	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	695	IVE
1	SET	SEALS	700SDKB	DKB	NGP
1	EA	DRIP CAP	16DKB	DKB	NGP
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT, LATCH BOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 015

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
2	EA	FIRE EXIT HARDWARE	9827EO-F-LBR	626	VON
1	EA	ELECTROMAGNETIC LOCK	M490DEP	628	SCE
1	EA	ELECTROMAGNETIC LOCK	M490P	628	SCE
2	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	ASTRAGAL SEAL	5070B	BRN	NGP
1	SET	SEALS	2525C	CHA	NGP
1	EA	OVERLAPPING ASTRAGAL	BY DOOR MFR.		B/O
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
2	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER ON EACH SIDE OF THE DOUBLE EGRESS OPENING WILL UNLOCK THE DOOR IN THE DIRECTION OF TRAVEL. PUSHING THE DOOR LEAF WITH DELAYED EGRESS LOCKING WILL SOUND THE ALARM HORN AND WILL UNLOCK FOR EGRESS AFTER A 15-SECOND DELAY. THE DOOR WITH THE M490P MAG LOCK WILL NOT UNLOCK FOR ENTRY UNLESS A VALID CREDENTIAL IS PRESENTED. THE DELAYED EGRESS LOCKING SHALL BE CONNECTED TO THE FIRE ALARM PANEL TO UNLOCK FOR EGRESS DURING A FIRE ALARM EVENT. THE DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE DELAYED EGRESS MAG LOCK ON THE DOOR SWINGING INTO CORRIDOR 1090.07.

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HW SET: 016

2	EA	CONTINUOUS HINGE	224XY-EPT	628	IVE
2	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	ELR FIRE EXIT HARDWARE	RX-QEL9827EO-F-LBR CON	626	VON
1	EA	ELR FIRE EXIT HARDWARE	RX-QEL9827L-F-LBR M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
2	EA	AUTO-EQUALIZER	4642 REGARM	689	LCN
2	EA	OVERHEAD STOP	900S	630	GLY
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	ASTRAGAL SEAL	5070B	BRN	NGP
1	SET	SEALS	2525C	CHA	NGP
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
2	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
2	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK BOTH DOORS FOR ENTRY AND ENABLE THE OUTSIDE ACTIVATION TO AUTOMATICALLY OPEN BOTH DOORS. THE INSIDE ACTIVATION SWITCH IS ALWAYS OPERABLE FOR EGRESS. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE AUTOMATIC OPERATOR AND ELECTRIC LATCHES SHALL BE CONNECTED TO THE FIRE ALARM PANEL TO DISABLE POWER TO ENSURE THE DOORS REMAIN CLOSED AND LATCHED DURING A FIRE ALARM EVENT. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: DO NOT CONNECT THE ELECTRIC LEVER TO THE FIRE ALARM PANEL SO THAT IT REMAINS OPERABLE DURING A FIRE ALARM EVENT. LOCATE THE KEY ON THE RHR DOOR LEAF.

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HW SET: 017

1	EA	CONTINUOUS HINGE	112XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL35ANL-OP CON	695	VON
1	EA	RIM CYLINDER	12E72	613	BES
1	EA	OFFSET DOOR PULL	8190EZHD-2-O	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	SET	WEATHER SEAL	BY FRAME MFR.		B/O
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT, LATCH BOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 018

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE PULL SIDE OF THE DOOR.

HW SET: 019

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET W/INDICATOR	L9040 02A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE

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HW SET: 020

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	SCHEDULED UNLOCKING	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER AND THE ACCESS CONTROL SCHEDULE WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 021

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	OVERHEAD STOP	900S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 022

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	SCHEDULED UNLOCKING	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER AND THE ACCESS CONTROL SCHEDULE WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 023

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE

HW SET: 024

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	STOREROOM LOCK	L9080BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.REGARM ST-1630	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS	630	IVE

HW SET: 025

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	L9050BDC 02A L583-363	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	WALL STOP	WS401/402CCV	626	IVE

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HW SET: 026

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE

HW SET: 027

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 028

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 029

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU FIRE EXIT HARDWARE	RX-98L-F M996L-FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 030

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU PANIC HARDWARE	RX-LD98L M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	SCHEDULED UNLOCKING	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER AND THE ACCESS CONTROL SCHEDULE WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 031

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU PANIC HARDWARE	RX-LD98L M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	SCHEDULED UNLOCKING	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER AND THE ACCESS CONTROL SCHEDULE WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 032

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 033

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
2	EA	WALL STOP	WS33/WS33X	626	IVE

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HW SET: 034

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.REGARM	689	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 035

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302-0-F 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE

HW SET: 036

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY

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HW SET: 037

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	FIRE EXIT HARDWARE	RX-9827EO-F-LBR CON	626	VON
1	EA	EU FIRE EXIT HARDWARE	RX-9827L-F-LBR M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
2	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE RHR DOOR LEAF.

HW SET: 038

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 02A	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	SET	SEALS	107NA	CL	NGP
1	EA	DOOR BOTTOM	423NA	CL	NGP
2	EA	STC FOAM PAD	60FP	BLK	NGP

NOTE: LOCATE THE FOAM PADS ON THE BOTTOM OF EACH JAMB.

HW SET: 039

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	SET	SEALS	2525C	CHA	NGP

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HW SET: 040

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE PULL SIDE OF THE DOOR.

HW SET: 041

6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458 (TOP)	626	IVE
1	EA	PASSAGE SET	L9010 02A	626	SCH
2	EA	OVERHEAD STOP	100S	630	GLY
1	SET	SEALS	107NA	CL	NGP

HW SET: 042

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080BDC 02A	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB SERIES	628	IVE
2	EA	SURFACE CLOSER	4040XP.EDA ST-1754	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	ASTRAGAL SEAL	5070B	BRN	NGP
1	SET	SEALS	2525C	CHA	NGP

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HW SET: 043

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	FIRE EXIT HARDWARE	LX-98EO-F CON	626	VON
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	ALARM HORN	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES BUT WILL SOUND THE ALARM HORN DURING EGRESS. THE LATCH BOLT MONITOR AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 044

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	OFFICE LOCK	L9050BDC 02A L583-363	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	WALL STOP	WS33/WS33X	626	IVE

HW SET: 045

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE

HW SET: 046

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM ST-1630	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP

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HW SET: 047

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP

HW SET: 048

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM ST-1630	689	LCN
1	EA	OVERHEAD STOP	100S	SPBLK	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 049

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS33/WS33X	626	IVE

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HW SET: 050

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	FIRE EXIT HARDWARE	RX-98EO-F CON	626	VON
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 051

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	STOREROOM LOCK	L9080BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	UL ARMOR PLATE	8402 34" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP

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HW SET: 052

2	EA	CONTINUOUS HINGE	224XY-EPT	628	IVE
2	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	ELR PANIC HARDWARE	RX-QEL9827EO-LBR CON	626	VON
1	EA	ELR PANIC HARDWARE	RX-QEL9827L-LBR M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	SET	ASTRAGAL	115NA	CL	NGP
2	EA	AUTO-EQUALIZER	4642 REGARM	689	LCN
2	EA	OVERHEAD STOP	900S	630	GLY
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	SET	SEALS	127SA	CL	NGP
2	EA	DOOR SWEEP	OV633A	CL	NGP
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
2	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
2	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK BOTH DOORS FOR ENTRY AND ENABLE THE OUTSIDE ACTIVATION TO AUTOMATICALLY OPEN BOTH DOORS. THE INSIDE ACTIVATION SWITCH IS ALWAYS OPERABLE FOR EGRESS. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE RHR DOOR LEAF.

HW SET: 053

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98L-BE-F 996L-BE	626	VON
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP

HW SET: 054

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 02A	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY

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HW SET: 055

1	SET	CONCEALED HINGES	BY FRAME MFR.	626	B/O
1	EA	STOREROOM LOCK	L9080BDC 02A X LLL	626	SCH
1	EA	CONCEALED EDGE PULL	885	626	ROC
1	EA	OVERHEAD STOP	100S	630	GLY

NOTE: LOCATE THE EDGE PULL ABOVE THE MORTISE LOCK ON THE PULL SIDE OF THE DOOR.
LOCATE THE LEVER ON THE PUSH SIDE OF THE DOOR.

HW SET: 056

2	SET	CONCEALED HINGES	BY FRAME MFR.	626	B/O
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080BDC 02A X LLL	626	SCH
1	EA	CONCEALED EDGE PULL	885	626	ROC
2	EA	OVERHEAD STOP	100S	630	GLY

NOTE: LOCATE THE EDGE PULL ABOVE THE MORTISE LOCK ON THE PULL SIDE OF THE DOOR.
LOCATE THE LEVER ON THE PUSH SIDE OF THE DOOR.

HW SET: 057

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HW SET: 058

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	PASSAGE SET	L9010 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.SCUSH	689	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS	630	IVE

HW SET: 059

4	EA	HINGES	BY PACKAGED DOOR MFR.		B/O
1	EA	L9050BDC 02A L583-363	OFFICE LOCK		
1	EA	ASSA ABLOY DC840	BY PACKAGED DOOR MFR.	626	B/O
1	EA	WALL STOP	CONCEALED CLOSER		
			BY PACKAGED DOOR MFR.		B/O
1	EA		447	IVE	626

NOTE: REFER TO SECTION 134275 INTEGRATED ASSEMBLIES FOR COORDINATION.

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HW SET: 060

4	EA	HINGES	BY PACKAGED DOOR MFR.		B/O
1	EA	L9070BDC 02A	CLASSROOM LOCK		
			BY PACKAGED DOOR MFR.	626	B/O
1	EA	ASSA ABLOY DC840	CONCEALED CLOSER		
			BY PACKAGED DOOR MFR.		B/O
1	EA	OVERHEAD STOP	BY PACKAGED DOOR MFR.		B/O

NOTE: REFER TO SECTION 134275 INTEGRATED ASSEMBLIES FOR COORDINATION.

HW SET: 061

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 062

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 063

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 064

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	PASSAGE SET	L9010 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.SCUSH	689	LCN
1	EA	UL ARMOR PLATE	8402 34" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP

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HW SET: 065

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP

HW SET: 066

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	SET	SEALS	107NA	CL	NGP
1	EA	DOOR BOTTOM	423NA	CL	NGP
2	EA	STC FOAM PAD	60FP	BLK	NGP

NOTE: LOCATE THE FOAM PADS ON THE BOTTOM OF EACH JAMB.

HW SET: 067

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU PANIC HARDWARE	RX-LD9827EO-LBR CON	626	VON
1	EA	EU PANIC HARDWARE	RX-LD9827L-LBR M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
2	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FRAME WIRE HARNESS	CON-6W		VON
2	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 068

1	EA	ALL HARDWARE	BY PACKAGED DOOR MFR.		B/O

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HW SET: 069

1	EA	PIVOT	7230F INT	630	IVE
1	SET	PIVOT SET	7230F SET	630	IVE
1	EA	ELECTROMAGNETIC LOCK	M420P	628	SCE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302-0-F 4" X 16"	630	IVE
1	EA	AUTO OPERATOR	BESAM SW200I PULL MOUNTED	689	BSM
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
2	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
2	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	PUSHBUTTON	623RD	630	SCE
1	EA	PUSHBUTTON	623RD EX	630	SCE
2	EA	MONITORING STATION	800L1	630	SCE
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK DPS	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK LOGIC	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE DOOR IS NORMALL UNLOCKED FROM BOTH SIDES AND THE ACTIVATION SWITCHES ON BOTH SIDES OF THE DOOR ARE ENABLED FOR AUTOMATIC OPERATION, EXCEPT WHEN INTERLOCKED WITH DOOR 4115.00.

INTERLOCK: THE DOORS WILL BE INTERLOCKED SO ONLY 1 CAN BE OPENED AT A TIME. THE RED/GREEN INDICATOR MONITOR ON EACH SIDE OF THE DOOR WILL ALERT THE USER WHEN THE DOOR CAN BE OPENED. OPENING ONE DOOR WILL LOCK THE OTHER MAG LOCK UNTIL THE DOOR CLOSES AGAIN. THE EXIT BUTTON ON EITHER SIDE WILL OVERRIDE THE INTERLOCK FOR EGRESS.

FIRE ALARM: THE ELECTROMAGNETIC LOCKS WILL BE CONNEDTED TO THE FIRE ALARM PANEL TO UNLOCK UPON ACTIVATION.

NOTE: LOCATE THE 623RD EX ON THE PULL SIDE OF THE DOOR.

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HW SET: 070

1	EA	PIVOT	7230F INT	630	IVE
1	SET	PIVOT SET	7230F SET	630	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC (LEAD-LINED)	626	SCH
1	EA	ELECTROMAGNETIC LOCK	M420P	628	SCE
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	PUSHBUTTON	623RD EX	630	SCE
1	EA	KEYSWITCH	653-04-L2	630	SCE
2	EA	MONITORING STATION	800L1	630	SCE
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK DPS	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK LOGIC	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE IS UNLOCKED TO PERMIT EGRESS EXCEPT WHEN INTERLOCKED WITH DOOR 4111.00. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

INTERLOCK: THE DOORS WILL BE INTERLOCKED SO ONLY 1 CAN BE OPENED AT A TIME. THE RED/GREEN INDICATOR MONITOR ON EACH SIDE OF THE DOOR WILL ALERT THE USER WHEN THE DOOR CAN BE OPENED. OPENING ONE DOOR WILL LOCK THE OTHER MAG LOCK UNTIL THE DOOR CLOSES AGAIN. THE EXIT BUTTON WILL OVERRIDE THE INTERLOCK FOR EGRESS. THE KEY SWITCH WILL BE USED TO SHUT DOWN THE INTERLOCK FUNCTION FOR EMERGENCY ACCESS.

FIRE ALARM: THE ELECTROMAGNETIC LOCKS WILL BE CONNETED TO THE FIRE ALARM PANEL TO UNLOCK UPON ACTIVATION.

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HW SET: 071

3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	ELECTROMAGNETIC LOCK	M420P	628	SCE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302-0-F 4" X 16"	630	IVE
1	EA	AUTO-EQUALIZER	4631	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
2	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
2	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	PUSHBUTTON	623RD	630	SCE
1	EA	PUSHBUTTON	623RD EX	630	SCE
2	EA	MONITORING STATION	800L1	630	SCE
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK DPS	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK LOGIC	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE DOOR IS NORMALL UNLOCKED FROM BOTH SIDES AND THE ACTIVATION SWITCHES ON BOTH SIDES OF THE DOOR ARE ENABLED FOR AUTOMATIC OPERATION, EXCEPT WHEN INTERLOCKED WITH DOOR 5111.00A.

INTERLOCK: THE DOORS WILL BE INTERLOCKED SO ONLY 1 CAN BE OPENED AT A TIME. THE RED/GREEN INDICATOR MONITOR ON EACH SIDE OF THE DOOR WILL ALERT THE USER WHEN THE DOOR CAN BE OPENED. OPENING ONE DOOR WILL LOCK THE OTHER MAG LOCK UNTIL THE DOOR CLOSES AGAIN. THE EXIT BUTTON ON EITHER SIDE WILL OVERRIDE THE INTERLOCK FOR EGRESS.

FIRE ALARM: THE ELECTROMAGNETIC LOCKS WILL BE CONNEDTED TO THE FIRE ALARM PANEL TO UNLOCK UPON ACTIVATION.

NOTE: LOCATE THE 623RD EX ON THE PULL SIDE OF THE DOOR.

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HW SET: 072

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	ELECTROMAGNETIC LOCK	M420P	628	SCE
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	PUSHBUTTON	623RD EX	630	SCE
1	EA	KEYSWITCH	653-04-L2	630	SCE
2	EA	MONITORING STATION	800L1	630	SCE
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK DPS	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK LOGIC	BY SECURITY CONTRACTOR		B/O
1	EA	INTERLOCK POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE IS UNLOCKED TO PERMIT EGRESS EXCEPT WHEN INTERLOCKED WITH DOOR 5111.00. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

INTERLOCK: THE DOORS WILL BE INTERLOCKED SO ONLY 1 CAN BE OPENED AT A TIME. THE RED/GREEN INDICATOR MONITOR ON EACH SIDE OF THE DOOR WILL ALERT THE USER WHEN THE DOOR CAN BE OPENED. OPENING ONE DOOR WILL LOCK THE OTHER MAG LOCK UNTIL THE DOOR CLOSES AGAIN. THE EXIT BUTTON WILL OVERRIDE THE INTERLOCK FOR EGRESS. THE KEY SWITCH WILL BE USED TO SHUT DOWN THE INTERLOCK FUNCTION FOR EMERGENCY ACCESS.

FIRE ALARM: THE ELECTROMAGNETIC LOCKS WILL BE CONNEDTED TO THE FIRE ALARM PANEL TO UNLOCK UPON ACTIVATION.

HW SET: 073

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	L9070BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.CYLDEL.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

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HW SET: 074

1	EA	CONTINUOUS HINGE	224XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	LX STOREROOM LOCK	L9080BDC-LX 02A CON	643E	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	695	IVE
1	SET	SEALS	700SDKB	DKB	NGP
1	EA	DRIP CAP	16DKB	DKB	NGP
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	425DKB	DKB	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE LATCH BOLT MONITOR AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE PULL SIDE OF THE DOOR.

HW SET: 075

1	EA	CONTINUOUS HINGE	224XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	643E	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM ST-1630	695	LCN
1	EA	OVERHEAD STOP	100S	695	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	695	IVE
1	SET	SEALS	127SDKB	DKB	NGP
1	EA	DRIP CAP	16DKB	DKB	NGP
1	EA	DOOR SWEEP	200SDKB	DKB	NGP
1	EA	THRESHOLD	896NDKB	DKB	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE DOOR SWEEP ON THE PULL SIDE OF THE DOOR.

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HW SET: 076

1	EA	CONTINUOUS HINGE	224XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	ELR PANIC HARDWARE	LX-RX-QEL35ANL-OP CON	695	VON
1	EA	RIM CYLINDER	12E72	613	BES
1	EA	OFFSET DOOR PULL	8190EZHD-2-O	695	IVE
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS	695	IVE
1	SET	SEALS	700SDKB	DKB	NGP
1	EA	DRIP CAP	16DKB	DKB	NGP
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	INTERCOM/REMOTE RELEASE	BY INTERCOM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER AND THE REMOTE RELEASE WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT, LATCH BOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 077

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE PULL SIDE OF THE DOOR.

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HW SET: 078

4	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU PANIC HARDWARE	RX-LD98L M996L FSE CON	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP.SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

HW SET: 079

1	EA	CONTINUOUS HINGE	112XY-EPT	710	IVE
1	EA	POWER TRANSFER	EPT-10 CON	695	VON
1	EA	PANIC HARDWARE	LX-RX-98EO CON	695	VON
1	EA	SURFACE CLOSER	4040XP.SCUSH ST-1595	695	LCN
1	EA	DOOR SWEEP	C627DKB	DKB	NGP
1	EA	THRESHOLD	8425DKB	DKB	NGP
1	SET	WEATHER SEAL	BY FRAME MFR.		B/O
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE REQUEST TO EXIT, LATCH BOLT MONITOR, AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

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HW SET: 080

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

OPERATION: THE CARD READER WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE PUSH SIDE OF THE DOOR.

HW SET: 081

1	SET	HANGING DEVICE	BY PACKAGED DOOR MFR.	630	B/O
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	EA	ELR FIRE EXIT HARDWARE	QEL98L-BE-F	626	VON
1	EA	AUTO OPERATOR	BESAM SW200I PULL MOUNTED	689	BSM
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	EA	SMOKE/FIRE SEALS	BY PACKAGED DOOR MFR.		B/O
1	EA	POWER SUPPLY	PS902-4RL-FA	GRY	VON
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
2	EA	TOUCHLESS, WALL MOUNT	10MS41-SA	630	BEA
2	EA	SURFACE MOUNT BOX	10MSBOXSGSM		BEA
1	EA	LINE VOLTAGE	BY ELECTRICAL CONTRACTOR		B/O
1	EA	FIRE ALARM RELAY	BY FIRE ALARM CONTRACTOR		B/O

OPERATION: THE ACTIVATION SWITCHES ON BOTH SIDES OF THE DOOR WILL AUTOMATICALLY OPEN THE DOOR FOR INGRESS/EGRESS. THE PANIC HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE AUTOMATIC OPERATOR AND ELECTRIC LATCH SHALL BE CONNECTED TO THE FIRE ALARM PANEL TO DISABLE POWER TO ENSURE THE DOOR REMAINS CLOSED AND LATCHED DURING A FIRE ALARM EVENT.

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HW SET: 082

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080BDC 02A	626	SCH
1	EA	SURFACE CLOSER	4040XP.EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS33/WS33X	626	IVE
1	SET	SEALS	2525C	CHA	NGP

HW SET: 083

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-10 CON	689	VON
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	EU-RX STOREROOM LOCK	L9092BDCEU-RX 02A 24VDC	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP.REGARM	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	MAGNETIC HOLD-OPEN	SEM7850	AL	LCN
1	EA	ASTRAGAL SEAL	5070B	BRN	NGP
1	SET	SEALS	2525C	CHA	NGP
1	EA	FRAME WIRE HARNESS	CON-6W		VON
1	EA	DOOR WIRE HARNESS	CON-XXP (LENGTH AS REQUIRED)		VON
1	EA	PUSHBUTTON	623RD	630	SCE
1	EA	FIRE PANEL POWER	BY FIRE ALARM CONTRACTOR		B/O
1	EA	CARD READER	BY SECURITY CONTRACTOR		B/O
2	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		B/O
1	EA	LOW VOLT. POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

CONDITION #1: THE DOORS ARE ALWAYS LOCKED BUT ARE HELD OPEN BY THE MAGNETIC HOLDERS

CONDTION #2: THE DOORS ARE CLOSED AND LOCKED.

OPERATION: THE CARD READER ON THE PUSH SIDE WILL UNLOCK THE DOOR FOR ENTRY. THE INSIDE HARDWARE WILL PERMIT FREE EGRESS AT ALL TIMES. THE REQUEST TO EXIT AND DOOR POSITION SWITCHES ARE MONITORED BY THE ACCESS CONTROL SYSTEM.

NOTE: LOCATE THE KEY ON THE PUSH SIDE OF THE DOOR.

-THE MAGNETIC HOLDERS ARE POWERED BY THE FIRE ALARM PANEL AND SHALL RELEASE TO CLOSE AND LATCH DURING ACTIVATION.

-THE PUSH BUTTON WILL INTERRUPT POWER TO RELEASE THE DOORS WHEN MAGNETICALLY HELD OPEN.

END OF SECTION

DOOR HARDWARE

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SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glass, glazing, and supplementary items necessary for installation, including glass specified in other Sections where glazing requirements referenced to this Section.
 - 1. Monolithic glass.
 - 2. Insulating glass.
 - 3. Decorative glazing.
 - 4. Fire-protection-rated glazing.
 - 5. Glazing sealants and glazing materials.
- B. Enhanced Source Quality Control Standards: Comply with Manufacturer/Fabricator Enhanced Source Quality Control Standards for glass fabrication.
- C. Related Requirements:
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.

1.2 ALTERNATES

- A. Alternate for Heat Soaked Fully Tempered Glass: Where fully tempered glass is required due to structural loads and other performance requirements that cannot be met by increased glass thickness, using laminated glass or other means, provide heat soaked fully tempered glass in lieu of fully tempered glass.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.

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- B. Project Glazing Analysis: Prepared by manufacturer for primary glass or fabricator for fabricated glass units. Analyze each glass type and glazing condition for thermal, wind, impact and additional design loads indicated in glass performance requirements.
 - 1. Provide glass products in the thickness and strengths required to meet or exceed the criteria based on project loads and in-service conditions.
- C. Delegated Engineering – Structural Glass and Other Applications Exceeding Project Glazing Analysis: Contractor shall employ a qualified structural engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified structural engineer.
- D. Delegated Engineering Professional Qualifications: Structural engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- E. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.5 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Include details of each type of glazing in conjunction with the appropriate framing system; indicate type of glass, sizes, shapes, glazing material, and quantity.
 - 2. Include details indicating glazing thickness, bite on glass, glass edge clearance, and depth of rabbet.

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- C. Glass Samples: For each type of glass product other than clear monolithic vision glass, 12 inches () square.
- D. Glass Range Sample Units: For each type of glass product other than clear monolithic vision glass, provide full size range samples representing anticipated range of appearance on the Project. Retain range samples for reference.
- E. Glazing Accessory Samples: For gaskets, sealants and colored spacers, each type and color, in 12-inch () lengths.
- F. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Manufacturer Project Acceptance Documents: Certifications by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Certification attesting application and use of glass for effects of thermal loading under expected service temperature ranges has been reviewed, and specified maximum probabilities of breakage will not be exceeded.
 - a. Certification shall include back pan and shadow box back pan conditions.
 - 2. Certifications attesting performance for specified design wind load criteria, has been reviewed; furnish design factor, statistical probability of breakage and center deflection for the largest size of each thickness and type.
 - 3. Certifications attesting face pressure of heat-strengthened glass units falls within limits specified. Glass determined to be outside these limits shall be replaced at no cost to Owner.
 - 4. Insulated Glass Units: Certification from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.
 - 5. Ceramic Frit Coated Glass: Certification from manufacturer acknowledging strength reduction of frit coating used on the Project.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified structural engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
 - 1. Include strength/deflection calculations and secondary sealant sightline analysis.
 - a. Provide thermal stress analysis and certification that heat strengthening or tempering complies with requirements and conditions indicated for this Project.
 - 2. Where IGU structural performance based on inner/outer lite combination cannot be determined, fabricator shall assume outer lite only to meet structural requirements.

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- C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- D. Source Quality Control Reports for Enhanced Quality Standards: When requested, provide written reports documenting testing procedures and recorded measurements. Include letter(s) certifying compliance for the following.
 - 1. Distortion Tolerance Measurements: For heat-treated glass 6mm or thicker.
 - 2. Insulating Glass Unit Fabrication and Testing Requirements: For insulating glass units.
 - 3. Glass Color Tolerance Measurements: For monolithic coated glass and insulating coated glass units.
- E. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.
- F. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
 - 4. Certification: Qualified glazing contractor certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- C. Reflective- and Low-E-Coated Vision Glass: ASTM C1376, and as follows, whichever is more restrictive.
 - 1. Inspection: At a distance of 10 ft (), in transmission and reflectance at a viewing angle of 90° to the specimen, using a bright uniform background with diffused daylight conditions, without direct sunlight. Vision area shall extend to within 3 in of the perimeter of glass panel.

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2. Reflectance and Transmission: Reflectance and transmission may vary slightly and be considered acceptable. Reflectance variations of plus or minus 1.5 percent are permissible.
 3. Pinholes: Pinholes greater than 1/16 in diameter shall not be allowed within vision area.
 4. Scratches: Scratches greater than 1/2 in shall not be allowed within vision area.
 5. Verification of Color: Color shall be verified by using a Spectrophotometer placed directly on the specimen.
 - a. Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.
- D. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS, and as follows, whichever is more restrictive.
1. Inspection: At a distance of 15 ft (), a viewing angle of 90° to the specimen, using a bright uniform background with diffused daylight conditions, without direct sunlight.
 2. Reflectance: Reflectance variations of plus or minus 1.5 percent are permissible.
 3. Verification of Color: Color shall be verified by using a Spectrophotometer placed directly on the specimen.
 - a. Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.
- E. Anisotropy Measurement: Anisotropy inspection is the measurement of polarized light calculated and presented as Maximum Iridescence or Total Stress in accordance with ASTM C1901-21.
1. Anisotropy shall be monitored using an on-line measurement system to assure that glass produced for this project measures within a consistent and accepted range of results established by baseline measurements on the accepted mockup glass.
 - a. The intent of this requirement is to use measurements taken from mockup glass during the manufacturing process to establish an acceptable range of results as the baseline for the mass production of glass for this project.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

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1.10 MOCKUPS

- A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Provide glazing in mockups to match glazing systems required for Project, including glazing methods.

1.11 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 - 3. Record discussions, including decisions and agreements, and prepare report.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Insulating Glass Units: Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.13 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

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1.14 Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg Fahrenheit unless approved otherwise by manufacturer in writing.COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate glazing channel dimensions.
 - 1. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
 - 2. Achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.15 WARRANTY

- A. Manufacturer Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coated Glass: Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.
 - 2. Insulating Glass Units: Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.
 - 3. Heat-Soaked Tempered Glass: Breakage of heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period.
 - a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.
- B. Installer Warranty: Furnish installer written workmanship warranty signed by an authorized representative using installer standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. Defects • • is defined to include but not limited to deterioration or failure to perform as required.

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1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 1. Glass Selections: As scheduled or indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
 1. Glazing to withstand each applicable design load case and load case combination within limits and under conditions determined in accordance with the IBC and ASTM E1300.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.
- D. Exterior Glazing:
 1. Design Wind Pressure: As indicated on Drawings or Wind Analysis Report.
 2. Other Loads: As indicated on Drawings.

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3. Vertical Glazing: For glass surfaces set vertically 15 degrees or less from vertical, design glass to resist design loads based on glass type factors.
 - a. Probability of Breakage for Vertical Glazing: For glass surfaces set vertically 15 degrees or less from vertical, design glass for a probability of breakage not greater than 0.008.
 4. Maximum Lateral Deflection: At design wind pressure.
 - a. For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/100 times the short-side length or 1 inch (25 mm), whichever is less and keeps glazing retained in place with a suitable margin of safety under design conditions.
 5. Thermal Loads: Design glazing to resist thermal stress breakage induced by conditions including differential shading within individual glass lites, temperatures and limited air circulation.
 - a. Include back pan and shadow box back pan applications.
 6. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.
 - a. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.
 7. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - a. For monolithic glass lites, properties are based on units with lites 1/4 in thick.
 - b. For laminated glass lites, properties are based on products of construction indicated.
 - c. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - d. U-Factors: Center-of-glazing values, according to NFRC 100, expressed as Btu/sq. ft. x h x deg F ().
 - e. Solar Heat-Gain Coefficient and Visible Light Transmittance: Center-of-glazing values, according to NFRC 200.
 - f. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
 8. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.
- E. Interior Glazing:
1. Maximum Lateral Deflection: For glass supported on all four edges or two edges, limit center-of-glass deflection to not more than 1/100 times the short-side length or 1/2 in (12 mm), whichever is less, at 10 lb/sq ft (479 Pa) lateral load.

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2. Differential Deflection: For glass installed to walking surfaces, deflection of adjacent unsupported edges shall not exceed glass thickness when subjected to 50 lbf/ft. (730 N/m) applied horizontally to one panel at any point up to 42 inches (1067 mm) above the adjacent walking surface.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by conditions including differential shading within individual glazing lites and temperatures.
4. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.
 - a. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.

2.4 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. FGIA/IGMA Publication for Insulating Glass: IGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
 2. FGIA/IGMA Publication Insulating Glazing Tolerances: IGMA TB-1200, "Guidelines for Insulating Glass Dimensional Tolerances."
 3. FGIA/IGMA Publication for Thermal Stress: IGMA TM-1500, "Guidelines to Reduce Instances of Thermal Stress."
 4. NGA/GANA Publications: "Guidelines for the Appearance of Insulating Glass Unit Edges in Commercial Applications at the Time of Installation"
- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 1. Acceptable Products: Complying with CSPC 16 CFR 1201, Category II.
 - a. Submit label location and size for Owner approval prior to fabrication. Glass having labels in locations not pre-approved shall be removed and replaced with glass having labels in the correct location at no cost to Owner.
 2. Products Not Permitted: Wired Glass.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
 1. Units shall be certified by IGCC to comply with ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
- D. Insulating Glass Units: Acceptable products shall comply with the following:
 1. ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units.
 2. ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.

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- E. Glass Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Exterior Glass Schedule: As indicated on Drawings, or as scheduled or as indicated in Design Selections.
 - a. Exterior Lites: Not less than 1/4 in minimum thickness.
 - b. Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
 2. Interior Glass Schedule: As indicated on Drawings, or as scheduled or as indicated in Design Selections.
 - a. Interior Lites: Not less than 1/4 in minimum thickness.
- F. Glass Strength: Provide Kind HS heat-strengthened float glass or Kind FT fully tempered float glass as required to comply with Performance Requirements, unless otherwise indicated:
1. Provide Kind HS (Heat Strengthened) at exterior conditions and where recommended by manufacturer to comply with performance requirements.
 2. Provide Kind FT (Fully Tempered) as indicated and where recommended by manufacturer to comply with performance requirements or required for safety glazing.
 3. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with Performance Requirements.
 4. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with Performance Requirements.
 5. Where fully tempered float glass is indicated, provide fully tempered float glass.
 - a. Provide Kind FT fully tempered float glass where recommended by manufacturer to comply with safety glazing requirements.

2.5 GLASS PRODUCTS

- A. Glass Manufacturers and Fabricators:
1. AGC Glass Co. North America, Inc.
 2. Guardian Industries Corporation
 3. Pilkington North America, Inc.
 4. Vitro Architectural Glass (formerly PPG Industries, Inc.)
 5. Saint Gobain.
 6. Viracon.
 7. Interpane.
 8. Tecnoglass.
 9. Oldcastle.
 10. McGrory
- B. Clear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- C. Low-Iron Float Glass (Ultraclear): ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent.

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1. Manufacturers and Products:
 - a. AGC Glass Co. North America, Inc.; Krystal Klear.
 - b. Guardian Industries Corp.; Ultrawhite.
 - c. Pilkington North America; Optiwhite.
 - d. Vitro Architectural Glass (PPG Industries, Inc.); Starphire.
- D. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided otherwise.
- E. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided otherwise.
- F. Heat Soaking Tempered Glass: Provide heat soak testing for fully tempered products in accordance with EN 14179-1 or EN 14179-2 and manufacturer's recommended heat soak testing process.
 1. Locations Schedule:
 - a. As scheduled or indicated in Design Selections or Drawings.
 - b. As indicated in Alternate for Heat Soaked Fully Tempered Glass.
 - c. Locations recommended by manufacturer.
- G. Reflective- and Low-E-Coated Vision Glass: ASTM C 1376, coated by pyrolytic process or vacuum deposition (sputter-coating) process, standard of manufacturer, and complying with other requirements as specified.
 1. Kind: Kind CV (coated vision glass), except that Kind CO (coated overhead glass) may be used where the lower edge of the glass is more than 6 ft above the adjacent floor level or cannot be approached closer than 10 ft.
- H. Ceramic-Coated Vision Glass: ASTM C 1048, Condition C, Type 1, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3, heat-treated float glass with ceramic enamel; complying with Specification No. 95-1-31 in NGA/GANA's "Engineering Standards Manual", and with other requirements as specified.
- I. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and with other requirements as specified.
- J. Reflective- and Low-E-Coated Spandrel Glass: ASTM C 1376, Kind CS; coated by pyrolytic process or vacuum deposition (sputter-coating) process, standard of manufacturer, and complying with other requirements as specified.

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- K. Decorative Film Overlay: Translucent, dimensionally stable, film, 2-mil- (0.05-mm-) minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Selections: As scheduled or indicated in Design Selections.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other specified requirements.

1. Insulating Glass Unit Thickness Tolerance: Minus 1/16 inch, plus 1/32 inch.

- a. Units Constructed with Patterned or Laminated Glass: Plus or minus 1/16 inch.

2. Sealing System: Dual seal, with polyisobutylene primary seal and silicone secondary seal in accordance with ASTM C 1249. Provide insulating glass units free of skips or voids in the primary or secondary seals.

- a. Primary IGU Seal: Primary IGU sealant shall be fully wetted against glass, applied in a continuous, uninterrupted, properly dimensioned bead with no skips or voids around perimeter, each side of IGU.

- 1) Primary Seal Width: 5/32-inch.
- 2) Primary Seal Thickness: 1/16-inch minimum thickness after pressing IGU.
- 3) Air Spacer Visibility: 3/32-inch maximum visible exposure beyond polyisobutylene primary seal.

- b. Secondary IGU Seal: Secondary IGU sealant shall be fully wetted against glass and spacer, applied in a continuous, uninterrupted, properly dimensioned bead, filling cavity with sealant completely.

- 1) Secondary Seal Thickness: As determined by glass manufacturer; meeting minimum design width and depth requirements as determined by glass strength and deflections, plus 1/16-inch tolerance.
- 2) Corners: IGU corners shall be completely filled with secondary sealant.

- c. Skips and Voids Between Primary and Secondary Sealant: Maximum of 2-inches long by 1/16-inch-wide discontinuity separated by at least 18-inches. Provide continuous contact between primary and secondary IGU sealant, cleanly tool secondary sealant prior to packing.

- d. Sealant Color: Black, unless otherwise scheduled or indicated in Design Selections.

3. Spacer: Provide a hermetically sealed and dehydrated space; lites shall be separated by a spacer with three bent corners and one keyed-soldered corner or four bent corners and one straight butyl injected zinc plated steel straight key joint.

- a. Spacer Material and Color:

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- 1) Spacer Material and Color: Aluminum with mill or clear anodic finish, unless otherwise scheduled or indicated in Design Selections.
4. Edge Deletion: Delete coating at perimeter of coated lite prior to fabrication of insulating glass units according to coated glass manufacturerTM instructions.
5. Desiccant: Molecular sieve or silica gel, or blend of both.

2.7 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and complies with NFPA 80.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F (250 deg C) temperature-rise limitation; and fire-resistance rating in minutes.
- C. Monolithic Fire-Protection-Rated Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) thickness; complying with 16 CFR 1201, Category II.
 1. Manufacturers and Products:
 - a. Technical Glass Products; FireLite.
 - b. Safti First; SuperLite.
 - c. Schott North America, Inc.; Pyran Star.
 - d. Vetrotech; Keralite.
 2. Basis of Design: Technical Glass Products; FireLite.
 - a. Locations - Safety Glazing not Required: Where indicated or scheduled for 20, 45, 60, and 90-minute ratings.
- D. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.
 1. Manufacturers and Products:
 - a. Technical Glass Products; FireLite Plus (Laminated).
 - b. Safti First; SuperLite (Laminated).
 - c. Schott North America, Inc.; Pyran Star (Laminated).
 - d. Vetrotech Saint-Gobain; Keralite (Laminated).
 2. Basis of Design: Technical Glass Products; FireLite Plus.
 - a. Locations - Safety Glazing Required: Where indicated or scheduled for 20, 45-, 60-, 90-, and 120-minute ratings.

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2.8 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Additional Movement Capability: Provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers and Products:

- a. Dow; DOWSIL 795 Silicone Building Sealant.
- b. GE Construction Sealants; Momentive Performance Materials Inc. GE Advanced Materials - Silicones; Silglaze II.
- c. Pecora Corporation; 895.
- d. Sika Corp.; Sikasil WS-295.

2. Color: As selected by Architect from manufacturer's full range of colors.

C. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone material with a Shore, Type A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Silicone blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

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2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
1. Silicone material of hardness needed to limit glass lateral movement (side walking).
 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
- B. Butt Glazing: Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.11 DECORATIVE GLASS FABRICATION

- A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.
- B. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.
- C. Basis of Design: McGrory; Ocean Series

2.12 SOURCE QUALITY CONTROL

- A. Inspections and Testing: Manufacturer/fabricator shall perform pre-construction source quality-control inspections and testing, including but not limited to the following.
1. Basis of Design for Enhanced Quality Control Standard: Guardian Elite Optical Quality Standards or equivalent enhanced fabrication standard as recommended by glass manufacturer/fabricator and accepted by the Architect to meet the design intent for the Project..

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2. Certification: Certifications by the manufacturer/fabricator that its products and systems comply with requirements and that products failing to meet requirements are not incorporated into the Work.
 3. Documentation: Inspection and testing records shall be maintained for a period of 10 years from the date of Substantial Completion. Provide inspection and testing records upon request and at no cost to Owner or Architect.
 4. Visual Mockup Glass:
 - a. Measurements reviewed and approved for glass panels used in mockups shall establish fabrication tolerances for the Project.
 - b. Glass panels used in visual mockups shall be fabricated to same fabrication tolerances as glass panels to be used on the Project.
- B. Distortion Tolerance Measurement for Processing Heat-Treated Glass.
1. On-Line Distortion Measurement System: Measure each piece of monolithic, uncoated or coated, heat-treated glass 6 mm or thicker.
 2. Roll Wave and Optical Distortion Limits (mD): On-Line Measurement.
 - a. Roll Wave Distortion Limits: Maximum peak-to-valley roll wave of 0.003 inch in the central area of the glass lite, and 0.008 inch within 12 inches of the leading and trailing edge of the lite, measured in accordance with ASTM C 1651 - Standard Test Method for Measurement of Roll Wave Optical Distortion in Heat-Treated Float Glass.
 - b. Center Kink Distortion Limits: Maximum center-kink of 0.001 inch roll wave measured over the surface of the glass perpendicular to the direction of travel through the heat treatment furnace.
 - c. Optical Distortion Limits - Millidiopter (mD) Measurements for Clear or Low-Iron Glass 1/4-Inch (6 mm) to 3/8-Inch (10 mm) Thickness, No Ceramic Frit or Ink: Maximum distortion of plus or minus 100 mD over 95% of the glass surface area, measured in accordance with ASTM C 1652 - Standard Test Method for Measuring Optical Distortion in Flat Glass Products Using Digital Photography Grids.
 - d. Measurement Equipment: On-Line measurement system utilizing high resolution optics measured in diopters.
 - 1) Basis of Design: LiteSentry; Osprey (Version 7 or Higher) Online Distortion Measurement System.
 - e. Exclusions: Silk screen, full coverage ceramic frit glass and glass panels 10 mm and thicker are excluded from this requirement.
 3. Bow/Warp (Concave/Convex) Distortion Limits: Off-Line Straight Edge Measurement.
 - a. Localized and Overall Bow (Warp) Distortion: Localized and overall bow (warp) per lite shall not exceed one-half of the maximum allowed by ASTM C 1048. Localized warp shall not exceed 1/32 in (0.8 mm) over any 12" span (30mm).
- C. Enhanced Insulating Glass Unit Fabrication and Testing Requirements.
1. Sealant Uniformity: Perform IGMA Sealant Uniformity of Mix Test not less than once per shift. Submit test reports upon Architect's request.

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2. Primary Seal - Sealant Adhesion Testing: Manufacturer recommended IGU adhesion pull testing process on units fabricated at the same time of production and on the same production line using the same processing equipment to produce this Project. Conduct testing each shift or carton change on units not less than 24 in (600 mm) x 24 in (600 mm).
 - a. Adhesion Criteria: Comply with pass/fail requirements of manufacturer published guidelines and/or manufacturer certification requirements.
 3. Residual Moisture Content: Perform IGMA Residual Moisture Content by Head of Absorption Test. Perform test in accordance with desiccant manufacturerTM's written recommendations. Submit test reports upon Architect's request.
 4. Bow/Warp Unit Distortion Tolerance (Concave/Convex): Off-Line Straight Edge Measurement.
 - a. Localized and Overall Bow (Warp) Distortion: Localized and overall bow (warp) per lite shall not exceed one-half of the maximum allowed by ASTM C 1048. Localized warp shall not exceed 1/32 in (0.8 mm) over any 12" span (30mm).
 - b. Air Space Gap Measurement: Visually inspect all units and measure center air space gap on all finished units over 35 square feet.
 - 1) Air Space Gap Tolerance: Maximum plus or minus 1/16 in (1.5 mm) at time of fabrication.
 5. Sealant Application: No skips/voids in primary or secondary seal. Secondary seal cleaned/tooled prior to packing; no sealant smears on glass surfaces.
 6. Coating Edge Deletion: Clean, straight and precise.
 - a. Coating Edge Deletion Tolerance: Uniformly remove coating to the greater of 3/8 in (from the edge of glass to the edge of the coating, or at least 50% through the primary seal width to the edge of glass.
 7. Spacers: Metal, bent.
 - a. Spacer connections shall be sealed to ensure IGU is hermetically sealed.
- D. Glass Color:
1. General: Based on established color target for each type of glass product, perform quality color control checks using on-line and off-line measurement spectrophotometer instrumentation to ensure compliance with ASTM C1376. Measure each piece of the following:
 - a. Monolithic coated glass.
 - b. Insulating glass units.
 2. Anisotropy (Iridescence): Perform anisotropy (iridescence) scan utilizing detection system approved by glass manufacturer. Perform test in accordance with detection system manufacturer written instructions. Continuously monitor production and record results. Maintain results for a period of not less than 10 years.

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3. Color Variation of Glass/Coatings: Provide vacuum deposition coatings on glass complying with color variation limits specified in ASTM C 1376. Perform color monitoring utilizing spectrophotometer equipment approved by glass manufacturer. Perform test in accordance with manufacturer approved procedure. Test finished insulated glass units in accordance with reflected color specifications and in comparison, to approved mockup control sample. Statistically monitor production and record results. Maintain results for a period of not less than 10 years.
 - a. Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

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- C. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.4 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 in .
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8 in minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

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3.5 INSTALLATION OF DECORATIVE GLAZING

- A. Set decorative glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.
- B. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Refer to Division 01 Section Field Test for Air and Water Leakage.
 - 2. Glass Color Tolerances: Owner testing agency may perform onsite color measurements using spectrophotometer instrumentation to ensure compliance with Tolerances for Color Variation.
 - a. Onsite Developed Reference Target: Onsite developed reference target shall be the average measurement of not less than 75% of glass units of the same glass type per façade.
 - 1) Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.
 - b. Testing agency will prepare survey report indicating locations not complying with specified tolerances.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove non-permanent labels and clean surfaces.
- B. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- C. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

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- E. Wash glass on both exposed surfaces in each area of Project before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.
 - 1. Coordinate glass cleaning schedule with Owner's requirements.

END OF SECTION

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SECTION 088300

UNFRAMED MIRRORED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes the following types of unframed mirrored glass, typically indicated as mirror Type "S", and supplementary items necessary to complete their installation.
 - 1. Annealed Float Glass Mirrors: Located at public restrooms.
 - 2. Tempered Float Glass, Film-Backed Mirrors or Laminated Mirrors: Located where safety glazing is indicated or required.
- B. Related Section:
 - 1. Metal framed mirror units are specified in Division 10 Section "Toilet Accessories."

1.2 DEFINITIONS

- A. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Include product data for mirror mastic and mirror hardware.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Samples: For the following products, in sizes indicated below:
 - 1. Mirrors: 12 insquare, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 in long.

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1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirrored glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- B. Glazing Publications: Comply with published recommendations in GANA's "Glazing Manual," unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
- C. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."
- D. Safety Glass: For film-backed, laminated or tempered mirrors provide Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
- E. Preconstruction Mirror Mastic Glass Coating Compatibility Test: Submit mirror mastic products to organic protective coating manufacturer for testing to determine compatibility of adhesive with mirrored glass coating.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Written warranty made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined in Definitions Article.

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1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Clear Glass: Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
 1. Nominal Thickness: 1/4 in .
- C. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
 1. Nominal Thickness: 1/4 in .
- D. Laminated Mirrors: ASTM C 1172, Type II.
 1. Glass for Outer Lite: Annealed float glass, Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
 - a. Nominal Thickness for Outer Lite: 1/8 in .
 2. Glass for Inner Lite: Annealed float glass; ASTM C 1036, Type I (transparent flat glass), Quality-Q3; Class 1 (clear).
 - a. Nominal Thickness: 1/8 in.
 3. Interlayer: Mirror manufacturer's standard 0.030 in thick, clear polyvinyl-butylal interlayer with a proven record of showing no tendency to delaminate from, or cause damage to, silver coating.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.

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- D. Top and Bottom Trim: Stainless steel J-channels formed with a return deep enough to produce a glazing channel to accommodate mirrored glass units of thickness indicated and in lengths required to cover bottom edge of each mirrored glass unit in a single piece.
1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 in in height, respectively, and a thickness of not less than 0.05 in
 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 in in height, respectively, and a thickness of not less than 0.062 in.
 3. Fastener Holes: Minimum 6 in on center with countersunk face for flush screw application, slotted holes for top trim.
 4. Finish: No. 4 satin finish, Type 304 stainless steel.
- E. Fasteners: Stainless steel flat head machine screws.
- F. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls.
- G. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 FABRICATION

- A. Silvered Mirrored Glass: Float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.
- B. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.
- C. Cutouts: Fabricate cutouts for notches and holes in mirrored glass without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrored glass.
- D. Mirrored Glass Edge Treatment: Treat edges as indicated below:
1. Seamed (swiped) edge when butted against wall, flat polished edge when edge is exposed.
 2. Seal edges of silvered mirrored glass after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 3. Require mirrored glass manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- E. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
 - 4. Referenced GANA and NAAMM publications.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. General: Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.
- B. Provide space for air circulation between back of mirrored glass units and face of mounting surface.
- C. Install permanent means of support at bottom and top edges with bottom support designed to withstand mirrored glass weight and top support designed to prevent mirrored glass from coming away from wall along top edges.
 - 1. Unless otherwise indicated, install continuous bottom and top trim. Fabricate trim in single lengths to fit and cover top and bottom edges of mirrored glass units.
 - 2. Attach mirror hardware securely to steel back up plates with mechanical fasteners and anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrored glass units.
 - 3. For continuous bottom supports, provide setting blocks 1/8 in thick by 4 in long at quarter points. For channel supports in which water could be trapped between setting blocks, provide two slotted weeps not less than 1/4 in wide by 3/8 in long.
 - 4. Place a felt or plastic pad between back of mirrored glass and each fastener to prevent spalling of mirrored glass edges or damaging mirror backing.

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5. Exercise extreme caution to avoid scratching silvering on mirror back during installation. Mirrors which are scratched, cracked, chipped or in any manner damaged shall be removed and replaced with new, undamaged mirrors.
- D. Mastic Spot Installation System: In addition to top and bottom trim supports, install mirrored glass units with mastic as follows:
1. Apply barrier coat to mirrored glass backing where approved in writing by manufacturers of mirrored glass and backing material.
 2. Apply mastic in spots to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrored glass units and face of mounting surface.
 3. After mastic is applied, align mirrored glass units and press into place while maintaining a minimum air space of 1/8 in between back of mirrored glass and mounting surface.

3.5 PROTECTION AND CLEANING

- A. Protect mirrored glass from breakage and contaminating substances resulting from construction operations.
1. Do not permit edges of silvered mirrored glass to be exposed to standing water.
 2. Maintain environmental conditions that will prevent silvered mirrored glass from being exposed to moisture from condensation or other sources for continuous periods of time.
- B. Wash mirrored glass before date scheduled for inspections intended to establish date for Substantial Completion. Wash mirrored glass by methods recommended in NAAMM publication and in writing by mirrored glass manufacturer. Use water and glass cleaners free from substances capable of damaging mirrored glass edges or coatings.

END OF SECTION

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SECTION 089100

WALL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fixed wall louvers and supplementary items necessary for installation.

1.2 DEFINITIONS

- A. BSRIA: Building Services Research and Information Association.
- B. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- C. Standard Free Area: Free area of a louver 48 in wide by 48 in high, identical to that provided.
- D. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 in wide by 48 in high, identical to that provided.
- E. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- F. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.
- G. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- H. Storm-Resistant (Wind-Driven-Rain-Resistant) Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

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D. Coordination of Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include typical unit elevations at 1/2 in scale and details at full scale.
2. Show frame profiles and blade profiles, angles, and spacing.
3. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
4. Show mullion profiles and locations.
5. Indicate where and how the system deviates from Contract Documents.
6. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
7. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

C. Samples for Verification Purposes: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

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1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. Aluminum Louvers: AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

- A. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

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1. Coverage includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.
- B. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Air Flow Company, Inc.
 2. Airolite Company, LLC.
 3. American Warming and Ventilating, Inc.; a Mestek company.
 4. Arrow United Industries; a division of Mestek, Inc.
 5. Construction Specialties, Inc. (C/S Group).
 6. Greenheck Fan Corporation.
 7. Industrial Louvers, Inc.
 8. Nystrom Building Products (Airline Louvers).
 9. Ruskin Company.
 10. Safe-Air Dowco.
 11. United Enertech.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Failure includes the following:
 - a. Noise or vibration created by wind and thermal and structural movements.
 - b. Loosening or weakening of fasteners, attachments, and other components.
- B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.
 - 1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
 - 2. Other Loads: As indicated on Drawings.
- C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
 - 1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
 - 2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
 - a. Design Displacement: As indicated on Drawings.
- D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.
- E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.
 - a. Fabrication, assembly and erection procedures shall take into consideration the ambient temperature range at the time of each operation.
- G. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

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2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 / B 221M, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 / B 209M, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26 / , Alloy 319.
- D. Fasteners: Use types and sizes to suit unit installation conditions. For color-finished louvers, use fasteners with heads that match color of louvers.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. Aluminum Louvers: For fastening aluminum, use 300 series stainless-steel fasteners.
- E. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel, unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacing indicated, but not more than recommended by manufacturer, or 72 in on center, whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Semi-recessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
 - 3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

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- 4. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semi-recessed mullions at corners.
- F. Provide subsills and extended sills made of same material as louvers where required for drainage to exterior and to prevent water penetrating to interior.
- G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers - Fully Recessed Mullions:
 - 1. Basis of Design: Construction Specialties Model RS-7315.
 - 2. Louver Depth: 7 in, unless otherwise indicated.
 - 3. Frame and Blade Nominal Thickness: As required by the engineered design.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.1 sf ()for 48 in ()wide by 48 in ()high louver.
 - b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in per hour and a wind speed of 29 mph at a core-area intake velocity of 283 fpm.
- B. Horizontal, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers - Fully Recessed Mullions with Integrated Backup Panels:
 - 1. Basis of Design: Construction Specialties Model MW-7315 with Centria MetalWrap Series MR-300 Insulated Backup Panels at inactive louver.
 - 2. Louver Depth: 7 in, unless otherwise indicated.
 - 3. Frame and Blade Nominal Thickness: As required by the engineered design.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.1 sf ()for 48 in ()wide by 48 in ()high louver.
 - b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in per hour and a wind speed of 29 mph at a core-area intake velocity of 283 fpm.

2.7 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location: Interior face, unless otherwise indicated.
 - 2. Screening Type: Bird screening, unless otherwise indicated.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 in from each corner and at 12 in on center.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.

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2. Finish: Same finish as louver frames to which louver screens are attached.
3. Bird Screening Type: Non-rewirable, U-shaped frames.

D. Louver Screening:

1. Bird Screening: Aluminum, 1/2 in square mesh, 0.063 in wire.

2.8 BLANK-OFF PANELS

- A. General: Fabricate blank-off panels from same materials and finish applied to louvers, but black color. Attach blank-off panels to back of louver frames with stainless-steel sheet-metal screws.
- B. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
 1. Thickness: 2 in.
 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032 in nominal thickness.
 3. Insulating Core: Rigid, glass-fiber-board insulation.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080 in nominal thickness, with corners mitered and with same finish as panels.
 5. Seal perimeter joints between blank-off panel faces and louver frames with gaskets or sealant to provide watertight louver assembly.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.
- D. Match Adjacent Aluminum Framing: Finish wall louver system components to match adjacent glazed aluminum framing system as specified in Division 08 Section "Glazed Aluminum Framing System".
- E. Finish Selections: As scheduled or as indicated in Design Selections.

2.10 ALUMINUM FINISHES

- A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

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- B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.
 - 1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.4 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

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1. All fasteners shall be stainless steel.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Louver systems will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

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1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.7 LOUVER SCHEDULE

A. Horizontal, Storm-Resistant Louvers:

1. Locations within exterior walls at typical and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

END OF SECTION

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SECTION 090565

FLOOR PREPARATION FOR RENOVATION WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Floor substrate testing for flatness, moisture vapor transmission, alkalinity.
2. Floor substrate preparation and remediation.
3. Installation of trowel applied and self-leveling floor leveling materials.
4. Installation of moisture floor treatment for moisture vapor transmission problems.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Preparation Instructions: Finished flooring manufacturer's written preparation instructions.

B. Shop Drawings: Plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1. Maintain as-built mark-up plans on site, indicating the quantity of underlayment installed in each area indicated, areas added or deleted, and date underlayment was installed.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1. Provide test reports for each type and location of field test, indicating type of test, location of test site, test values, values required to pass, and identification of testing agency.

B. Quality Assurance submittals:

1. Certifications:

- a. Submit certification of qualification from the installer.
- b. Submit certification of compliance with specifications and flooring manufacturer's requirements for floor preparation.

- 1) Furnish copies with Operating and Maintenance Manual.

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2. Test reports: submit copies of field test reports, with location of test indicated, for the following:
 - a. Concrete slab moisture vapor transmission rate
 - b. Concrete slab alkalinity
 - c. Concrete floor flatness and levelness
3. Flooring preparation plan: Provide written plan indicating locations, flooring material, substrate, proposed remediation products, and proposed preparation steps based on known or anticipated conditions.
 - a. Coordinate plan with written preparation and installation instructions provided by finished flooring manufacturer and written instructions of remediation products specified under this Section.

1.4 QUALITY ASSURANCE

- A. Installer qualifications:
 1. Experience: Installer's personnel with not less than 3 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 3 years of experience installing products and systems similar to scope of this Project.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review requirements for verification and testing of subfloor condition, subfloor preparation, and environmental conditions required at time of flooring installation.
 3. Review requirements for installation and protection of moisture vapor reducing membrane.
 4. Review flooring product requirements for subfloor flatness, subfloor surface profile, moisture vapor transmission, and alkalinity.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
 1. Flatness and levelness testing: Floor flatness and levelness testing shall be performed by a technician trained in the use of the testing equipment and the procedures of ASTM E 1155.
- C. Preconstruction Testing Service: Engage a qualified independent testing agency to test flooring substrate for compliance with specified requirements for performance and test methods.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to jobsite or offsite warehouse in unopened wrapping, boxes or containers.
- B. Storage:
 - 1. Store materials in a covered, climate controlled facility, with temperatures between 40 deg F and 90 deg F.
 - 2. Store material off ground or floor in protective packaging.
 - 3. Do not permit materials to become wet.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate schedule and location of testing to minimize disruption of Work.
- C. Coordinate requirements for testing, preparation, and remediation work with work specified in other sections.

1.9 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Defects include, but are not limited to, the following:
 - a. Structural failures including delamination or blistering.
 - b. Incompatibility with or failure of product to adhere to substrate material up to the tensile strength of concrete.
 - 2. Replacement includes removal of existing flooring and underlayment or moisture vapor reducing membrane, replacement of defective or non-performing material, and replacement of finish flooring with new flooring of the same type.
 - 3. Period of warranty: As specified.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 TROWELABLE POLYMER-MODIFIED CEMENTITIOUS UNDERLAYMENT

- A. Underlayment: Hydraulic-cement-based, polymer-modified, trowelable product that can be applied to a maximum uniform thickness of 3/8 in and that can be feathered at edges to match adjacent floor elevations.
1. Manufacturers and Products:
 - a. ARDEX Engineered Cements; SD-F Feather Finish.
 - b. BASF:
 - 1) MasterEmaco R300 (Formerly Sonneborn Sonocrete Sonopatch PC).
 - 2) MasterTop 115 FC (Formerly Sonneborn Sonoskim).
 - 3) MasterTop 116 FC (Formerly Thoro Underlayment (Trowel Grade)).
 - c. Bonsal American; B-1 Leveler.
 - d. Dayton Superior Corporation; Sure Finish.
 - e. Dependable Chemical Co., Inc.; Skimcrete.
 - f. L&M Construction Chemicals, Inc.; Durathin.
 - g. MAPEI Corporation; Planipatch.
 - h. TEC; VersaPatch.
 2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - a. Do not use air entraining agents or cements.
 3. Compressive Strength: Not less than 3500 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.

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2.4 SELF-LEVELING CEMENTITIOUS UNDERLAYMENTS

- A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 in and that can be feathered at edges to match adjacent floor elevations.
1. Manufacturers and Products:
 - a. ARDEX Engineered Cements; K-15 Self-Leveling Underlayment Concrete.
 - b. BASF:
 - 1) MasterTop 110 SL (Formerly MBT Mastertop 110 Plus Underlayment)
 - 2) MasterTop 110 SL (Formerly Sonneborn Sonocrete Sonoflow).
 - c. Bonsal American; ProSpec Self-Leveling Underlayment.
 - d. Dayton Superior Corporation; LeveLayer I.
 - e. Dependable Chemical Co., Inc.; Skimflow ES.
 - f. L&M Construction Chemicals, Inc.; Levelex.
 - g. MAPEI Corporation; Ultraplan 1 Plus.
 - h. Maxxon Corporation; Level-Right.
 - i. US Mix Products Company; US SPEC Self - Leveling Underlayment.
 2. Cement Binder: ASTM C 150, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - a. Do not use air entraining agents or cements.
 3. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 in, or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

2.5 TOPPING MORTAR

- A. Mortar: Premixed, Portland-cement-based, polymer-modified, trowelable product that can be applied to a minimum uniform thickness of 3/8 in, level or sloped up to 4 in, in one or more lifts.
1. Manufacturers and Products:
 - a. ARDEX Engineered Cements; ERM.
 - b. MAPEI Corporation; MapeCem 100.
 - c. Sika Corporation; SikaTop 122 Plus.
 2. Cement Binder: ASTM C 150, Portland cement.
 - a. Do not add air entraining agents, cements, or other additives.

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3. Compressive Strength: Not less than 6500 psi at 28 days when tested according to ASTM C 109/C 109M.

2.6 MOISTURE FLOOR TREATMENT

- A. Epoxy-Based Moisture Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.
 1. Basis of Design (Product Standard): Bostik, Inc.; D-250.
- B. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.
 1. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

2.7 PRIMER

- A. Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

2.8 WATER

- A. Potable, at a temperature of not more than 70 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with substrate condition, maximum moisture content, adhesive bond, substrate alkalinity, subfloor levelness and flatness tolerances, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 1. Ensure that existing adhesives have been totally removed prior to new installation.
 2. Furnish written report to the Architect/Engineer describing and locating non-conforming substrates. Do not proceed with Work until non-conforming substrates are corrected.
 3. Re-inspect corrected areas as required for initial examination, to confirm substrate is ready for application of flooring.
 4. The start of flooring installation shall indicate that substrate conditions are acceptable for application of flooring, including the following conditions:
 - a. The moisture vapor transmission rate and alkalinity of the concrete subfloor and patching materials is within the acceptable limits as defined by the flooring manufacturer's requirements.

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- b. Proper bond will be obtained between the finished flooring, adhesive, moisture floor treatment, patching materials and concrete subfloor.
- c. Subfloor flatness and levelness are within specified tolerances.

B. Site Verification of Conditions:

1. Test concrete floor moisture vapor transmittance rate (MVTR) using the calcium chloride test, ASTM F1869 or internal relative humidity using in-situ probes per ASTM F 2170; as acceptable to the flooring manufacturer.
 - a. Pre-installation Testing:
 - 1) Perform testing prior to flooring installation, permitting enough time for additional drying or remediation of high moisture transmittance conditions.
 - 2) Test in areas scheduled to receive impervious and/or resinous floorings.
 - 3) Perform a minimum of 3 tests for the first 1000 sq ft per floor, with 1 test per additional 1000 sq ft.
 - 4) Maximum tested value shall be 3 pounds per 1000 sq ft per 24 hours or 75 percent relative humidity at 1/4 slab depth; as acceptable to the flooring manufacturer.
 - 5) Where MVTR or relative humidity test fails, retest each non-complying area, after remediation, per requirements for initial testing.
2. Test alkalinity (pH) of concrete subfloor in accordance with ASTM F 710, or using method recommended by flooring manufacturer.
 - a. Perform test in area adjacent to each pre-installation MVTR test. Report alkalinity on the same form used for reporting results of adjacent MVTR test.
 - b. Do not apply flooring if pH is equal to or greater than 10, or maximum level acceptable to flooring manufacturer.
3. Floor Flatness and Levelness Testing:
 - a. Verify flatness and levelness of area to receive underlayment using a 10 ft straightedge or Type I or Type II floor profilometer capable of producing a graphic record of floor elevation changes, measured in accordance with ASTM E 1155.
 - b. Tolerances: Areas exceeding tolerances shall receive cementitious underlayment to meet or exceed installation tolerances specified in the Section.
 - 1) Flatness:
 - a) Straightedge: 1/8 in gap under a 10 ft unlevelled straightedge, when measured between any 2 high points.
 - b) Profilometer: any aggregate area with a maximum flatness variation exceeding 1/8 in from highpoint to low-point
 - 2) Level Alignment: Variance in elevation of top of slab in any structural bay shall not exceed 3/4 in

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- c. Test Sections less than 8 feet on a side or less than 320 sq ft or at slab boundaries, block-outs or other discontinuities excluded by ASTM E 1155: measure surface so gap to at any point between concrete surface and an unveled freestanding 10 ft long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/8 in.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION FOR FLOORING INSTALLATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Concrete Substrates: Prepare according to ASTM F710.
- C. Prepare substrates according to floor covering manufacturer's written recommendations to ensure adhesion of floor coverings.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Perform tests recommended by manufacturer and as specified. Proceed with installation only after substrates pass testing.
- D. Remove existing flooring, including underlayments, and setting beds (where applicable) to expose a sound substrate. Grind substrate if required to thoroughly remove any traces of the floor material adhesive or other foreign material.
 - 1. Remove adhesives from all existing floors receiving new covering, where recommended or required by finished flooring manufacturer, using methods recommended or approved by the flooring manufacturer.
- E. Surface preparation:
 - 1. Concrete subfloors and cementitious underlayments shall cure a minimum of 28 days before flooring is installed.
 - 2. Scrape, grind, or otherwise remove projections from the face of subfloor to level with the subfloor.
 - 3. Neatly patch, fill, or otherwise repair all cracks, marks, irregularities, and other conditions in the subfloors that may telegraph through the finished installation.
 - 4. Apply moisture floor treatment where moisture vapor transmission rate or internal relative humidity exceeds limits indicated in specifications.

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5. Apply trowelable polymer modified cementitious underlayment where required to correct subfloor irregularities and floor depressions greater than a 1/8 in gap under a 10 ft straightedge.
 6. Apply trowelable polymer modified cementitious underlayment at transition edge between resilient flooring and dissimilar flooring materials to allow for a "flush" transition. The slope of the underlayment shall provide for a gradual transition to the thicker flooring material.
 7. Trowelable polymer modified cementitious fill shall be steel troweled smooth. Trowel marks showing through installed flooring shall be reason to remove flooring and sand out trowel marks.
 8. For areas scheduled to receive epoxy flooring or tile, remove concrete surface and contaminants using bead blasting methods, to a maximum profile depth of 1/8 in.
 9. Apply topping mortar in areas scheduled to receive tile requiring slope to drain. Slope bed 1/4 in per foot minimum.
 10. Apply self-leveling cementitious underlayment in areas scheduled to receive large-format (greater than 12 in in length) paver tile, to correct floor depressions greater than 3/8 in, and where indicated
- F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of completed applications of moisture floor treatments and underlayments shall take place in successive stages, in areas of extent and using methods as specified. Do not proceed with application for the next area until test results for previously completed applications show compliance with requirements.
- C. Remove and replace applications of moisture floor treatment and underlayment where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING

- A. Clean floors thoroughly, using dry methods, after completion of preparation work.
- B. Clean excess material, splatter, dust, or other foreign material from non-floor surfaces.

3.6 PROTECTION

- A. Protect moisture floor treatments from damage until finish flooring is installed.

END OF SECTION

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SECTION 092900

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Gypsum board assemblies and supplementary items necessary for installation.
 - 1. Grid suspension systems for ceilings.
 - 2. Metal framing systems for interior partitions.
 - 3. Interior gypsum board and tile backing panels.
 - 4. Gypsum board accessories and finishing systems.

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 Standard Terminology Related to Gypsum and Related Building Materials and Systems for definitions of terms not defined in this Section or in other referenced quality standards.
- B. Damage: Stored or installed gypsum board materials shall be classified as defective and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Substantial Completion or if they exhibit evidence of active or dormant mold or mildew.
- C. Concentrated Loads: Wall or partition mounted equipment, wall finishes, stone facings, lead lined doors and frames, or ornamentation exceeding 15 lbs/sf uniform load, 75 lb. point load, or 50 lb/ lf lineal load.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Project Framing Analysis: Analyze each framing condition for design loads indicated in performance requirements.
 - 1. Provide framing products in sizes and thicknesses required to meet or exceed the criteria based on project loads, spans and in-service conditions.
 - 2. Material Quality Standard for Metal Framing Components: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

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- C. Gypsum Board Assemblies Supporting Concentrated Loads - Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems required to support concentrated loads including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- E. Coordination of Contract Documents and Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators. Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings:
 - 1. Include scaled and dimensioned drawings showing locations of control joints.
 - 2. Gypsum Board Location Schedule: Provide detailed schedule in format similar to "Gypsum Board Schedule" at end of this Section indicating gypsum board products to be installed and their respective locations.
- C. Shop Drawings for Engineered Gypsum Board Assemblies - Concentrated Loads: Scaled and dimensioned drawings showing locations, fabrication, and installation of gypsum board assemblies required to support concentrated loads, including plans, elevations, sections, details of components, and attachments to building structure; include seal and signature of delegated engineering professional responsible for their preparation.

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1.5 INFORMATIONAL SUBMITTALS

- A. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- B. Preconstruction Test Reports for Acoustical Sealant: Compatibility test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility with sealants; include sealant manufacturer's certification of test results for sealant compatibility and recommendations for primers and substrate preparation needed to obtain adhesion and prevent corrosion of substrate.

1.6 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Certification of framing members in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code-compliance program.
- B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 - b. Field Samples for Gypsum Board Finishing: Build 10 ft square gypsum board (attached to metal studs) area for each finish level specified. Include not less than one tapered-to-tapered edge gypsum board joint and cut edge-to-cut edge gypsum board joint.
 - 2. Clean exposed faces of mock-up.
 - 3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Protect accepted mock-up from the elements with weather-resistant membrane.
 - 6. Obtain Architect's acceptance of mockups before starting fabrication.
 - 7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
 - 8. Acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
 - 9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

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1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: Comply with ASTM C 840 requirements or respective gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Movement: Withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads established by authorities having jurisdiction.
 - 1. Live Load Deflection: Accommodate differential vertical deflection of floors:
 - a. Deflection: As indicated on Drawings.
- C. Seismic Performance: Withstand the effects of earthquake motions determined in accordance with local building code and authorities having jurisdiction.
- D. Horizontal Deflection: For composite and non-composite wall assemblies, limited to deflections and horizontal loading indicated in Metal Framing Schedule.
- E. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 / NFPA 251 / UL 263, and displaying a classification label from an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Construct fire-resistance-rated partitions in compliance with tested assembly requirements indicated on Drawings.
 - 2. Rated assemblies to be substantiated from applicable testing using proposed products, by Contractor.
 - 3. Independent Testing Agencies as evidenced by design designation included in approval manual.
 - a. UL - "Fire Resistance Directory", Category BXUV.
 - b. GA 600 - "Fire Resistance Design Manual".
 - c. Other agencies acceptable to authorities having jurisdiction.
- F. Smoke-Resistance-Rated Assemblies: For smoke-resistance-rated assemblies, provide materials and construction identical to those tested in accordance with fire-resistance-rated assemblies by an independent testing agency acceptable to authorities having jurisdiction.
- G. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.
- H. Dimensional Tolerances: Provide products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

- A. Suspension System:

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1. Material Quality Standard: ASTM C 645, heavy-duty rating.
 2. Description: Manufacturer's standard direct-hung suspended grid system composed of main beams and cross furring members that interlock to form a modular supporting network for application of gypsum board.
 3. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.
 4. Main Beams: Inverted T-shaped profile of single or double mounting flange; minimum 1-1/2 in profile height with top bulb and minimum 1-3/8 in wide knurled mounting flange; factory punched for hanger wire, and to receive cross furring members.
 5. Cross Furring Members:
 - a. Tees: Inverted T-shaped profile of single or double mounting flange; 1-1/2 in profile height with top bulb and minimum 1-3/8 in wide knurled mounting flange; with ends formed for positive interlocking with main beam.
 - b. Channels: Inverted hat shaped profile; minimum 7/8 in profile height and minimum 1-3/8 in wide knurled mounting flange; with ends formed for positive interlocking with main beam.
 6. Wall Angle: Angle shaped profile with each leg not less than 1-1/4 in .
 7. Curved Members: Where curved ceilings are indicated, members shall be rolled by manufacturer; field fabricated curved members not permitted.
 8. Accessories: Specifically designed as an integral part of suspended grid system.
 9. Manufacturers and Products:
 - a. Armstrong World Industries Inc.; Drywall Grid System.
 - b. Chicago Metallic Corporation; 650-C/670-C Fire-Rated Drywall Grid System.
 - c. United States Gypsum Company (USG Interiors, Inc.); Drywall Suspension System.
- B. Wire:
1. Material Quality Standard: ASTM A 641 / A 641M, Class 1, zinc-coated, soft annealed, mild steel wire.
 2. Tie Wire Minimum Size: Single 0.0625 in (16 gage) diameter strand, or double 0.0475 in (18 gage) diameter strands. Preformed furring channel clips are acceptable.
 3. Hanger Wire Minimum Size: 0.1620 in (8 gage) diameter.
- C. Rod Hangers: ASTM A 1008 / A 1008M, 7/32 in diameter mild carbon steel rod, with primer painted finish.
- D. Flat Hangers: ASTM A 1008 / A 1008M, 1 in by 3/16 in by length indicated or required, with primer painted finish.
- E. Angle Hangers: ASTM A 36 / A 36M, rolled steel angle, 2 in by 2 in , with primer painted finish.

2.5 FRAMING SYSTEMS

- A. Project Framing Analysis: Analyze each framing condition for design loads indicated in performance requirements.

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1. Provide framing products in sizes and thicknesses required to meet or exceed the criteria based on project loads, spans and in-service conditions.
- B. Framing Members, General: Comply with ASTM C645 and AISI S220 for conditions indicated.
 1. Steel Sheet Components: Comply with ASTM C645 and AISI S220 requirements for metal unless otherwise indicated.
 2. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating or coating with equivalent corrosion resistance, unless otherwise indicated.
 - a. Equivalent Protective Coatings: Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- C. Metal Studs and Floor Track (Runners):
 1. Metal Framing Components for Typical Partitions:
 - a. Stud Description: C-shaped members formed from galvanized sheet steel with 1 1/4 in flange edges bent back 90 degrees and doubled over to form 13/64 in wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
 - 1) Alternative Jamb Stud Members - Contractor's Option: "Heavy Duty" or "King" studs; C-shaped members formed from galvanized sheet steel with 3 in flange width; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section.
 - b. Track (Runner) Description: U-shaped members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
 - 1) Floor Track (Runner): 1-1/4in .
 - 2) Top of Wall Track (Runner): 3 in .
 2. Metal Framing for Shaftwall Partitions:
 - a. Stud Description: C-H, double E, C-T, or I-shaped members formed from galvanized sheet steel; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
 - b. Track (Runner) and Jamb Description: J-shaped track or jamb members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
 3. Equivalent Products - Deformed Metal Studs and Tracks (Runners):

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- a. Equivalent Gauge Thickness (EQ) Steel Studs and Runners Evaluation Criteria: Certified third-party testing with gypsum board in accordance with ICC-ES AC86 indicating compliance with requirements.
 - b. Material Quality Standard: ASTM A 1003 / A 1003M sheet steel with galvanized coating.
 - c. Stud Description: C-shaped members formed from deformed surface galvanized sheet steel with 1-1/4 in flange edges bent back 90 degrees and bent again to form 3/16 in wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
 - d. Track (Runner) Description: U-shaped members formed from deformed surface galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
 - e. Manufacturer and Product: ClarkDietrich Building Systems; ProSTUD.
- D. Flat Straps and Back-Up Plates: Galvanized sheet steel for blocking and bracing in length and width indicated, of same uncoated base metal thickness as adjacent metal studs.
- E. Bridging:
- 1. Channel: U-shaped members formed from galvanized sheet steel not less than 0.0566 in (16 gage) minimum uncoated base metal thickness, with 1/2 in flanges and depth fitting stud punchouts.
 - 2. Clip Angle: 1-1/2 in by 1-1/2 in L-shaped members formed from galvanized sheet steel not less than 0.0713 in (14 gage) uncoated base metal thickness.
- F. Rigid Furring Channels: Hat-shaped members formed from galvanized sheet steel not less than 0.0312 in (20 gage) minimum uncoated base metal thickness; 7/8 in depth and minimum 1-3/8 in wide knurled mounting flange.
- G. Resilient Furring Channels: 1/2 in deep members formed from galvanized sheet steel not less than 0.0283 in (22 gage) minimum bare-metal thickness, designed to reduce sound transmission.
- 1. Configuration: Asymmetrical or hat shaped.
- H. Sound Isolation Clips: Uni-body molded rubber and galvanized steel mount designed to receive standard galvanized steel furring channels.
- 1. Basis of Design: Pliteq; GenieClip RST.
- I. Framing Accessories for Spanning Multiple Floors: Framing manufacturers standard connectors, bracings, brackets, clips, gussets, and other framing devices as required by conditions, formed from galvanized sheet steel complying with requirements of main support system.
- J. Z-Shaped Furring: Members formed from galvanized sheet steel not less than 0.0283 in (22 gage) minimum bare-metal thickness, with slotted or non-slotted web, face flange of 1-1/4 in , wall attachment flange of 7/8 in ; depth required to fit insulation thickness indicated.

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- K. Pony Wall Framing Connection: ASTM A36 hot rolled steel base plate, Structural Grade 50 Type H Stud connector designed to support cantilevered partial wall systems.
 - 1. Basis of Design: ClarkDietrich; Pony Wall.
- L. Manufacturers:
 - 1. Building Products Division of Consolidated Fabricators Corp.
 - 2. California Expanded Metal Products Co. (CEMCO).
 - 3. ClarkDietrich Building Systems
 - 4. Marino Ware; Division of Ware Industries.
 - 5. MBA Metal Framing.
 - 6. Scafco Corp.
- M. Heavy-Duty Framing Systems (HDS) Headers and Jambs at Lead Lined Doors: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges and as follows:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Heavy Duty Studs - HDS and Header Bracket - HDSC and accessories as required for a complete installation.
 - a. Minimum Base-Steel Thickness: 0.0538 inch as indicated on drawings.
 - b. Web and Flange Widths, Type HDS: 3-5/8 by 3 by 1-1/16 by 3/4 inch 6 by 3 by 2-1/4 by 3/4 inch as indicated on drawings.
 - c. Web and Flange Widths, Type HDSC: 3-1/2 by 3-1/16 by 2 inches 5-7/8 by 3-1/16 by 2 inches as indicated on drawings.
 - 2. Slip-Type Head Joints: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing for vertical movement.
 - a. Basis of Design: ClarkDietrich Building Systems; Fast Top Clip FTC3 or FTC5.
 - 3. Anchor Clips: Pre-punched, galvanized anchor clips designed for use in floor n conditions that provide a positive attachment of studs to runners while allowing for horizontal, torsional and vertical (uplift) loads.
 - a. Basis of Design: ClarkDietrich Building Systems; EasyClip T-Series, T685 or T683.

2.6 GYPSUM BOARD PRODUCTS

- A. Sizes: Maximum lengths and widths available that will minimize short edge-to-short edge butt joints and to correspond to support system indicated.
- B. Typical Paper-Faced Gypsum Board Products:
 - 1. Paper-Faced Type X Gypsum Board:
 - a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
 - b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in thick.

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- c. Manufacturers and Products:
 - 1) American Gypsum Company; FireBloc Type X Gypsum Board.
 - 2) CertainTeed Corporation; Type X Gypsum Board.
 - 3) Georgia-Pacific Gypsum LLC; ToughRock Fireguard Gypsum Board.
 - 4) National Gypsum Company; Gold Bond Fire-Shield Gypsum board.
 - 5) United States Gypsum Company (USG); Sheetrock Firecode Core.
- 2. Sustainable Paper-Faced Type X Gypsum Board: At Contractors option, provide sustainable paper-faced Type X gypsum board or typical paper-faced Type X gypsum board.
 - a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
 - b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in thick. UL Type Designation ULIX.
 - 1) ISO 14040 Environmental Management, Life Cycle Assessment, Principles and Framework:
 - a) Carbon emissions per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard with a manufacturing Global Warming Potential of 317.4 kg CO₂-eq./1000MSF.
 - b) Water reduction per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard having net use of fresh water value of 1.329 m³/1000 ft².
 - c) Primary Energy from non-renewable resources per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard have a value of 5,291 MJ/1000 ft².
 - c. Basis of Design:
 - 1) United States Gypsum Company, LLC, USG Sheetrock Brand EcoSmart Panels Firecode X.
- 3. Paper-Faced Type C Gypsum Board:
 - a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
 - b. Description: Noncombustible fire resistant gypsum core, with additives to enhance fire resistance, with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in thick.
 - c. Manufacturers and Products:
 - 1) American Gypsum Company; FireBloc Type C Gypsum Board.
 - 2) CertainTeed Corporation; Type C Gypsum Board.
 - 3) Georgia-Pacific Gypsum LLC; ToughRock Fireguard C Gypsum Board.
 - 4) National Gypsum Company; Gold Bond Fire-Shield C Gypsum board.
 - 5) United States Gypsum Company (USG); Sheetrock Firecode C Core Gypsum Panels.
- 4. Paper-Faced Acoustically Enhanced Gypsum Board:

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- a. Description: Noncombustible gypsum core, with polymer sound dampening sheet in center, with paper surfacing on face, back and long edges; tapered long edges; 5/8 in thick.
- b. Manufacturers and Products:
 - 1) CertainTeed Corporation; SilentFX Acoustical Gypsum Board.
 - 2) National Gypsum Company; Gold Bond SoundBreak Gypsum Board.
 - 3) PABCO Gypsum; QuietRock ES.

C. Moisture-Resistant Gypsum Board Products:

1. Moisture-Resistant Paper-Faced Gypsum Board:

- a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
- b. Description: Enhanced moisture-resistant, noncombustible gypsum core, with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 5/8 in thick.
- c. Manufacturers and Products:
 - 1) American Gypsum Company; M-Bloc Mold and Moisture Resistant Type X Gypsum Board.
 - 2) CertainTeed Corporation; M2Tech Moisture and Mold Resistant Type X Gypsum Board.
 - 3) National Gypsum Company; Gold Bond XP Gypsum Board.
 - 4) United States Gypsum Company (USG); Sheetrock Mold Tough Firecode Gypsum Board.

2. Moisture-Resistant Paperless Glass-Mat Gypsum Board:

- a. Material Quality Standard: ASTM C 1658 / C 1658M.
- b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces; square edges; score or 10 according to ASTM D 3273; 5/8 in thick.
- c. Manufacturers and Products:
 - 1) Georgia-Pacific Gypsum LLC; DensArmor Plus Fireguard Interior Guard.
 - 2) National Gypsum Company; eXP Interior Extreme Gypsum Panels.

3. Moisture-Resistant Paperless Glass-Mat Shaft-Liner Gypsum Board:

- a. Material Quality Standard: ASTM C 1658 / C 1658M.
- b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces, double bevel long edges; score of 10 according to ASTM D 3273; 1 in thick.
- c. Manufacturers and Products:
 - 1) American Gypsum Company; M-Glass Shaft Liner Panels.
 - 2) CertainTeed Corporation; GlasRoc Shaftliner Type X.
 - 3) Georgia-Pacific Gypsum LLC; DensGlass Shaftliner.
 - 4) National Gypsum Company; eXP Extended Exposure Shaftliner.
 - 5) USG Corp.; SHEETROCK Glass-Mat Liner Panels

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4. Moisture-Resistant Coated Glass-Mat Gypsum Board Products (Tile Backing Panel):
 - a. Material Quality Standard: ASTM C 1178 / C 1178M.
 - b. Description: Enhanced moisture-resistant, noncombustible, gypsum core with inorganic, embedded fiberglass mat on both sides; outside face coated with heat-cured copolymer water-resistant coating; square edges; score or 10 according to ASTM D 3273; 5/8 in thick.
 - c. Manufacturers and Products:
 - 1) CertainTeed Corporation; Diamondback Tile Backer.
 - 2) Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
 - 3) National Gypsum Company; eXP Tile Backer.
 - 4) USG; Durock Brand Glass-Mat Tile Backerboard.
5. Moisture-Resistant, Impact-Resistant Gypsum Board Products for Elevator Hoistway Enclosures and Stairwells and Mechanical Shafts:
 - a. Material Quality Standard: ASTM C 1629, Type X, and as follows:
 - 1) Soft Body Impact Test: ASTM E 695, Classification Level 2.
 - 2) Hard Body Impact Test: Annex A1, Classification Level 3.
 - 3) Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - b. Paper-Faced Products: Specially formulated, noncombustible, gypsum core with heavy liner paper on back and smooth, heavy abrasive-resistant face paper on face and long edges; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in thick.
 - 1) Manufacturers and Products:
 - a) CertainTeed Corporation; Air Renew Extreme Impact.
 - b) National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.
 - c. Paperless Products: Specially formulated, noncombustible, gypsum core with coated, fiberglass mat on both faces; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in thick.
 - 1) Manufacturers and Products:
 - a) USG Corporation; Fiberock Panels, VHI Abuse-Resistant.
 - d. Locations: As indicated on the Drawings and as follows.
 - 1) Elevator Hoistway Enclosures and Stairwells.
 - 2) Fire Service Access Elevator Hoistways Enclosures.
 - 3) Mechanical Shafts

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2.7 TRIM ACCESSORIES

A. Typical Drywall Trim Accessories:

1. Material Quality Standard: ASTM C 1047.
2. Description: Trim profile fabricated of galvanized steel sheet; of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
3. Trim Products:
 - a. Cornerbead:
 - 1) Purpose: For protecting outside (external) corners.
 - 2) Basis of Design: United States Gypsum Company (USG); Dur-A-Bead Corner Bead, 103.
 - b. Optional Equivalent Products – Structural Laminate Cornerbead System: At Contractor's option, provide high strength tapered co-polymer core cornerbead with tight fibered paperboard facing and joint tape paper backing.
 - 1) Purpose: For protecting outside (external) corners.
 - 2) Basis of Design: Structus Building Technologies; No-Coat Structural Laminate Drywall Corner System.
 - c. LC-Bead (J-Bead):
 - 1) Purpose: For protecting exposed edges of gypsum board where back flange can be used.
 - 2) Basis of Design: United States Gypsum Company (USG); J-Trim, 200-A.
 - d. L-Bead:
 - 1) Purpose: For protecting exposed edges of gypsum board where back flange cannot be used.
 - 2) Basis of Design: United States Gypsum Company (USG); L-Trim, 200-B.
 - e. J-Stop:
 - 1) Purpose: For protecting edges of gypsum board that does not require finishing.
 - 2) Basis of Design: United States Gypsum Company (USG); J-Stop, 402.
 - f. Control Joint:
 - 1) Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
 - 2) Purpose: For conditions requiring expansion and contraction stresses of large areas of gypsum board to be relieved.
 - 3) Basis of Design: United States Gypsum Company (USG); Control Joint, 093.
 - g. Control Joint - Fire Rated:

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- 1) Description: One-piece trim formed with V-shaped slot and intumescent tape factory applied to one side of back of control joint, with removable strip covering slot opening.
 - 2) Purpose: For conditions requiring expansion and contraction stresses of large areas of gypsum board to be relieved at fire rated partitions.
 - 3) Basis of Design: Clark Dietrich; Fire Rated Control Joint.
- h. Other Trim or Special Shapes: Products as required by condition.
4. Manufacturers:
- a. Dietrich Industries, Inc.; Unimast.
 - b. Fry Reglet Architectural Metals.
 - c. Marino Ware; Division of Ware Industries.
 - d. Niles Building Products Co.
 - e. Superior Metal Trim; Division of Delta Star, Inc.
 - f. United States Gypsum Company (USG).
- B. Plastic Drywall Trim Accessories:
1. Description: Trim profile fabricated of high-impact PVC, of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
 2. Trim Products Profiles: As listed above in "Typical Drywall Trim Accessories".
 3. Manufacturers:
 - a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
 - b. Phillips Manufacturing Co.
 - c. Plastic Components, Inc.
 - d. Trim Tex Drywall Products.
 - e. Vinyl Corp., a division of ClarkDietrich Building Systems.
- C. Accent Trim Accessories:
1. Description: Extruded aluminum accessories of profiles and dimensions indicated of alloy and temper with not less than strength and durability properties of ASTM B 221, alloy 6063-T5.
 2. Basis of Design:
 - a. Aluminum Trim Accessory Type 1:
 - 1) Manufacturer:
 - 2) Product:
 - 3) Reveal Dimension:
 - 4) Finish:
 - b. Aluminum Trim Accessory Type 2:
 - 1) Manufacturer:
 - 2) Product:
 - 3) Reveal Dimension:
 - 4) Finish:

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3. Manufacturers:

- a. Fry Reglet Architectural Metals.
- b. Gordon, Inc.
- c. Pittcon Industries.

D. Partitions to Glazed Aluminum Framing Trim Accessories:

1. Partition and Mullion Gap Closure:

- a. Description: Pre-assembled, spring loaded, partition gap closure fabricated from extruded aluminum with sound attenuating mineral wool insulation, compressible foam between extrusion and interior face of glass and acoustical sealant.
- b. Manufacturers and Products:
 - 1) Basis of Design: Gordon; Mullion Mate Series 30, Series 40 or Series 60.
 - 2) STC Rating: Not less than Partition STC Rating; refer to Partition Types.
 - 3) Finish: As selected by Architect to match mullion finish, unless indicated otherwise.

2.8 FASTENERS

A. Limitations: Nails and staples are not permitted.

B. Fasteners for Attaching Metal Framing to Concrete Structure:

- 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
 - a. Cast-in-place anchor, designed for attachment to concrete.
 - b. Post-installed chemical anchor.
 - c. Post-installed expansion anchor.
- 2. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A 10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- 3. Manufacturers:
 - a. Construction Materials, Inc.
 - b. Heckman Building Products, Inc.
 - c. Hilti Corp.
 - d. ITW Ramset/Red Head.
 - e. Powers Fasteners.
 - f. Simpson Strong Tie Anchor Systems.

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4. For post-tensioned concrete, anchors shall not exceed 1 in embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.
- C. Metal Framing Screws: Screw fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten metal framing and furring members securely to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.
- D. Gypsum Board Screws: Steel Drill Screws, ASTM C1002 unless otherwise indicated.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 2. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, corrosion resistant steel screws with Phillips-head recess of type, size and other properties recommended by gypsum panel manufacturer.
 3. Product Description - High Moisture / Humidity Applications: Bugle head, self-drilling, self-tapping, stainless steel screws with Phillips-head recess of type, size and other properties recommended by gypsum panel manufacturer; for use at high moisture areas such as Kitchens, Showers and Tub Enclosures, Saunas, Steam Rooms, and Pool Enclosures.
- E. Miscellaneous Fasteners: For conditions not indicated, fasteners shall be type, finish, size, and holding power recommended by respective gypsum board manufacturer and conditions.

2.9 JOINT TREATMENT MATERIALS

- A. Material Quality Standard: ASTM C 475 / C 475M.
- B. Joint Tape:
 1. Paper Tape: Nominal 2 in wide cross-fibered paper tape with finish suitable for bonding, creased in center for easy folding, and compatible with joint compound.
 2. Mesh Tape: Nominal 2 in wide self-adhering 10-by-10 fiberglass mesh tape.
- C. Joint Compound:
 1. Setting-Type: Job-mixed powder for mixing with water, chemical-hardening compound; includes taping types.
 2. Drying-Type: Ready-mixed or job-mixed powder for mixing with water, air-drying, vinyl based compounds; includes taping, topping, and all-purpose types.

2.10 RELATED MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced quality standards and recommendations of gypsum board manufacturer.
- B. Firestopping Products at Penetrations: As specified in Division 07 Section "Penetration Firestopping".
- C. Fiberglass Sound Attenuation Blankets:

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1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:
 - a. Flame Spread: Class A - no greater than 25.
 - b. Smoke Developed: No greater than 50.
4. Thickness: Not less than 2-1/2 in , unless otherwise indicated.
5. Basis of Design: Johns Manville; Sound Control Batts, Formaldehyde Free.

D. Mineral Wool Sound Attenuation Blankets:

1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of rock or slag with thermosetting resins.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:
 - a. Flame Spread: Class A - no greater than 25.
 - b. Smoke Developed: No greater than 50.
4. Thickness: Not less than 3 in , unless otherwise indicated.
5. Density: Not less than nominal 2.5 pounds per cubic foot.
6. Manufacturers:
 - a. Fibrex Insulations, Inc.
 - b. Rock Wool Manufacturing Co.
 - c. Roxul.
 - d. Thermafiber LLC.

E. Acoustical Sealant:

1. Description: Manufacturer's standard nonsag, paintable, nonstaining sealant complying with ASTM C 834 or ASTM C 920. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90 or other acceptable test method.
 - a. Preconstruction Compatibility Testing: Test sealant for compatibility with copper substrates. Testing will not be required if data submitted on previous testing of current sealant products matches those submitted.
 - b. Do not use acrylic, neoprene, and nitrile based sealants that are not recommended for use with copper substrates.

F. Fire-Resistance Rated and Acoustical Putty Pads:

1. Product Quality Standard: UL 263 (ASTM E 119).
2. Description: Fire-rated, non-hardening, moldable, intumescent compound formed into sheets designed to seal penetrations, construction gaps, and around electrical boxes against spread of fire, smoke, and toxic gases.
3. Manufacturers and Products:

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- a. Grace Construction Products; Flamesafe FSP 1077 Putty Pads.
 - b. Hilti; CP 617 Intumescent Acoustic Putty Pads.
 - c. Hilti; CFS-P PA.
 - d. Specified Technologies, Inc; Series SSP Putty Pads.
 - e. Tremco; TREMstop Electrical Box Insert.
 - f. 3M; Fire Barrier Moldable Putty+Pads.
- G. One-Piece Barrier Box:
- 1. Description: Rigid reinforced polyethylene box designed to fit around electrical boxes to prevent leaks of air and vapor.
 - 2. Basis of Design: Lessco Air-Vapor Barrier Box.
- H. Fire Resistive Sealants: Intumescent elastomeric sealant as specified in Division 07 Section "Fire-Resistive Joint Firestopping".
- I. Sealants: Sealant as specified in Division 07 Section "Joint Sealants".
- J. Isolation Strips: Adhesive-backed, closed cell neoprene or vinyl foam strips that allow fastener penetration with foam displacement, size as indicated, compressed 50 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
- 1. Respective Manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
 - 4. ASTM C754 Standard Specification for installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - 5. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board.
 - 6. Gypsum Association GA 216.
 - 7. United States Gypsum Company (USG); Gypsum Construction Handbook when no other installation quality standard applies to condition.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Suspended Gypsum Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hanger wires at spacing required to support ceilings and that hangers will develop their full strength.
- C. Coordination with Sprayed Fire-Resistance Materials:
 - 1. Pre-Application Coordination: Before sprayed fire-resistance materials are applied, attach Z shaped clips and offset mounting plates to structural steel members with powder actuated fasteners, leaving portion of flange exposed outside of sprayed fire-resistive materials to attach head of wall track for gypsum board assembly.
 - 2. Post-Application Coordination: After sprayed fire-resistive materials are applied, remove materials only to extent necessary for installation of gypsum board assemblies, attach Z shaped clips and offset mounting plates to structural steel members with powder actuated fasteners, leaving portion of flange exposed outside of sprayed fire-resistive materials to attach head of wall track for gypsum board assembly, and patch with fire-resistive material specified in Division 07 Section "Cementitious Fireproofing" that is required to obtain fire-resistance rating indicated.

3.4 INSTALLATION OF GYPSUM BOARD ASSEMBLIES

- A. Resistance Rated Partitions: Construct fire resistance rated, smoke resistance rated, and sound resistance rated partitions according to respective assembly test reports. Ensure every material used within an assembly shall comply with manufacturers listed and product qualities indicated in respective assembly test report.
- B. Penetrations and Openings: Construct within gypsum board assemblies work as required to properly form penetration or opening to receive firestopping materials specified in following Sections:
 - 1. Division 07 Section "Penetration Firestopping".
 - 2. Division 07 Section "Fire-Resistive Joint Firestopping".
- C. Control Joints: Install control joints at locations indicated on Drawings, in specific locations approved by Architect for visual effect and according to the following:
 - 1. Spaced not more than 24 to 30 feet in either direction for uninterrupted straight planes of ceilings and walls.
 - 2. Where different substrates occur at ceilings and walls.
 - 3. Where control joints occur in substrates at ceilings and walls.
 - 4. Where L, U, or T shaped ceiling configurations are joined.
 - 5. At less-than-ceiling-height cased opening frames and gypsum board openings over 60 inches in width; extend control joints from both corners at top of frame or opening up to ceiling.

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6. Where less-than-ceiling-height door frames occur on walls more than 30 feet in length; extend control joints from top of frame up to ceiling at corner of hinge side of door
 7. Where less-than-ceiling-height borrowed lites occur on walls more than 30 feet in length; extend control joints from top of frame up to ceiling and from bottom of frame to floor at both corners.
- D. Isolation from Building Structure: Isolate gypsum board assemblies from building structure to prevent transfer of loading imposed by structural movement.
1. Provide isolation joints as indicated or required by installation quality standards.
 2. Isolate ceiling assemblies abutting or penetrated by building structure.
 3. Isolate partition framing and wall furring abutting or penetrated by building structure, except at floor.
- E. Building Expansion Joints: Avoid bridging building expansion joints with metal framing or furring members; frame both sides of joints independently with framing or furring members, coordinating with building expansion joint products specified in Division 07 Section "Expansion Control".
- F. Fire-Resistance Rated and Acoustical Putty Pads: Hand apply pads to surfaces indicated, packing tightly into gaps and openings, in such a manner that pad will remain secured to surface; pinch pleat excess material together to close gaps.
- G. One-Piece Barrier Box: Install in accordance with manufacturer's recommendations as indicated on the Drawings.
- H. Supplemental Accessories: Install supplementary framing, blocking, reinforcing, and bracing in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, hand rails, furnishings, or similar construction. Comply with details indicated and recommendations of installation quality standards or manufacturer.

3.5 INSTALLING SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

- A. Installation Quality Standard: In addition to standards listed elsewhere, perform suspended ceiling work according to following, unless otherwise specified in this Section:
1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- B. Pattern: Lay out spaces and arrange suspension system in a regular pattern, parallel or perpendicular to surrounding walls.
- C. Hangers for Ceiling System: Suspend hangers from building structural members and as follows:
1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

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2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers required to support suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 4. Secure the appropriate hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Install metal framing components for suspended ceilings so that members are level to within 1/8 in in 12 ft as measured both lengthwise on each member and transversely between parallel members.
 6. Attach hangers to structural members.
 7. Do not connect or suspend any ceiling components from ducts, pipes or conduit.
- D. Perimeters: Using gypsum board screws through gypsum board into metal studs, attach perimeter wall angle where suspended grid system meets vertical surfaces unless otherwise indicated; cut main beams and cross furring members to fit into wall angle.
- E. Main Beams:
1. Suspend main beams spaced 48 in on center from structure with wire hangers spaced not greater than 48 in on center.
 2. Install main beams level within 1/8 in in 12 ft with hanger wire taut and tightly wrapped to prevent vertical movement or rotation.
 3. Do not make local kinks or bends in hanger wires as a means of leveling.
- F. Cross Furring Members:
1. Install cross furring members at right angles to main beams, spaced as required and join to main beams with positive interlock.
 2. Install cross furring members to within 1/32 in of their required location and within 0.015 in of same horizontal plane as main beam, and never below continuous member.
 3. Install additional cross furring members at right angles to beams and cross furring members to support ends of recessed light fixtures, diffusers or grilles.

3.6 INSTALLING METAL FRAMING COMPONENTS

- A. Priority: Assemble various assemblies giving priority to partitions with higher rating; extend partition with higher rating intact through partition with lower rating.
- B. Joinery and Connections: Install various metal framing components according to details indicated; for situations and conditions not indicated, comply with installation quality standards and with respective manufacturer's recommendations.
- C. General Requirements: Construct partition framing of studs, tracks, and headers using screws of number and spacing required.
1. Install studs of uncoated base metal thickness as determined by Metal Framing Schedule at end of this Section.

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2. Extend partition framing full height to underside of structure above, except where partitions are indicated to terminate at, or immediately above, suspended ceilings.
 3. Continue framing over door frames and openings to provide support for gypsum board.
 4. Space studs as indicated on Metal Framing Schedule at end of this section.
 5. Cut studs 1 in short of full height to provide deflection relief at head of wall conditions.
 6. Install studs so that flanges point in same direction.
 7. Attach with screws through each stud flange and track (runner) flange, except top deflection track assemblies.
 8. For fire resistance rated, smoke resistance rated, and sound resistance rated assemblies that are required to extend to underside of structure above to obtain ratings, install framing around structural and other members extending below floor slabs or roof decks, as needed to support gypsum board closures and make partitions continuous from floor to underside of structure above.
 9. Do not lap studs.
 10. At intersections and corners, locate studs no more than 2 in from partition intersections and corners and secure with screws through both flanges of studs and tracks.
- D. Metal Track (Runner) Requirements:
1. Floors: Install tracks (runners) using appropriate fasteners spaced not more than 16 in on centers.
 2. Head of Wall: Install deep leg deflection tracks using appropriate fasteners to laterally support assembly, and to avoid axial loading of assembly by deflection from building structure above.
- E. Support for Wall Mounted Accessories or Equipment: Install back-up plate or track (runner) turned on its side, using screws as indicated or as required, to studs to properly transfer accessory or equipment load to metal framing.
- F. Openings: Frame single door, double door, above ceiling openings, and below ceiling openings using studs, tracks (runners), clip angles, and headers.
1. Install 2 studs on each side of each opening in configuration indicated, including strap plates; extend from floor to underside of structure above; do not cut these studs under any circumstances. Include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
 2. Construct header of appropriate configuration for type of opening to be spanned and secure with clip angles; include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
 3. Install short intermediate studs 16 in on center between top track and header.
 4. At partitions indicated to terminate immediately above ceiling, install diagonal bracing at not less than spacing as indicated.
- G. Supplementary Framing: Install around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by metal framing.
- H. Penetrations: Maintain fire-resistance rating of assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- I. Chase Partitions:

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1. Position double row of studs vertically in tracks (runners), opposite each other in pairs with flanges pointing in same direction.
2. Attach with screws through each stud flange and track (runner) flange.
3. Cross brace between rows of studs with one of following at 48 in on center maximum vertically, attached to stud webs with screws:
 - a. Coated glass-mat gypsum board, 12 in high by chase width.
 - b. Metal studs turned on side, webs back-to-back.

J. Furred Walls:

1. Erect furring channels vertically, spaced 16 in on centers maximum, unless otherwise indicated.
2. Attach with appropriate fasteners, staggered on flanges.
3. Splice ends by nesting channels 8 in and securely anchoring to surface.
4. Miter 24 in long horizontal furring channels at corners and space 24 in on centers vertically.
5. Locate furring channels around perimeter of openings and secure to surfaces.

K. Control Joints:

1. Construct metal framing as indicated by installation quality standard to allow gypsum board control joints to function as intended.
2. For control joints located in fire resistance rated walls and partitions, construct of metal studs and mineral wool, full height of partition, according to assembly fire test reports.

L. Metal Framing Spanning Multiple Floors: Construct metal framing as required using longest length metal studs possible and attach to building structure with floor bypass clips.

M. Installation Tolerances: Install each metal stud metal framing and furring member so that fastening surfaces do not vary more than 1/8 in from plane formed by faces of framing members.

3.7 INSTALLING GYPSUM BOARD PRODUCTS

A. General Requirements:

1. Install type of gypsum board at location indicated by gypsum board schedule at end of this Section.
2. Do not install damaged gypsum boards.
3. Install gypsum boards with finishable face side out.
4. Butt gypsum boards together for a light contact at edges and ends with not more than 1/16 in of open space between panels.
5. Do not force gypsum boards into place.
6. Do not place tapered edges against cut edges or ends.
7. Locate panel joints so that no joint will align with the edge of an opening unless control joints are installed at these locations.

B. Isolation from Building Structure:

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1. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments or surfaces where movement is anticipated. Provide 1/4 in to 1/2 in wide spaces at these locations or as indicated below:
 - a. At top of wall or where partitions intersect open building structure members projecting below underside of floor slabs and roof decks, cut to fit profile formed by coffers, joists, beams, and other structural members; form proper annular joint to receive firestopping at rated partitions and form 3/4 in joint at top of wall at non-rated partitions.
 2. Trim edges with edge trim where edges of gypsum boards are exposed.
 3. Seal joints between edges and abutting structural surfaces with firestopping at rated locations and acoustical sealant at non-rated locations.
- C. Single-Layer Board Assemblies:
1. At typical conditions, install gypsum board vertically (long dimension parallel to metal framing), to minimize short end-to-short end joints unless otherwise indicated or required by assembly fire test reports.
 2. At interior of stairwells and other high walls, install gypsum boards horizontally, unless otherwise indicated or required by assembly fire test reports. Stagger abutting end joints not less than one framing member in alternate courses of gypsum boards.
- D. Multi-Layer Board Assemblies: Apply base layers and face layers vertically (long dimension parallel to metal framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud space from base layer joints, unless otherwise indicated or required by assembly fire test reports. Stagger joints on opposite sides of partitions.
- E. Ceiling Applications:
1. Apply gypsum board at right angles to main beams of suspension framing to minimize number of abutting end joints and avoid abutting end joints in central area of each ceiling.
 2. Stagger abutting end joints of adjacent panels not less than one framing member.
 3. Locate both edge or end joints of gypsum boards over intermediate supports or gypsum board back-blocking where metal framing is not present.
- F. Typical Wall Applications:
1. Attach gypsum boards to metal studs so that leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
 2. Stagger vertical joints on opposite sides of partitions.
 3. Do not make joints other than control joints at corners of framed openings.
 4. Attach gypsum boards to framing provided at doors, openings and cutouts. Install gypsum boards over door heads and extend to not less than one stud space - 16 in at each side of door or opening.
 5. Cover both faces of metal framing with gypsum boards as indicated, except in chase walls that are braced internally.
 6. Cut and fit gypsum boards around ducts, pipes, conduits, and other penetrations to form proper annular joint to receive firestopping at rated partitions.

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- a. At non-rated partitions, annual space around ducts, pipes, conduit or other penetrations to be properly sized to receive sealant; 3/4 in maximum.
 - b. "Blow-out" patches are not allowed.
 7. Support both edge and end joints of gypsum boards over metal framing.
- G. Screw Attachments:
1. Attach gypsum board to metal framing with screw fasteners of type appropriate for gypsum board materials and installation conditions:
 - a. Length shall be as required by condition and penetrating metal framing not less than 3/8 in .
 - b. Spacing shall be as recommended by installation quality standard, gypsum board manufacturer, or respective assembly test report.
 - c. Use properly adjusted, positive-clutch electric power tool equipped with adjustable screw-depth head and a Phillips bit. Nails and staples are not permitted.
 2. Drive screws to slightly dimple surface without breaking face paper, fracturing core, or stripping metal framing member around screw shank.
 3. Space screws for non-fire resistance rated partitions and ceilings as recommended by installation quality standards.
 4. Space screws for fire resistance rated partitions as required by assembly fire test reports.
 5. Start field screwing near center and work towards edges.
 6. Space screws not less than 3/8 in from gypsum boards edges.
 7. Do not attach gypsum boards to top runner where wall or partition extends to building structure unless required by fire test reports.
- H. Control Joints: Form control joints and expansion joints at locations indicated with required space between edges of adjoining gypsum boards.
- I. Sound Attenuation Blankets: Install blankets within stud cavities set so that they are held in place by friction with metal studs; ensure blankets are secure within cavity and will not become displaced when second gypsum board side is closed.
- J. Elevator Shaft Cants: Where gypsum board shaftwall assemblies cannot be positioned within 4 in of shaft face of structural beams, floor edges, and similar projections into shaft, install 5/8 in thick gypsum board cants covering tops of projections.
1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 in on centers with screws fastened to shaftwall framing.
 2. Where steel framing is required to support gypsum board cants, install framing at 24 in on centers and extend studs from projection to shaftwall framing.
- K. Sealant:
1. Comply with ASTM C 919 and manufacturers written recommendations for closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
 2. Seal wall assemblies at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant material according to following:

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- a. Fire Resistance Sealant: Joints within fire resistance rated assemblies.
- b. Water Resistance Sealant: Joints within non-fire resistance rated assemblies exposed to possible water infiltration.
- c. Acoustical Sealant: All other joints.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: Fasten trim accessories continuously according to accessory manufacturer's instructions using gypsum board screws; installation by clinch-on tool and staples not permitted.
- B. Interior Trim Accessories: Install in the following locations:
 - 1. Corner Beads: Install trim at external corners; use screws at each flange at 9 in on centers, opposite each other.
 - 2. Edge Trim: Install trim where gypsum boards abut dissimilar material, and where edge of gypsum boards would otherwise be exposed; use screws at flange at 9 in on centers.
 - a. LC-Bead (J-Bead): Install trim at exposed conditions where back flange can be attached to framing or supporting substrate before gypsum board installation.
 - b. L-Bead: Install trim at exposed conditions where trim can only be installed after gypsum board installation.
 - c. J-Stop: Install trim at concealed conditions where trim can only be installed after gypsum board installation.
 - 3. Control Joints: Install trim at appropriate locations, ensuring gypsum board is not continuous over joint; use screws at each flange at 6 in on centers.
 - a. Control joints to extend 4 in above finished ceiling at non-rated conditions and extend to structure at rated wall conditions.
- C. Accent Trim Accessories: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in on centers.
- D. Trim Accessories at Exterior Windows: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in on centers or as recommended by manufacturer for manufactured products.

3.9 FINISHING GYPSUM BOARD PRODUCTS

- A. General: Treat board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare surfaces for decoration.
- B. Joint Tape: Finish joints according to the following and as recommended by manufacturer:
 - 1. Typical Paper-Faced Gypsum Board Products: Paper tape.
 - 2. Moisture-Resistant Gypsum Board Products:
 - a. Moisture-Resistant Paper-Faced Gypsum Board: Paper tape.
 - b. Moisture-Resistant Paperless Glass-Mat Gypsum Board: Paper or mesh tape.
 - c. Moisture-Resistant Coated Glass-Mat Gypsum Board - Tile Backer: Mesh tape.

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- C. Finishing: Finish boards and units to achieve specified level of finish as indicated in schedule at end of Section:
 - 1. Typical Paper-Faced Gypsum Board: Either or combination of the following as recommended by manufacturer:
 - a. Setting-type joint compounds.
 - b. Drying-type joint compounds.
 - 2. Moisture-Resistant Paper-Faced Gypsum Board: Setting-type joint compounds.

3.10 ADJUSTMENTS

- A. Damaged Materials: Stored or installed gypsum board materials shall be classified as damaged, defective, and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Substantial Completion or if they exhibit evidence of active or dormant mold or mildew. Damaged materials and assemblies shall be replaced with new and dry materials and assemblies.

3.11 PROTECTION

- A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.12 METAL FRAMING SCHEDULE

- A. Metal Stud Framing Schedule:
 - 1. Stud Depth: As indicated on Drawings.
 - 2. Spacing: Maximum 16 in on centers, unless otherwise indicated, or as required to comply with respective assembly test report.
 - 3. Minimum Performance Requirements: Lateral pressure loads (lb/sq ft) are allowable design values and shall not be reduced further by load combinations. Minimum performance requirements unless otherwise indicated:
 - a. Typical Partitions: L/240 at 5 lb/sq ft lateral load.
 - b. Elevator Shaft Partitions: L/240 at 7.5 lb/sq ft lateral load.
 - c. Partitions with Tile Facing: L/360 at 7.5 lb/sq ft lateral load.
 - d. Partitions with Interior Stone Facing Concentrated Loads: Provide delegated engineering to comply with L/720 at 10 lb/sq ft lateral load.
 - e. Partitions supporting Lead Lined Doors and Frames: Provide delegated engineering to comply with L/480 at 10 lb/sq ft lateral load.
 - f. Partitions supporting all other Concentrated Loads: Provide delegated engineering to comply with L/360 at 10 lb/sq ft lateral load
 - 4. Minimum Uncoated Base Steel Thickness:
 - a. Typical Gypsum Board Assemblies: As determined by manufacturer's limiting height engineering data unless otherwise indicated.
 - 1) 20 Gauge Drywall Studs: 0.0296 inch () minimum base steel thickness.

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- a) Typical partitions unless otherwise indicated.
- 2) 20 Gauge Equivalent Studs: Allowed only when included as part of an approved tested assembly.
- 3) 20 Gauge Structural Studs: 0.0329 inch () minimum base steel thickness.
- a) Partitions supporting ceramic or stone tile.
- b. 16 Gage Studs:
 - a) Typical at partitions supporting stone facing unless otherwise indicated.
- c. Gypsum Board Assemblies required to Support Concentrated Loads: As required by delegated engineering professional but not less than minimum uncoated base metal thickness indicated above.

3.13 GYPSUM BOARD SCHEDULE

- A. Gypsum Board Schedule, General: Install the designated gypsum board product based on exposure classification to water and / or moisture and applied finish system as follows, unless otherwise indicated or scheduled on the Drawings.
- B. No Exposure: Surfaces not normally exposed to water and / or moisture sources, including but not limited to the following locations:
 - 1. Typical walls and ceilings.
 - a. Paint and Wall Coverings Only: Typical paper-faced gypsum board.
 - b. Tile: Moisture-resistant coated-glass-mat gypsum board.
 - 2. Horizontal fire-rated assemblies and ceilings:
 - a. Paint Only: Paper-faced Type C gypsum board.
 - 3. Walls in acoustical barriers as indicated in the Drawings.
 - a. Paint and Wall Coverings Only: Paper-faced acoustically enhanced gypsum board.
 - 4. Shaft-Side Face of Shaft-Liner Assemblies:
 - a. No Finish Required: Moisture-resistant paperless glass mat shaft-liner gypsum board.
- C. Incidental Exposure: Surfaces immediately adjacent to water and / or moisture sources, including but not limited to the following locations:
 - 1. Walls and ceilings in mechanical equipment rooms and janitor closets.
 - 2. Walls within 24 inches of centerline of drinking fountains, isolated wall-hung lavatories, and countertop sinks and other similar water sources.
 - 3. Interior face of exterior walls.
 - 4. Acceptable gypsum board products for the above listed conditions:

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- a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
 - b. Tile: Moisture-resistant coated-glass-mat gypsum board.
- 5. Top of walls above ceilings adjacent to mechanical equipment in corridors.
 - a. Moisture-resistant paperless glass-mat gypsum board.
- D. Direct Exposure: Surfaces normally soaked, saturated, or regularly and frequently exposed to water and / or moisture, including but not limited to the following locations:
 - 1. Walls and ceilings in commercial kitchens, toilet rooms and bathrooms including bathtubs and showers:
 - a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
 - b. Tile: Moisture-resistant coated-glass-mat gypsum board.
- E. Any Exposure:
 - 1. Moisture-Resistant, Impact-Resistant Gypsum Board Products for Enclosing High-Rise Elevator Shafts and Stairwells: Where indicated on drawings.
 - a. Paint and Wall Coverings: Paper-faced or paperless products.
 - b. Tile: Paperless products.

3.14 GYPSUM BOARD FINISHING SCHEDULE

- A. Gypsum Board Finishing Schedule, General: Finish panels to Levels of Finish indicated below. Apply joint tape over panel joints, except those with trim having flanges not intended for tape. Sand between coats and after last coat to produce a surface free of defects and ready for applied finish system.
 - 1. Levels of Finish: According to ASTM C 840.
- B. Preparation: Apply joint compound at open joints, panel edges, and damaged surface areas.
- C. Level 1: At following locations, embed tape at joints in joint compound unless a higher level of finish is required for fire resistance rated assemblies. Trim accessories to be installed but not embedded in joint compound unless required for fire rating:
 - 1. Ceiling plenum areas above ceilings.
 - 2. Concealed areas.
 - 3. Substrate for interior stone facing.
 - 4. Substrate for interior woodwork.
- D. Level 2: At following locations, embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges:
 - 1. Substrate for tiling.

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- E. Level 3: At following locations, embed tape and apply separate first and second coats of joint compound to tape, fasteners, and trim flanges:
1. Mechanical, electrical, data and elevator equipment rooms.
 2. Stair towers.
- F. Level 4: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges:
1. Areas to receive paint.
 2. Areas to receive wall coverings.
- G. Level 5: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound or Level 5 Primer and Surfacer over entire surface:
1. Other areas as indicated on the Drawings.

END OF SECTION

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SECTION 093000

TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Modular tiles, membrane underlayments, setting materials, grouting materials, accessories, and supplementary items necessary for installation.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 and ANSI A137.3 apply to Work of this Section unless otherwise specified.
- B. Module Size: Actual tile size plus joint width indicated.
- C. Face Size: Actual tile size, excluding spacer lugs.
- D. Ceramic (Mosaic) Tile: Tile formed by either the dust-pressed or plastic method, usually 1/4 in to 3/8 in to thick, and having a facial area of less than 6 sq in. Ceramic mosaic tile may be of either porcelain or natural clay composition and they may be either plain or with an abrasive mixture throughout.
- E. Paver Tile: Glazed or unglazed porcelain or natural clay tile formed by dust-pressed method having a facial area of 6 sq in or more.
- F. Porcelain Tile: A ceramic tile or paver tile that is generally made by the dust-pressed method of a composition resulting in a tile that is dense, impervious, fine grained, and smooth with sharply formed face and with a porosity of less than 0.5.
- G. Gauged Porcelain Tile Panels/Slabs: A ceramic tile or panel size greater than or equal to 11 sq ft
- H. Wall Tile: A glazed tile with a body that is suitable for interior use and which is usually non-vitreous and is not required nor expected to withstand excessive impact or be subject to freezing and thawing conditions.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturers technical literature for each product and system indicated.
 - 1. Include manufacturers specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings:
 - 1. Include plans of rooms and elevations of walls showing tile and patterns; include sections showing underlayments, setting materials, and grouting materials.

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2. Include details showing widths and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.
 1. Tile: Each type and composition of tile and for each color and finish required, at least 12 in square, mounted on rigid panel, and with grouted joints using product complying with specified requirements and in color approved for completed work.
 2. Tile Trim and Accessories: Full-size units of each type and for each color required.
 3. Simulated Stone (Solid Surfacing) Thresholds: 6 in lengths of specified profile.
 4. Metal Edge Strips: 6 in lengths of specified profile.

1.4 INFORMATIONAL SUBMITTALS

- A. List of Materials for Layered Mock-Up for Construction Quality Purposes:
 1. Product, material, and equipment names, model numbers, lot numbers, batch numbers, source of supply, and other information required to identify items used.
 2. Receipt of list does not constitute acceptance of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.
- B. Warranty:
 1. Provide manufacturers written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Instructions: Include in operation and maintenance manual required by Division 01 Section Closeout Requirements. Submit manufacturers instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

- A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 - b. Build mock-ups in a layered fashion omitting tile in particular areas to reveal underlayment membranes and setting bed installation including but not limited to the following:

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- 1) Tiled floor conditions at thin-set mortar setting beds.
 - 2) Tiled floor conditions at LHT mortar setting beds.
 - 3) Movement joints at tiled floor conditions.
 - 4) Tiled wall conditions, including one interior corner.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Install tile only when construction in room is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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1.11 WARRANTY

- A. Manufacturer Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period - Shower Tiling System: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 25 years from date of Substantial Completion.
- B. Installer Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. Defects is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
 - 1. Tiling: Obtain tile of each type and color or finish from single source or producer.
 - a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
 - b. Obtain setting and grouting materials from single manufacturer.
 - 2. Shower Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.
 - a. Obtain setting and grouting materials from single manufacturer.

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- b. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
- c. Obtain joint sealants from manufacturer of setting and grouting materials.

2.3 PERFORMANCE REQUIREMENTS

- A. Slip Resistance Requirements for Floor Tile: Products and installation shall comply with ANSI A137.1, and state and local accessibility standards.
 - a. Slip Resistant Walkway Surfaces: Dynamic Coefficient of Friction DCOF AcuTest Method per ANSI A326.3.
 - 1) DCOF Level Walkways: Minimum 0.42.
 - 2) DCOF Inclined Walkways: Minimum DCOF as required to comply with code.

2.4 CERAMIC TILE PRODUCTS

- A. Material Quality Standard: ANSI A137.1 Specifications for Ceramic Tiling and ANSI A137.3 Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs for types, compositions, and grades of tiling indicated.
 - 1. Furnish tiling complying with Standard Grade requirements, unless otherwise indicated.
- B. Ceramic Tile, General: Thin ceramic surfacing unit made from clay, porcelain, or mixture of ceramic materials, glazed or unglazed, fired above red heat to temperature sufficient to produce specific physical properties and characteristics specified.
- C. Factory Blending: For tile exhibiting color variations, blend tile in factory and package so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- D. Mounting: Where factory-mounted tile is used, provide back- or edge-mounted tile assemblies as standard with manufacturer. Where tile is intended for installation in wet exposure areas, do not use factory mounted tile assemblies unless tile manufacturer states that this type of mounting is suitable for installation indicated.

2.5 WATERPROOF MEMBRANE UNDERLAYMENTS FOR INTERIOR APPLICATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is acceptable to authorities having jurisdiction for use as shower pan waterproofing, as selected from one of the following available options. Include primer, installation adhesives/modified setting mortars, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.
- B. Faced Plastic Waterproof Membrane Underlayments:
 - 1. Faced Chlorinated Polyethylene (CPE):
 - a. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, non-woven polyester fabric; minimum 0.030 in nominal thickness.
 - b. Manufacturers and Products:

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- 1) The Noble Company; Nobleseal TS.
 - 2) Laticrete International Corp.; Hydro Ban Sheet Membrane.
2. Faced Polyethylene (PEVA):
- a. Description: Modified polyethylene (PEVA) membrane faced on both sides with high-strength, non-woven polypropylene fabric; minimum 0.008 in nominal thickness.
 - b. Manufacturers and Products:
 - 1) Schluter Systems; KERDI Waterproofing Membrane.
3. Faced Polyvinyl Chloride (PVC):
- a. Description: ASTM D 4551, multiple layers of polyvinyl chloride sheet heat-fused together and to facings of bondable nonwoven polyester; minimum 0.040 in nominal thickness.
 - b. Manufacturer and Product: Compotite Corporation; Composeal Gold.
4. Locations: Thin-set installations at floors, walls, and ceiling; including thin-set shower pan floor installations.

2.6 CRACK ISOLATION MEMBRANE UNDERLAYMENTS

- A. General: Manufacturers standard product that complies with ANSI A118.12 as selected from one of the following available options. Include primer, installation adhesives/modified setting mortars, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.
- B. Fluid-Applied Crack Isolation Membrane Underlayment: Not permitted or allowed within shower and bathtub areas.
1. Description: Manufacturers proprietary system consisting of liquid applied component and synthetic fabric sheet reinforcement when recommended by manufacturer.
 2. Manufacturers and Products:
 - a. ARDEX Engineered Cements; Ardex 8 + 9 Waterproofing and Crack Isolation Membrane.
 - b. Custom Building Products; 9240 Waterproofing and Crack Isolation Membrane.
 - c. Laticrete International Inc.; Hydro Ban Waterproofing and Crack Isolation Membrane.
 - d. Laticrete International Inc.; Blue 92 Anti-Fracture Membrane.
 - e. Mapei Corp.; Mapelastic Aquadefense.
 - f. Sika Corp.; Merkrete Hydroguard 2000.
- C. Faced Chlorinated Polyethylene (CPE) Crack Isolation Membrane Underlayment:
1. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.030 in nominal thickness.
 2. Manufacturer and Product: The Noble Company; NobleSeal CIS.

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2.7 SETTING MATERIALS - MORTAR AND GROUT

- A. Material Quality Standards: ANSI A118 Series as indicated.
- B. LHT Latex-Portland Cement Mortar:
 - 1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:
 - a. Manufacturer's premium polymer modified LHT mortar product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
 - b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
 - c. Non-sag capability.
 - d. Suitable for use in LHT mortar beds up to 1/2 in thick.
 - 2. Manufacturers and Products - Floor Tiling:
 - a. ARDEX Engineered Cements; X 77 Microtec.
 - b. Custom Building Products; ProLite Tile & Stone Mortar.
 - c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
 - d. Mapei Corp.; Ultraflex LFT.
 - e. Sika Corp.; SikaTile 500 LHT Lite.
 - f. Sika Corp.; Merkrete 820 Dustless Merlite.
 - g. Schluter Systems; All-Set.
 - 3. Manufacturers and Products - Gauged Tile Panels / Slabs:
 - a. Comply with ANSI A108.19 Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar.
 - b. Confirm with tile manufacturer and mortar setting material manufacturers the use of required setting materials, methods and cure times.
- C. Thin-Set Latex-Portland Cement Mortar (For All Tile Types Except Glass):
 - 1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:
 - a. Manufacturer's premium polymer modified thin-set product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
 - b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
 - c. Non-sag capability.
 - d. Suitable for use in thin set mortar beds up to 1/4 in thick.
 - 2. Manufacturers and Products - Floor Tiling:
 - a. ARDEX Engineered Cements; X 77 Microtec.
 - b. Custom Building Products; ProLite Tile & Stone Mortar.
 - c. Laticrete International, Inc.; Laticrete 254 Platinum Thin-Set Mortar.

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- d. Mapei Corp.; Keraflex Super Mortar.
- e. Sika Corp.; SikaTile 500 LHT Lite.
- f. Sika Corp.; Merkrete 820 Dustless Merlite.
- g. Schluter Systems; All-Set.

3. Manufacturers and Products - Wall Tiling:

- a. ARDEX Engineered Cements; X 77 Microtec.
- b. Custom Building Products; ProLite Tile & Stone Mortar.
- c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
- d. Mapei Corp.; Keraflex Super Mortar.
- e. Sika Corp.; SikaTile 500 LHT Lite.
- f. Sika Corp.; Merkrete 820 Dustless Merlite.
- g. Schluter Systems; All-Set.

D. Latex-Portland Cement Grout for Tile Joints:

1. Unsanded Grout:

- a. Material Quality Standard: ANSI A118.7, with following physical properties:
 - 1) Manufacturer's premium polymer modified unsanded grout product.
 - 2) Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
- b. Manufacturers and Products:
 - 1) ARDEX Engineered Cements; FG-C Unsanded Grout.
 - 2) Custom Building Products; Prism Surecolor Grout.
 - 3) Laticrete International, Inc.; Permacolor Grout.
 - 4) Laticrete International, Inc.; Permacolor Select NS.
 - 5) Mapei Corp.; Ultracolor Plus FA Grout.
- c. Locations: Tile Joints less than 1/8 in wide.

2. Sanded Grout:

- a. Material Quality Standard: ANSI A118.7, with following physical properties:
 - 1) Manufacturer's premium polymer modified sanded grout product.
 - 2) Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
- b. Manufacturers and Products:
 - 1) ARDEX Engineered Cements; FL Rapid Set, Flexible, Sanded Grout.
 - 2) Custom Building Products; Prism Surecolor Grout.
 - 3) Laticrete International, Inc.; Permacolor Grout.
 - 4) Laticrete International, Inc.; Permacolor Select Grout.
 - 5) Mapei Corp.; Ultracolor Plus FA Grout.
- c. Locations: Tile Joints 1/8 in wide and larger.

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2.8 ELASTOMERIC SEALANTS

- A. Sealant Colors: Match color of adjacent grout unless otherwise indicated.
- B. Mildew-Resistant Floor or Wall Joint Sealant:
 - 1. Material Quality Standard: ASTM C 920, Type S, Grade NS, Class 25, with following physical properties:
 - a. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
 - b. Intended for sealing interior ceramic tile joints and other nonporous substrates.
 - c. Resistant to in-service exposures of high humidity and temperature extremes.
 - d. Use Related to Exposure: T (Traffic).
 - 2. Description: One-part mildew-resistant silicone sealant.
 - 3. Manufacturers and Products:
 - a. ARDEX Engineered Cements; SX.
 - b. Custom Building Products; Commercial 100% Silicone Caulk.
 - c. Laticrete International, Inc.; Latasil.
 - d. Mapei Corp.; Mapesil T.
 - e. Sika Corp.; SikaSeal 122 MS.
- C. Backer Rods:
 - 1. Material Quality Standard: ASTM C 1330, Type B.
 - 2. Description: Non-gassing (when punctured), bi-cellular polyethylene or polyolefin foam rod with a surface skin, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 3. Manufacturers and Products:
 - a. Sika Corp.; MasterSeal 921.
 - b. Nomaco Inc.; Sof Rod.
- D. Backer Tape: Bond-breaking polyethylene or other plastic tape, self-adhesive where applicable, recommended by sealant manufacturer for preventing sealant from adhering to back of joint where such adhesion would result in sealant failure.

2.9 RELATED MATERIALS

- A. Cementitious Underlayments: Trowelable or self-leveling as required by conditions; pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.
- B. Patching Compounds: Trowelable pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.
- C. Metal Transition Strips (Tile to Adjacent Flooring Material):
 - 1. Schluter Systems; Schiene, stainless steel.

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- D. Simulated Stone (Solid Surfacing) Threshold:
 - 1. Fabrication: Of shape and width to allow top at no more than 1/2 in above adjoining finished floor surface and both edges beveled on a slope no greater than 1:2 and as indicated in the Drawings.
 - 2. Color: As indicated in Division 01 Design Selections specification section(s).
- E. Glass-Fiber Tape: Self-adhering, alkali-resistant, glass-fiber tape, 10 by 10 or 10 by 20 threads per 1 in.; minimum 2 in wide.
- F. Tile Cleaner: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, provided by or specifically approved by tile and grout manufacturers.
- G. Grout Sealer: Manufacturers standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.10 MIXING MORTARS AND GROUT

- A. General Procedures:
 - 1. Mix to comply with referenced quality standards and manufacturers written instructions.
 - 2. Add materials, water, and additives in accurate proportions.
 - 3. Use type of mixing equipment, speeds, containers, time, and other procedures to produce uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to which tile will be installed for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents. Starting work within a particular area will be construed as acceptance.
 - 1. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 2. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standard: In addition to standards listed elsewhere, perform tile work according to following, unless otherwise specified:
 - 1. Respective manufacturers written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
 - 4. ANSI A108 installation method indicated.
 - 5. TCNA installation method indicated.

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B. General Requirements:

1. Extend tile into recesses and under or behind equipment and fixtures to form a complete covering without interruptions unless otherwise indicated.
2. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns.
4. Perform cutting and drilling of tile without marring visible surfaces.
5. Grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints, to form smooth edges.
6. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile by not less than 1/8 in.

C. Jointing Pattern:

1. Unless otherwise indicated, lay tile in grid pattern.
2. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
3. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
4. Provide uniform joint widths of size recommended by tile and grout manufacturer unless otherwise indicated.
5. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

D. Wainscots: Lay out tile to next full tile beyond dimensions indicated, and finish with bullnose shape.

3.3 PREPARATION

A. General: Comply with manufacturers instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Substrate Cleaning: Remove curing compounds, coatings, laitance, efflorescence, concrete dust, dirt, oil, gypsum board dust, paint, and other residue that would adversely affect or reduce bonding.

C. Concrete Floor Preparation:

1. Prepare concrete floor substrates to comply with flatness tolerance of 1/4 in in 10 ft . Comply with more restrictive flatness tolerances when recommended or required by manufacturer.
 - a. Fill cracks, holes and depressions with trowelable cementitious underlayments and patching compounds.
 - b. Remove concrete protrusions, bumps, and ridges by sanding or grinding.
2. If substrate does not have fine broom finish, mechanically scarify concrete substrates to not less than ICRI CSP 4 finish.
3. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 in per foot toward drains.

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- D. Substrate Joints, Gaps, Penetrations, and Different Substrates within Shower and Tub Enclosures: Prior to installing tile, seal the following joints, gaps, and spaces between differing materials as follows:
 - 1. Penetrations: Apply wall joint sealant at penetrations through wall substrates to create water resistant barrier; especially at piping and valve penetrations.
 - 2. Toilet Accessories: Apply wall joint sealant at fastener penetrations and around perimeter of backing plates to create water resistant barrier.
 - 3. Joints and Corners: Apply glass-fiber tape to joints and corners of substrates within Showers and Tub Enclosures with thin-set mortar.
- E. Blending: Verify tile has been factory blended and packaged as specified; if not, either return to manufacturer or blend tiles at site before installing.
- F. Field-Applied Temporary Protective Coating: Where needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.4 WATERPROOF MEMBRANE UNDERLAYMENT INSTALLATION

- A. Installation Quality Standard: ANSI A108.13 and manufacturers written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. General Requirements:
 - 1. If required by manufacturer, prime concrete substrate.
 - 2. Install to produce a continuous waterproof membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles or kinks.
 - 3. For sheets, overlap and seal seams.
 - 4. Turn membrane up wall at locations where tile is scheduled for wall or base.
 - 5. Roll installed sheet if required by manufacturer.
 - 6. Install tile after waterproofing has cured and been tested determined it is watertight.

3.5 CRACK ISOLATION MEMBRANE UNDERLAYMENT INSTALLATION

- A. General Requirements:
 - 1. If required by manufacturer, prime concrete substrate.
 - 2. Install to produce a continuous crack isolation membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles, or kinks.
 - 3. For sheets, overlap and seal seams.
 - 4. For liquid applied products, brush or roll liquid uniformly over area in number of coats required and install reinforcing fabric.
 - 5. Roll installed sheet if required by manufacturer.
 - 6. After installation of tile, install floor joint sealant in tile joints recommended by manufacturer to coordinate with membrane strips.

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3.6 TILE INSTALLATION

- A. Comply with TCNAs Handbook for Ceramic Tile Installation for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series Specifications for Installation of Ceramic Tile that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Installation Quality Standard: Install tile according to following standards:
 - 1. LHT Mortar: ANSI A108.5; for floor tiles larger than 8 in by 8 in or with at least one side greater than 15 in and where subfloor is not recessed.
 - a. For tile with one side greater than 15-inches, the maximum allowable subfloor surface variation is 1/8-inch in 10 feet (3mm in 3m) and 1/16-inch in 2 feet (1.6mm in 0.6m) from the required plane when measured from the high points in the subfloor surface
 - 2. Thin-set Latex-Portland Cement Mortar: ANSI A108.5; for floor tiles 8 in by 8 in and smaller where subfloor is not recessed; and for interior wall tiles.
 - 3. Latex-Portland Grout: ANSI A108.10, typical unless indicated otherwise.
 - 4. Interior Gauged Porcelain Tiles and Panels/Slabs: A108.19
- C. Back Buttering: For following installations, obtain minimum 95 percent mortar coverage as in referenced ANSI A108 series of installation standards:
 - 1. Tile floors and ceilings in wet and limited water exposures.
 - 2. Tile floors composed of tiles 12 in by 12 in or larger.
 - 3. Tile floors composed of rib-backed tiles.
- D. Grout Joint Widths: Unless indicated otherwise, install the respective types of tile with the following grout joint widths, unless otherwise recommended by tiling and grout manufacturers.
 - 1. Ceramic Mosaic Tile - Less than 6 sq in: 1/16 in.
 - 2. Paver Tile - 6 sq in or More: 1/4 in.
- E. Simulated Stone (Solid Surfacing) Thresholds: Install at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated. Where edge of mortar bed would be exposed, set in thin-set mortar.
- F. Metal Trim: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- G. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.7 MOVEMENT JOINTS

- A. Movement Joints, General: Installation Quality Standard: In accordance with TCNA Movement Joint Design Essentials EJ171 and as specified below.
- B. Wall Joints: The following conditions shall not be grouted; install wall joint sealant and backer rod or backer tape:

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1. Gypsum board assembly control joints.
2. Building expansion joints, unless scheduled for expansion joint cover.
3. Interior corners of tiled walls, including shower and bathtub walls.
4. Around substrates and tile at penetrations through tiled substrates.
5. At one side of changes in direction or plane of wall.
6. At joint closest and parallel to changes in substrates supporting tile between wall and floor.

C. Floor Joints:

1. General Requirements:

- a. Where full coverage crack isolation membrane is not provided, continue construction, contraction (control), and expansion joints in building structure through tile work.
- b. Isolate tile work that abuts a restraining structure or assembly.
- c. When metal trim or sealant/backer is used for joint, width shall not be less than width of joint in building structure.
- d. Tile shall not be placed over building expansion joints.

2. Schedule of Sealant Products and Locations:

- a. Latex-Portland Cement Grouted Floors: Install floor joint sealant with backer rod at horizontal joints in mortar and grout setting conditions.

3. Interior Movement Joint Spacing: As indicated on Drawings and as specified below:

- a. Tile Exposed to Direct Sunlight or Moisture: 8 ft to 12 ft on center each way, 1/4-inch wide unless indicated otherwise.
- b. Tile Not Exposed to Sunlight: 20 ft to 25 ft on center each way, 1/4-inch wide unless indicated otherwise.

D. Interior Floor Joint Installation Schedule: Seal interior floor movement joints, as defined by TCNA, according to following schedule:

1. Construction Joints: Floor joint sealant and backer rod.
2. Contraction (Control) Joints: Floor joint sealant and backer rod.
3. Isolation Joints: Floor joint sealant and backer rod.
4. Tile Expansion Joints: Floor joint sealant and backer rod.
5. Perimeter Joints between Wall and Floors: Floor joint sealant with backer tape.

3.8 FIELD QUALITY CONTROL

A. Contractor Shower Receptor Test: Where shower floors and receptors are made water-tight by the application of the waterproof membrane, the completed membrane installation shall be tested at each installation.

1. The pipe from the shower drain shall be plugged and the receptor area shall be filled with water to a depth of not less than 2 in measured at the threshold.
2. Where a threshold of adequate height does not exist a temporary threshold shall be constructed to retain the test water to the stated depth.
3. The water shall be retained for a test period of not less than 24 hours, and there shall not be evidence of leakage.

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4. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing membrane in event of an unsuccessful test.
5. Materials and installations failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

3.9 CLEANING

A. Cleaning:

1. Acids are not permitted, nor will they be allowed.
2. Clean tile surfaces so they are free of foreign matter.
3. Remove grout residue from tile as soon as possible.
4. No sooner than 10 days after installation, clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.
5. Protect metal surfaces and plumbing fixtures from effects of cleaning.
6. Flush surfaces with clean water before and after cleaning.
7. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.10 DEMONSTRATION

- #### A. Cleaning and Maintenance Training:
- Provide instruction to Owner's personnel for cleaning and maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use; include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

3.11 PROTECTION

- #### A. Coverings:
- When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.
- #### B. Traffic Restrictions:
- Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

3.12 INTERIOR TILE INSTALLATION SCHEDULE

A. Floors, Concrete Substrate:

1. TCNA Installation Method F125-Full (Crack Isolation Membrane; Full Coverage): Thin-set Latex-Portland cement mortar over crack isolation membrane over concrete subfloor; Latex-Portland Cement Grout.

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- a. Location: Where scheduled in the Room Finish Schedule or located on the drawings and in all thin-set tile locations having neither waterproofing nor sound isolation scheduled.
- 2. TCNA Installation Method F122 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over concrete subfloor; Latex-Portland Cement Grout.
 - a. Location: As scheduled in the Room Finish Schedule or located on the drawings.
- B. Floors, Elevator Car, Cementitious Backer Unit Substrate:
 - 1. TCNA Installation Method F144 (Crack Isolation Membrane; Full Coverage): Epoxy mortar over crack isolation membrane over cementitious backer unit; Commercial Epoxy Grout.
- C. Walls and Floors, Gauged Porcelain Tile Panels and Slabs:
 - 1. ANSI A 108.19 Interior Installation of Gauged Porcelain Tile and Gauged Porcelain Tile Panels/Slabs (Material and Installation Standards), 2017 or Current Version.
- D. Walls, Gypsum Board Substrate:
 - 1. TCNA Installation Method W243: Thin-set Latex-Portland cement mortar over coated-glass-mat gypsum board; Latex-Portland Cement Grout.

END OF SECTION

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SECTION 095113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Acoustical lay-in ceiling panels, exposed metal suspension systems, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.
- C. Samples for Verification Purposes: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. Acoustical Panels: Set of 6 insquare samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 12 inlong samples of each type, finish, and color.
 - 3. Clips: Full size clips.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.

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- e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
- 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 - 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 - 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 - 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units.

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1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. Chicago Metallic / Rockfon.
 - 4. Lindner Ceiling Systems.
 - 5. OWA USA.
 - 6. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
 - 1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer if both are offered by the manufacturer.

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2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 450 or less.
- C. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.

2.4 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.
 - 1. Selections: As scheduled or as indicated in Design Selections.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times design load indicated in ASTM C 635/C 635, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Cast-in-place anchors, designed for attachment to concrete.
 - b. Post-installed expansion anchors.
 - c. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC1 service condition.
 - 2. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

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- a. Manufacturers:
 - 1) Construction Materials, Inc.
 - 2) Heckman Building Products, Inc.
 - 3) Hilti Corp.
 - 4) ITW Ramset/Red Head.
 - 5) Powers Fasteners.
 - 6) Simpson Strong Tie Anchor Systems.
- 3. For post-tensioned concrete, anchors shall not exceed 1 in embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Wire:
 - a. Zinc-Coated Carbon-Steel Wire: ASTM A 641 / A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic; for use at MRI and related spaces.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635/C 635M, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.
- E. Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces and complying with requirements of authorities having jurisdiction or as recommended by manufacturer.
- F. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.
- G. Clean-Room Sealant for Concealed Joints: Manufacturer's standard nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
 - 1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
 - 4. Round Column Angle Molding:

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- a. Basis of Design: Fry Reglet Corporation; "Column Collar", extruded aluminum with PVC spacer, size as required for column diameter, finish to match suspension system.
- B. Specialty Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 2. Basis of Design (Product Standard) Manufacturer and Product: Armstrong World Industries, Inc.; Axiom series, with manufacturer's 30 year warranty.
 - a. Classic Trim.
 - b. Soft Edge.
 - c. Vector.
 - d. Knife Edge Trim.
 - e. Drywall Trim.
 - f. Transitions.
 - g. Glazing Channel Trim.
 - h. Building Perimeter System.

2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653 / A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16 in wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) type.
 - 3. Face Design: Flush face.
 - 4. Cap Material: Steel sheet.
 - 5. Cap Finish: Painted white, unless indicated otherwise.
- B. Wide-Face, Capped, Double-Web Aluminum Suspension System: Main and cross runners roll formed from cold-rolled aluminum sheet, with prefinished 15/16 in wide aluminum caps on flanges.
 - 1. Structural Classification: Light-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) type.
 - 3. Face Design: Flush face.
 - 4. Cap Material: Aluminum sheet.
 - 5. Cap Finish: Painted white, unless indicated otherwise.
 - 6. Manufacturers and Products:
 - a. Armstrong World Industries, Inc.; AL Prelude Plus XL.
 - b. Chicago Metallic / Rockfon.; 830 All Aluminum.
 - c. USG Interiors, Inc.; Donn AX.

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2.8 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Division 7 Section Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.4 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

- A. Installation Quality Standard: Install acoustical ceiling panels according the following standards, seismic design requirements and manufacturer's written instructions.
1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation, or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system.

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2. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, power-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
 6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Space hangers not more than 48 in on center along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 in (200 mm) from ends of each member.
 9. Do not connect or suspend any ceiling components from ducts, pipes or conduit.
 10. Do not make local kinks or bends in hanger wires as a means of leveling.
- C. Install edge moldings and trim at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 in on center and not more than 3 in from ends, leveling with ceiling suspension system to a tolerance of 1/8 in per 12 ft. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 4. Provide control joints where joints occur in abutting surfaces.
 5. Hold tees in place with concealed clips.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
1. Space steel main runners at 48 in on center.
 2. Space aluminum main runners at 24 in on center.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

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4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Clean Room Installations: Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

3.5 PROTECTION

- A. Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 095135

SNAP-IN METAL PAN CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this Section includes snap-in metal pan ceilings with concealed suspension system and supplementary items necessary to complete their installation.
- B. Refer to Division 9 Section "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
- C. Refer to Division 9 Section "Linear Metal Ceilings" for horizontal slat type metal ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Performance Data: For exterior ceilings indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.
 - 2. Method of attaching hangers to building structure.
 - 3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 - 4. Ceiling perimeter and penetrations through ceiling; trim and moldings.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Pan: Full-size samples of each type, finish, color, pattern, and texture.
 - 2. Exposed Moldings and Trim: Set of 12 inlong Samples of each type, finish, and color.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide snap-in metal pan ceilings with surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

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- B. Mockup: Build mockup to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Unless otherwise indicated, construct mockup a minimum of 50 square feet.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver snap-in metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install snap-in metal pan ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 COORDINATION

- A. Coordinate layout and installation of snap-in metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
 - 1. American Decorative Ceilings.
 - 2. Capaul Corporation.
 - 3. Chicago Metallic Corporation.
 - 4. Hunter Douglas Architectural Products.
 - 5. Simplex Ceilings.
 - 6. Steel Ceilings, Inc.

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- C. For manufacturers not listed, submit as substitution according to the Conditions of the Contract and Division 1 Specification Sections.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain each set of snap-in metal pans and concealed suspension systems from one source with resources to provide products of consistent quality in appearance, physical properties, and performance.

2.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide exterior snap-in metal pan ceilings capable of withstanding exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - 1. Wind Load: Uniform pressure acting inward or outward as indicated on Drawing "Building Summary".
- B. Thermal Movements: Provide exterior snap-in metal pan ceilings that allow for thermal movements resulting from 100 deg. F. maximum temperature change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- C. Seismic Performance: Provide snap-in metal pan ceilings designed and installed to withstand the effects of earthquake motions according to requirements of authorities having jurisdiction.

2.4 CEILING PAN MATERIAL

- A. Sheet Metal Characteristics: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - 1. Aluminum Sheet: Minimum 0.032 in roll-formed aluminum sheet, complying with ASTM B 209; alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - 2. Steel Sheet: Minimum 0.0239 in commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.
 - a. Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 591, 40Zcoating; surface treatment as recommended by finish manufacturer for type of use and finish indicated.
 - 3. Stainless-Steel Sheet: Minimum 0.0187 in stainless steel sheet complying with ASTM A 240, Type 304.
- B. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated with dimples or continuous beads on flanges for snap-in engagement with concealed suspension system.

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1. Pan Pattern: Smooth flat without perforations.
 2. Pan Pattern: Perforated with small holes regularly spaced, with uniform perforations of dimension, holes per square foot, and percent open area as selected from manufacturer's full range.
 3. Pan Edge Detail: Square.
 4. Pan Size: 24 in by 24 in.
 5. Scoring: Score pans at intervals to appear as 12 in by 12 in ceiling units.
 6. Pan Face Finish:
 - a. Painted in color selected from manufacturer's full range.
 - b. Bright-reflective finish selected from manufacturer's full range.
 - c. As scheduled in Division 1 Section "Design Selections".
- C. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of pans, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
1. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - a. Type and Thickness: Mineral wool or glass fiber; 1 in.
 - b. Density: 1 lb/cu. ft.
 - c. Plastic Sheet Thickness and Color: Not less than 0.003 in flat black.

2.5 METAL SUSPENSION SYSTEMS

- A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Suspension Systems: Provide systems complete with snap-in carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
- C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Cast-in-place anchors.
 - b. Type: Postinstalled expansion anchors.

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- c. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC service condition (mild).
- 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency. Power – actuated fasteners are not allowed in post-tensioned structures.
- D. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure snap-in metal pans in place, to molding and trim at perimeter and to resist wind-uplift forces.
- E. Exposed Metal Edge Moldings and Trim: Provide exposed members required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching snap-in metal pans, unless otherwise indicated.
 - 1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.
- F. Direct-Hung System: Designed to support metal pans that snap into main runners, consisting of main runners supported by hangers attached directly to building structure, and complying with the following requirements:
 - 1. Hangers: Angles or channels, as standard with ceiling system manufacturer, formed from same metal as main runners.
 - 2. Main Runners: Rolled aluminum sheet; alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209.
- G. Indirect –Hung System: Designed to support metal pans that snap into main runners, consisting of main runners connected to carrying channels that are attached by hangers to building structure, and complying with the following requirements:
 - 1. Hangers: Type and metal standard with ceiling system manufacturer, sized to comply with structural classification required.
 - a. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
 - b. Size: Select wire diameter so its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 in diameter wire.
 - 2. Angle Hangers: Angles with legs not less than 7/8 in wide; formed from 0.04 in thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16 in diameter bolts.
 - 3. Main Runners: Formed from the following metal:
 - a. Aluminum Sheet: Alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209.

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- b. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, with not less than 80Z zinc coating.
 - c. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher leveled, with cold-rolled mill finish.
4. Carrying Channels: Cold-rolled steel, not less than 0.0598 innominal thickness of base (uncoated) metal and 7/16 inwide flanges.
- a. Interior: Protected with rust-inhibitive paint, 1-1/2 indeep and weighing 475 lb/1000 feet.
 - b. Exterior: Hot-dip galvanized according to ASTM A 653, G60coating designation, 2 in deep and weighing 590 lb/1000 feet
5. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
6. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure snap-in metal pans in place.
7. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60coating designation; size and profile as required to withstand wind load.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- C. Clear Mirror-Anodized Finish: AA-M21C12A212 (Mechanical Finish: smooth specular; Chemical Finish: chemically cleaned; Anodic Coating: protective and decorative, clear film of 0.2-mil minimum thickness.

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- D. Color-Coated Finish: Manufacturer's standard powder-coat or baked enamel paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 - 1. Color: Match Architect's sample.
 - 2. Color: As selected by Architect from manufacturer's standard choices for color and gloss.
 - 3. Color: As scheduled in Division 1 Sections "Design Selections".
- E. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

2.8 STEEL SHEET FINISHES

- A. Color-Coated Finish: Manufacturer's standard powder-coat or baked enamel paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 - 1. Color: Match Architect's sample.
 - 2. Color: As selected by Architect from manufacturer's standard choices for color and gloss.
 - 3. Color: As scheduled in Division 1 Sections "Design Selections".

2.9 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- D. No. 4 finish, Satin, Directional Polish.
- E. No. 7 finish, Satin, Reflective, Directional Polish.
- F. No. 8 finish, Mirrorlike, Reflective, Nondirectional Polish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates surfaces to receive metal pan ceilings and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of existing conditions.

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3.2 PREPARATION

- A. Measure each ceiling area and establish layout of snap-in metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install snap-in metal pan ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure angle, channel, and rod hangers to structure, including compression struts by attaching to inserts, eye screws, or other devices that are secure and appropriate both for structure to which hangers are attached and type of hanger involved. Install hangers and struts in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or steel deck. Do not attach hangers to steel deck tabs.
 - 7. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 8. Space hangers not more than 48 in o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 in from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of snap-in metal pans.
 - 1. Screw attach moldings to substrate at intervals not more than 16 in o.c. and not more than 3 in from ends, leveling with ceiling suspension system to a tolerance of 1/8 in in 12 ft. Miter corners accurately and connect securely.

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2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 - F. Cut snap-in metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
 - G. Install snap-in metal pans in coordination with suspension system and exposed moldings and trim.
 1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated.
 2. Fit adjoining units to form flush, tight joints.

3.4 CLEANING

- A. Clean exposed surfaces of snap-in metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION

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SECTION 095423

LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this Section includes strip, decorative linear metal pan ceilings with concealed suspension system and supplementary items necessary to complete their installation.
- B. Refer to Division 9 Section "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
- C. Refer to Division 9 Section "Snap-in Metal Pan Ceilings" for flat rectangular metal ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Performance Data: For exterior ceilings indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Linear pattern.
 - 2. Joint pattern.
 - 3. Ceiling suspension members.
 - 4. Method of attaching hangers to building structure.
 - 5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 - 6. Ceiling perimeter and penetrations through ceiling; trim and moldings.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Linear Metal Pan: Set of 12 inlong Samples of each type and color and a 12 inlong spliced section.
 - 2. Suspension System Members: 12 inlong Sample of each type.
 - 3. Exposed Molding and Trim: Set of 12 inlong Samples of each type, finish, and color.
 - 4. Filler Strips: Set of 12 inlong Samples of each type, finish, and color.
 - 5. Sound Absorber: 12 in long.
 - 6. End Cap: Full size.

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1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide linear metal ceilings with surface-burning characteristics complying with ASTM E 1264 for Class A materials, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Mockup: Build mockup to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Unless otherwise indicated, construct mock-up a minimum of 50 square feet.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install linear metal ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 COORDINATION

- A. Coordinate layout and installation of linear metal pans and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. Aluminum Ceiling System

- a. Longboard; Endura Linear
- b. American Decorative Ceilings.
- c. Ceilings Plus.
- d. Chicago Metallic Corporation.
- e. Hunter Douglas Architectural Products.
- f. Simplex Ceilings.
- g. USG Interiors.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain each set of linear metal pans and suspension systems from one source with resources to provide products of consistent quality in appearance, physical properties, and performance.

2.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide exterior linear metal ceilings capable of withstanding exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - 1. Wind Load: Uniform pressure acting inward or outward as indicated on Drawing "Building Summary".
- B. Thermal Movements: Provide exterior linear metal ceilings that allow for thermal movements resulting from 100 def. F. maximum temperature change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- C. Seismic Performance: Provide linear metal ceilings designed and installed to withstand the effects of earthquake motions according to requirements of authorities having jurisdiction.

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2.4 CEILING PAN MATERIAL

- A. Sheet Metal Characteristics: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - 1. Aluminum Sheet: Minimum 0.024 inch thick roll-formed aluminum sheet, complying with ASTM B 209 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.
- C. Pan Splices: Construction same as pans, in lengths 8 in to 12 in; with manufacturer's standard finish.
- D. End Caps: Manufacturer's standard material; fabricated to fit and conceal exposed ends of pans.
- E. Filler Strips: Manufacturer's standard material; fabricated to uninterruptedly close voids between pans.
- F. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.
- G. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
 - 1. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - a. Mineral-Fiber Type and Thickness: Mineral wool or Glass fiber; 1 in thick.
 - b. Mineral-Fiber Density: 1 lb/cu. ft..
 - c. Plastic Sheet Thickness and Color: Not less than 0.003 in flat black.

2.5 METAL SUSPENSION SYSTEMS

- A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
- C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

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1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Cast-in-place anchors.
 - b. Type: Postinstalled expansion anchors.
 - c. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC service condition (mild).
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency. Power-actuated fasteners are not allowed in post-tensioned structures.
- D. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed from 0.04 inch thick, galvanized steel sheet complying with ASTM A 653, G90 coating designation; with bolted connections and 5/16 inch diameter bolts.
- F. Carriers: Factory finished with matte-black baked finish.
1. Main Carriers: Aluminum, not less than 0.24 inch rolled sheet, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209.
 2. Main Carriers: Steel, not less than 0.0209 inch nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C 635.
 - a. Electrolytic Zinc-Coated Steel: ASTM A 591, not less than 80Z zinc coating.
 3. Flexible Radial Carriers: Manufacturer's standard radial carriers.
 4. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.
- G. Carrier Splices: Same metal, profile, and finish as indicated for carriers.
- H. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.
- I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

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- J. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653, G60coating designation; size and profile as required to withstand wind load.
- K. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.
- L. Edge Moldings and Trim: Provide exposed members as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic, unless otherwise indicated.

2.6 METAL CEILING PAN

- A. Pan Pattern: Perforated with small holes, regular spaced, with hole pattern and size as selected from manufacturer's full range.
- B. Pan Edge Detail: Refer to Design Selections.
- C. Linear Module Width and Pan Face Width:
 - 1. Refer to Design Selections
- D. Pan Depth: Manufacturer's standard but not less than 5/8 in deep.
- E. Pan Face Finish:
 - 1. As schedule in "Design Selections".
- F. End Cap, Finish of Exposed Portions: To match pan.
- G. Filler Strip Design: Refer to Design Selections.
- H. Filler Strip, Finish of Exposed Portions: To match pan.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Clear Anodized Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- C. Clear Mirror-Anodized Finish: AA-M21C12A212 (Mechanical Finish: smooth specular; Chemical Finish: chemically cleaned; Anodic Coating: Protective and decorative, clear film of 0.2- mil minimum thickness.
- D. Color-Coated Finish: Manufacturer's standard powder-coat or baked enamel paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 - 1. Color: Match Architect's sample.
 - 2. Color: As selected by Architect from manufacturer's standard choices for color and gloss.
 - 3. Color: As scheduled in Division 1 Sections "Design Selections".
- E. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.
 - 2. Color: Match Architect's sample.
 - 3. Color: As selected by Architect from manufacturer's standard choices for color and gloss.
 - 4. Color: As scheduled in Division 1 Sections "Design Selections".
- F. Bright- Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

2.9 STEEL SHEET FINISHES

- A. Color-Coated Finish: Manufacturer's standard powder-coat or baked enamel finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 - 1. Color: Match Architect's sample.
 - 2. Color: As selected by Architect from manufacturer's standard choices for color and gloss.
 - 3. Color: As scheduled in Division 1 Sections "Design Selections".

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2.10 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- D. No. 4 finish, Satin, Directional Polish.
- E. No. 7 finish, Satin, Reflective, Directional Polish.
- F. No. 8 finish, Mirrorlike, Reflective, Nondirectional Polish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates surfaces to receive linear metal ceilings and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of existing conditions.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of linear metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

- A. General: Install linear metal ceilings to comply with ASTM C 636 and seismic requirement indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

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4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure angle, channel, and rod hangers to structure, including compression struts by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers and struts in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or steel deck. Do not attach hangers to steel deck tabs.
 7. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 8. Space hangers not more than 48 in.o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 in from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
1. Screw attach moldings to substrate at intervals not more than 16 in.o.c. and not more than 3 in from ends, leveling with ceiling suspension system to a tolerance of 1/8 in in 12 ft. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- G. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated.
 2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 3. Install pans with butt joints using internal pan splices and uniform joint configuration aligned at every other pan length.
 4. Where metal pan ends are visible, install end caps unless trim is indicated.
 5. Install filler strips where indicated.
 6. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.

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3.4 CLEANING

- A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION

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SECTION 096115

CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required of this Section includes sealing of exposed interior concrete floors as a finished floor material along with supplementary items necessary to complete work required for their installation.
- B. Related Section:
 - 1. Division 03 Section "Concrete Finishing" for other floor sealers and curing agents not used as interior finish flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, instructions for evaluating, preparing, and treating the substrate, installation instructions, and recommendations for maintenance.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit to include in manual specified in Division 01 Section "Closeout Procedures". Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of coatings.

1.4 QUALITY ASSURANCE

- A. Mockups: Provide a full-coat benchmark finish sample. Select one room or surface, not less than 100 square feet, to represent surfaces and conditions for application of coating and substrate. Apply sealer materials according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. After finish is accepted, the room or surface will be used to evaluate coatings of remainder of work.

1.5 PROJECT CONDITIONS

- A. Environmental Conditions: Apply sealer materials within the range of ambient and substrate temperatures recommended by the manufacturer. Do not apply to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.

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1.6 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 SEALING COMPOUND

- A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Manufacturers and Products:

- a. Burke by Edoco; Cureseal 1315 WB.
- b. ChemMasters; Polyseal WB.
- c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
- d. Euclid Chemical Company (The); Super Diamond Clear VOX.
- e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
- f. Lambert Corporation; UV Safe Seal.
- g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
- h. Meadows, W. R., Inc.; Vocomp-30.
- i. Metalcrete Industries; Metcure 30.
- j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
- k. Tamms Industries, Inc.; LusterSeal WB 300.
- l. Unitex; Hydro Seal 25.
- m. US Mix Products Company; US Spec Radiance UV-25.
- n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
 - 1. Do not proceed with application until after the minimum concrete curing period recommended by coating manufacturer.
 - 2. Verify substrate is visibly dry and free of moisture.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 SURFACE PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Mask off adjoining surfaces not being sealed and close off drains and other penetrations to prevent spillage and migration of liquids.
- C. Remove grease, oil, paints, or other penetrating contaminants from concrete. Remove concrete fins, ridges, or other projections. Remove material to provide a sound surface free of laitance, glaze, or efflorescence. Remove remaining loose material and clean surfaces according to ASTM D 4258.

3.4 APPLICATION

- A. General: Apply materials according to respective manufacturer's instructions, approved submittals and Contract Documents.
- B. Sealer: Apply by spray, roller, or other applicators according to manufacturer's recommended coverage rate.

END OF SECTION

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SECTION 096116

LIQUID FLOOR HARDENER

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required of this Section includes a penetrating liquid floor hardener and sealer applied to interior concrete surfaces along with supplementary items necessary to complete work required for their installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit to include in manual specified in Division 01 Section "Closeout Procedures". Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of coatings.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 2 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 2 years of experience installing products and systems similar to scope of this Project.
- B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

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2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Coverage of warranty includes but is not limited to the following: Degradation of dust proofing capabilities from abrasion.
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 LIQUID FLOOR HARDENER

- A. Penetrating Liquid Floor Hardener and Sealer: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, densifies, and seals concrete surfaces.
 1. Manufacturers and Products:
 - a. Curecrete Distribution, Inc.; Ashford Formula
 - b. Euclid Chemical Company (The); Euco Diamond Hard

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- c. L&M Construction Chemicals, Inc.; Seal Hard
- d. Sika Corp.; Scofield Formula One Lithium Densifier MP.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION, LIQUID FLOOR HARDENER

- A. Liquid Floor Hardener: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions including preparation, application, precautions, limitations, and compatibility with other surface conditions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days old unless recommended by manufacturer in written literature describing application procedure, but only with prior approval of Architect.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
 - 4. Locations:
 - a. Where indicated on room finish schedule or on drawings, including exposed concrete floors noted or scheduled as having "sealed concrete" or similar wording.

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3.5 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

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SECTION 096500

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Resilient flooring products and systems and supplementary items necessary for installation.
 - 1. Resilient tile flooring.
 - 2. Resilient sheet flooring.
 - 3. Luxury vinyl tile flooring.
- B. Related Section:
 - 1. Resilient wall base, reducer strips, and other accessories installed with resilient flooring are specified in Division 09 Section "Resilient Base and Accessories".

1.2 ALLOWANCES

- A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, recommended adhesives, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings for Special Patterns: Show layout and details of special patterns for resilient flooring.
- C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.
- D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in sample of each different color and pattern of resilient flooring product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.
 - 1. Heat-Welded Sheet Flooring: For heat-welding bead, manufacturer's standard-size samples, but not less than 9 in long, of each color specified.
 - 2. Seam Samples for Sheet Flooring: For each color and pattern of resilient sheet flooring product required; with seam running lengthwise and in center of 6 in by 9 in sample applied to a rigid backing and prepared by installer for this Project.

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1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.
 - 1. Product Compatibility: On installations incorporating products provided by more than one manufacturer, each manufacturer's certificate shall include specific reference to and approval of the other manufacturer's products.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Procedures". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

- A. Slip Resistance: Provide products identical to those tested for slip resistance per ASTM D 2047 with a static coefficient of friction not less than 0.6 for level surfaces and 0.8 for ramped surfaces.
- B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. LVT manufacturer's qualified technical representative for each product specified
 - e. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.

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- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store flooring products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 70 deg F () or more than 85 deg F ().
 - 1. Resilient Tile Flooring: Store floor tiles on flat surfaces.
 - 2. Resilient Sheet Flooring: Store sheet flooring rolls upright.

1.9 PROJECT CONDITIONS

- A. Unless otherwise approved in writing by the manufacturer, do not begin flooring installation unless permanent building HVAC system is operational and capable of maintaining relative humidity and temperature of not less than 70 deg F () or more than 85 deg F () for at least 48 hours before installation, during installation, and after installation.
 - 1. Maintain relative humidity of not more than the designed relative humidity for spaces to receive flooring.
- B. Maintain flooring products prior to installation at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended by manufacturer.
- D. Install flooring products after other finishing operations, including painting, have been completed.
- E. Do not install flooring over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY FOR LUXURY VINYL TILE

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

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1. Guestrooms Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 20 years from date of Substantial Completion.
 2. Public Areas Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.
- B. Installers Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installers standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Vinyl Flooring:
 - a. AB; American Biltrite
 - b. AVA
 - c. Interface
 - d. Altro Group.
 - e. Armstrong World Industries, Inc.
 - f. Congoleum Corporation.
 - g. Forbo Flooring, Inc.
 - h. Gerflor, Architectural Floor Systems, Inc.
 - i. Lonseal, Inc.
 - j. Mannington Mills, Inc.
 - k. Tarkett, Inc.
 2. Rubber Flooring
 - a. AB; American Biltrite.
 - b. Flexco.
 - c. Nora Systems, inc.
 - d. PRF USA, Inc.
 - e. R.C.A. Rubber Company (The).
 - f. VPI, LLC, Floor Products Division.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
1. Selections: As scheduled or as indicated in Design Selections.

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT TILE FLOORING MATERIALS

- A. Solid Vinyl Floor Tile Standard: ASTM F 1700, Class 1, monolithic vinyl tile, unless otherwise indicated.
 - 1. Size: 12 in by 12 in by 0.125 in.

2.4 RESILIENT SHEET FLOORING MATERIALS

- A. Rubber Sheet Floor Coverings: ASTM F 1859, Type I (homogeneous rubber sheet).
- B. Sheet Flooring Thickness: 0.125 in .
- C. Heat-Welding Seam Bead: Solid-strand product of floor covering manufacturer for heat welding seams.
 - 1. Selections: As scheduled or as indicated in Design Selections.

2.5 LUXURY VINYL TILE FLOORING MATERIALS

- A. LVT Class: ASTM F1700 Composition of Material: Class III Printed Film Vinyl Plank or Tile, Type B (Embossed).
 - 1. Size and Squareness: ASTM F 2055, plus or minus 0.016-inch per linear foot in size and less than 0.010-inch for squareness.
 - 2. Overall Thickness: 0.1875-inch (4 mm and thicker).
 - a. Wear Layer Thickness: ASTM F386, plus or minus 0.020-inch ().
 - 3. Backing Class: Commercial Grade.
 - 4. Dimensional Stability: ASTM F2199, less than 0.020-inch per linear foot.
 - 5. Residual Indentation: ASTM 1914, less than 8 percent total thickness.
 - 6. Flexibility: ASTM F137, less than 1.0-inch diameter, no cracks or breaks.
 - 7. Chemical Resistance: ASTM F 925, no more than slight change in surface dulling, attack or color change.
 - 8. Heat resistance: ASTM F1514, less than 8 color change.
 - 9. Light Resistance: ASTM F1515, less than 8 color change.
 - 10. Static Load Limit: ASTM F 970, 750 psi minimum.

2.6 SOUND REDUCTION SHEET MEMBRANE UNDERLAYMENTS FOR LUXURY VINYL TILE

- A. General: Manufacturer's standard product complying with Floor Assembly Sound Reduction Performance Requirements. Include primer, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products as required by underlayment manufacturer and recommended by the flooring manufacturer for this application.

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1. Sound reduction underlayment may be a separate component as recommended by the LVT flooring manufacturer and compatible with the LVT flooring material or the underlayment may be a composite component integral to the LVT flooring material.

2.7 ACCESSORY MATERIALS

- A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based formulation provided or approved by flooring manufacturer for products and applications indicated.
- C. Adhesives: Water-resistant type recommended by flooring manufacturer suitable for products, applications, and substrate conditions indicated.
 1. Product Compatibility: Provide Manufacturer's written recommendation for each product within an assembly. On installations incorporating products provided by more than one manufacturer, each manufacturer shall approve in writing all adhesives that are in contact with their products.
- D. Concrete Moisture Barrier Floor Treatment:
 1. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.
 - a. Basis of Design (Product Standard): Bostik, Inc.; D-250.
 2. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.
 - a. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

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1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving resilient flooring.
 2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
 3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Unless concrete has been water-cured, then proceed with the following:
 - a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.
 4. Determine adhesion and dryness characteristics by performing the following tests as recommended by flooring manufacturer.
 5. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydration paper is applied. Proceed with installation only after concrete substrates pass testing.
 6. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.
 - a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
 - b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.
 7. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture floor treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.
- C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

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- D. Broom and vacuum clean substrates to be covered immediately before flooring product installation. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF RESILIENT FLOORING, GENERAL

- A. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.
- E. Adhere flooring to substrates using a full spread of adhesive applied to substrate to comply with flooring manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- F. Hand-roll flooring in both directions from center out to embed flooring in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press flooring firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF RESILIENT TILE FLOORING

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles square with room axis, unless otherwise indicated.
 - 2. Lay tiles with grain running in one direction, unless otherwise indicated.

3.6 INSTALLATION OF RESILIENT SHEET FLOORING

- A. Unroll sheet flooring and allow it to stabilize before cutting and fitting, if recommended in writing by manufacturer.
- B. Lay out sheet flooring to comply with the following requirements:

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1. Maintain uniformity of sheet flooring direction.
 2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 in away from parallel joints in flooring substrates.
 3. Match edges of sheet flooring for color shading and pattern at seams according to manufacturer's written recommendations.
 4. Avoid cross seams.
- C. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into seamless flooring. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining flooring surfaces.

3.7 INSTALLATION OF LUXURY VINYL FLOORING, GENERAL

- A. Apply concrete slab primer, if recommended by LVT flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.
- B. Scribe, cut, and fit flooring and underlayment to allow for thermal movement to gap to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.
- E. Where floating installation is indicated or required, maintain a minimum 5/16 inch expansion around perimeter of the room.
- F. Where adhered installation is indicated or required, adhere flooring components to substrates using a full spread of adhesive applied to substrate to comply with flooring manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- G. Hand-roll flooring in both directions from center out to embed flooring in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press flooring firmly in place with flat-bladed instruments.

3.8 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing flooring products:
 1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by flooring manufacturer.
 2. Sweep or vacuum floor thoroughly.
 3. Do not wash floor until after time period recommended by flooring manufacturer.

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4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by flooring manufacturer.
1. Cover products installed on floor surfaces with undyed, untreated building paper until just prior to Substantial Completion.
 2. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

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SECTION 096513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Resilient wall base, resilient flooring accessories, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.
- C. Samples for Verification Purposes: In manufacturer's standard size, but not less than 12 in sample of each different color and pattern of resilient product specified, showing the full range of variations expected in these characteristics.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by product manufacturer, but not less than 50 deg F or more than 90 deg F.

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1.7 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F or more than 85 deg F in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless otherwise recommended by product manufacturer.
- B. Maintain resilient products prior to installation at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during installation and for time period after installation recommended by manufacturer.
- D. Install resilient products after other finishing operations, including painting, have been completed.
- E. Resilient Stair Accessories: Do not install resilient stair accessories over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by resilient accessory manufacturer's recommended tests. Refer to "Examination" Article for requirements.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Armstrong World Industries, Inc.
 - 2. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
 - 3. Endura Rubber Flooring; Division of Burke Industries, Inc.
 - 4. Flexco, Inc.
 - 5. Johnsonite.
 - 6. Mondo Rubber International, Inc.
 - 7. Musson, R. C. Rubber Co.
 - 8. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
 - 9. Roppe Corporation, USA.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Selections: As scheduled or as indicated in Design Selections.

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT MATERIALS

A. Rubber Wall Base:

1. Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic), Group 1 and 2.
2. Thickness: Nominal 1/8 in.
3. Lengths: Provide longest length(s) available per manufacturer. Provide coils if available in profile(s) indicated.
4. Outside and Inside Corners:
 - a. Job-formed.

B. Resilient Molding Accessories:

1. Carpeting Accessories: Carpet cove cap, carpet step-off, carpet reducer, carpet edge bar.
2. Resilient Flooring Accessories: Reducer strip and others as required.
3. Material: Rubber.
4. Lengths: Provide longest length(s) available per manufacturer. Provide coils if available in profile(s) indicated.
5. Color and finish as selected by Architect from manufacturer's standard colors.

C. Resilient Stair Accessories:

1. Standard: ASTM F 2169, Type TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic), Class 1 and 2.
2. Rubber Stair Treads:
 - a. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
 - b. Nosing Height: 1-1/2 in to 2 in.
 - c. Thickness: 1/4 in at nosing, tapered to 1/8 in.
 - d. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
 - e. Manufacturing Method: Group 1, tread with embedded abrasive strips; and Group 2, tread with contrasting color for the visually impaired; as selected by Architect.
 - f. Exit Stairs at High Rise Structures: Provide embedded photoluminescent abrasive strips, minimum 1 inch (25 mm) wide by full width of stair nosing, incorporated into stair nosings.
3. Risers: Smooth, flat, coved-toe, 1/4 in thick by 7 in high by length matching treads produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
4. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

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2.4 ACCESSORY MATERIALS

- A. Adhesives: Water-resistant type recommended by product manufacturer suitable for products, applications, and substrate conditions indicated.
- B. Resilient Stair Accessory Materials:
 - 1. Concrete Slab Primer: Non-staining type as recommended by product manufacturer.
 - 2. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based formulation provided or approved by product manufacturer for products and applications indicated.
 - 3. Stair Tread-Nose Filler: Two-part epoxy compound recommended by rubber stair tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare according to ASTM F 710.
 - 1. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing the following tests as recommended by resilient accessory manufacturer.
 - 2. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving resilient flooring.
 - 3. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 4. Alkalinity and Adhesion Testing: Perform tests recommended by resilient accessory manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydron paper is applied. Proceed with installation only after concrete substrates pass testing.
 - 5. Moisture Testing: Perform one or both of the following tests as recommended by resilient accessory manufacturer. Perform 3 moisture tests for first 1000 sf of concrete substrate scheduled to receive resilient stair accessories. Proceed with installation only after concrete substrates pass testing.
 - a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sf in 24 hours.
 - b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Resilient Stair Accessories:
1. Remove substrate coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
 3. Broom and vacuum clean substrates to be covered by resilient stair accessories immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.
 4. Apply concrete slab primer, if recommended by product manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.4 INSTALLATION OF RESILIENT WALL BASE

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. Masonry Wall Surfaces: On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Job-Formed Corners: Use straight pieces of maximum lengths possible.
1. Outside Corners: Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

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2. Inside Corners: Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 INSTALLATION OF RESILIENT FLOORING ACCESSORIES

A. Resilient Stair Accessories:

1. Use stair tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by manufacturer.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by manufacturer.
4. Damp-mop surfaces to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

END OF SECTION

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SECTION 096623

THIN-SET TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Thin-set epoxy-resin terrazzo flooring products and systems and supplementary items necessary for installation.

1.2 ALLOWANCES

- A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Include the following:
 - 1. Divider, control-, and expansion-joint strips.
 - 2. Base and border strips.
 - 3. Precast terrazzo jointing and edge configurations.
 - 4. Terrazzo patterns.
- C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.
- D. Samples for Verification Purposes: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:
 - 1. Terrazzo: 12 in square samples.
 - 2. Accessories: 6 in long samples of each exposed strip item required.
 - 3. Precast Terrazzo: 6 in square samples.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

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- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals. Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance. Include product data for flooring care products used or recommended by installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
4. NTMA Membership: Installer shall be a contractor member of NTMA.

- B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
 - a. Architect.

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- b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- C. Close spaces to traffic during epoxy terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- D. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
- E. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Crossfield Products Corp., Dex-O-Tex Division; Cheminert Terrazzo.
 2. Key Resin Co.; Key Epoxy Terrazzo #108.
 3. Sherwin-Williams - General Polymers; Epoxy Terrazzo #1100 System.
 4. Sika Corporation; SikaFloor Terrazzo Resin.
 5. TEC Specialty Construction Brands, Inc.; Tuff-Lite Epoxy Terrazzo.
 6. Terrazzo & Marble Supply Co.; Terroxy Resin System.

2.2 MATERIALS, GENERAL

- A. Single Source Limitations for Aggregates: Obtain each color, grade, type, and variety of aggregate from one source with resources to provide materials of consistent quality in appearance and physical properties. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.4 THIN-SET RESINOUS TERRAZZO MATERIALS

- A. Flexible Reinforcing Membrane: Manufacturer's recommended resinous membrane for substrate crack preparation and reflective crack reduction.
- B. Primer: Manufacturer's product recommended for substrate and use indicated.
- C. Epoxy Resin: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
1. Physical Properties without Aggregates:
 - a. Hardness: 60 to 85 per ASTM D 2240, Shore D.
 - b. Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2 in specimen made using a "C" die per ASTM D 412.
 - c. Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
 - d. Chemical Resistance: No deleterious effects by contaminants listed below after 7 day immersion at room temperature per ASTM D 1308.
 - 1) Distilled water.
 - 2) Mineral water.
 - 3) Isopropanol.

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- 4) Ethanol.
 - 5) 0.025 percent detergent solution.
 - 6) 1.0 percent soap solution.
 - 7) 10 percent sodium hydroxide.
 - 8) 10 percent hydrochloric acid.
 - 9) 30 percent sulfuric acid.
 - 10) 5 percent acetic acid.
2. Physical Properties with Aggregates: For resin blended with Georgia White marble, ground, grouted, and cured per requirements in NTMA's "Guide Specification for Epoxy Terrazzo," comply with the following:
- a. Flammability: Self-extinguishing, maximum extent of burning 0.25 in per ASTM D 635.
 - b. Thermal Coefficient of Linear Expansion: 0.0025 in/in per deg F for temperature range of minus 12 to 140 deg F per ASTM D 696.
- D. Aggregate: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
1. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 2. 24-Hour Absorption Rate: Less than 0.75 percent.
 3. Dust Content: Less than 1.0 percent by weight.
- E. Finishing Grout: Resin based.
- F. Terrazzo Mix: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip proportions and mixing.
1. Color and Pattern: As scheduled or as indicated in Design Selections.

2.5 STRIP MATERIALS

- A. Heavy-Top Divider Strips: L-type angle, 3/8 in deep.
1. Refer To drawings for Interior Design Selections
 2. Bottom-Section Material: Match top section material.
 3. Top-Section Material: As scheduled or as indicated in Design Selections.
 4. Top-Section Width: As scheduled or as indicated in Design Selections.
- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.
- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
1. Base-bead strips for exposed top edge of terrazzo base.
 2. Edge-bead strips for exposed edges of terrazzo.

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2.6 ACCESSORY MATERIALS

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
- B. Anchoring Devices:
 - 1. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
 - 2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.
- E. Seal Coat: Slip- and stain-resistant surface-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
- F. Joint Sealants: Refer To drawings for Interior Design Selections.

2.7 PRECAST EPOXY-RESIN TERRAZZO

- A. Precast Terrazzo Base Units: Minimum 3/4 in thick, resinous terrazzo units cast in maximum lengths possible, but not less than 36 in.
 - 1. Type: As indicated on drawings.
 - 2. Type: As scheduled or as indicated in Design Selections.
 - 3. Top Edge (Exposed): As scheduled or as indicated in Design Selections.
 - 4. Metal Toe Strip for Coved-Toe Bases: Match divider strips.
 - 5. Outside Corner Units: With finished returned edges at outside corner.
 - 6. Color and Pattern: Match adjacent terrazzo flooring.
 - 7. Height: As scheduled or as indicated in Design Selections.
- B. Precast Terrazzo Finishing:
 - 1. Finish exposed-to-view edges or reveals to match face finish.
 - 2. Ease exposed edges to 1/8 in radius.

2.8 CONCRETE MOISTURE BARRIER FLOOR TREATMENT

- A. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.

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1. Basis of Design (Product Standard): Bostik, Inc.; D-250.
- B. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.
 1. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Concrete Substrates:
 1. Verify that concrete substrates are dry and free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo flooring. Determine adhesion and dryness characteristics by performing the following tests as recommended by terrazzo manufacturer.
 - a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and re-circulates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
 2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.

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3. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf or fraction thereof. Proceed with installation only after concrete substrates pass testing.
 - a. Anhydrous Calcium Chloride Test: Perform in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, perform in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 80 percent relative humidity level measurement.
 4. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture barrier floor treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.
- C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

3.4 INSTALLATION OF THIN-SET TERRAZZO

- A. General:
1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
 2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide".
 3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 in per 10 ft (6 mm per 3 m); noncumulative.
 4. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 5. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- B. Thin-Set Terrazzo Thickness: 3/8 in.
- C. Flexible Reinforcing Membrane:
1. Prepare and prefill substrate cracks with membrane material.
 2. Coverage:
 - a. Install membrane to produce full substrate coverage in areas to receive terrazzo.
 3. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
- D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
1. Strip Materials:
- E. Divider and Control-Joint Strips:

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1. Locate divider strips in locations indicated, but not to exceed 400 sf.
 2. Install control-joint strips back to back directly above concrete-slab control joints and construction joints (cold joints).
 3. Install control-joint strips with 1/4 in gap between strips, and install sealant in gap.
 4. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
- F. Accessory Strips: Install as required to provide a complete installation.
- G. Fine Grinding: Grind with 120 or finer grit stones until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
- H. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as accepted by Architect.

3.5 INSTALLATION OF PRECAST RESINOUS TERRAZZO

- A. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
- B. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 in maximum in length, height, or width; noncumulative.
- C. Do not install units that are chipped, cracked, discolored, or not properly finished.
- D. Seal joints between units with joint sealant in accordance with Division 07 Section "Joint Sealants".

3.6 CLEANING AND PROTECTION

- A. Cleaning:
1. Remove grinding dust from installation and adjacent areas.
 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
- B. Sealing:
1. Seal surfaces according to NTMA's written recommendations.
 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 096723

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Resinous flooring systems, integral cove base, accessories and supplementary items for a complete installation.

1.2 ALLOWANCES

- A. Concrete Moisture Barrier Allowance: Include allowance to provide negative side Concrete Moisture Barrier Floor Treatment to concrete floor decks exceeding moisture content recommended by flooring manufacturer.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance
- B. Samples for Verification: For each resinous flooring system required, 6 insquare, applied to a rigid backing by Installer for this Project.
- C. Product Schedule: For resinous flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

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1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals. Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance. Include product data for flooring care products used or recommended by installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, apply full-thickness mockups on 96-inch- square floor area selected by Architect.
 - a. Show typical components and requirements of installation.
 - b. Include 96-inch length of integral cove base.
 - 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 - 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 - 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.

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- b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

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1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing in accordance with ASTM D635.

2.4 RESINOUS FLOORING (RF-01)

- A. Resinous Flooring: Chemical-resistant epoxy floor surfacing designed to produce a seamless floor and integral cove base with a chemical-resistant epoxy topcoat.
- B. System Characteristics:
 1. Acceptable Manufacturers and Products:
 - a. Basis of Design: Stonhard; Stonclad GS with Stonkote HT4 topcoat.
 - b. Sherwin Williams; FasTop Multi SL45 with Resuflor 3741 Novolac Epoxy topcoat.
 - c. Sika Corp.; Sikafloor Epo-Rok 160 with Purcem 19NA topcoat.
 2. Color and Pattern:

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- a. As scheduled or as indicated in Design Selections.
- 3. Wearing Surface: Textured for slip resistance.
- 4. Overall System Thickness: Nominal 3/16 in.
- 5. Application Method: Screed and troweled base coat, squeegee and roll topcoat.
- C. Base Coat: Three-component, troweled mortar base consisting of epoxy resin, curing agent and selected, graded aggregates.
- D. Topcoat: Two component, 100%-solids epoxy coating.
- E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
 - 1. Base Coat:
 - a. Compressive Strength: 10,000 psi per ASTM C-579.
 - b. Tensile Strength: 1,750 psi per ASTM C-307.
 - c. Flexural Modulus of Elasticity: 2.0×10^{-6} psi per ASTM C-580.
 - d. Impact Resistance: >160 in./lbs. per ASTM D-2794.
 - e. Abrasion Resistance: 0.1 gm max. weight loss per ASTM D-4060, CS-17.
 - f. Hardness: 85 to 90 per ASTM D-2240, Shore D.
 - g. Flammability: Class 1 per ASTM E-648.
 - h. Coefficient of Friction (Dry): 0.83 per ASTM F-1679.
 - i. Slip Resistance Index (Wet): 0.66 per ASTM F-1679.

2.5 CONCRETE MOISTURE BARRIER FLOOR TREATMENT (MOISTURE BARRIER PRIMER)

- A. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of resinous finish flooring.
 - 1. Acceptable Manufacturers and Products: As recommended by resinous flooring manufacturer.
 - a. Basis of Design: Stonhard; Stondri MVT.
 - b. Sherwin Williams; Resuprime 3830/3835.
 - c. Sika Corp.; Sikafloor 1620.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Roughen concrete substrates as follows:
 - a. Bead-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written recommendations for specified product(s).
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours or as recommended by manufacturer for specified product(s).
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement or at levels as recommended by manufacturer for specified product(s).
 4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrates pass testing.
 5. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified by manufacturer for specified product(s), apply moisture barrier floor treatment to concrete substrate in accordance with manufacturer's written instructions.
- D. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

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1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
- E. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.4 INSTALLATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Reinforcing Membrane: Apply reinforcing membrane to substrates as recommended by manufacturer.
1. Locations:
 - a. Control joints and substrate cracks only at typical locations.
 - b. Where waterproof membrane is installed, apply at cracks wider than 1/16 inch only.
 - c. Entire substrate surface at composite deck assemblies and locations indicated or scheduled on Drawings.
- D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners. Extend integral cove base at top against metal cap strip.
1. Integral Cove Base: 6 in high.
- E. Self leveling Body Coats: Apply self-leveling slurry body coats, or troweled or screeded body coats in thickness recommended by flooring system manufacturer. Hand or power trowel and grout to fill voids in troweled or screeded systems. When troweled or screeded systems are cured, remove trowel marks and roughness using method recommended by manufacturer.
1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.
- G. Grout Coat: Apply grout coat to fill voids in surface of final body coat.

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- H. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - 2. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.
- C. Prepare test and inspection reports.

3.6 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

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SECTION 096800

CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Carpeting products and systems and supplementary items necessary for installation.
- B. Resilient wall base and resilient molding accessories installed with carpeting are specified in Division 09 Section "Resilient Base and Accessories".

1.2 ALLOWANCES

- A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Provide floor plans, including columns, doorways, enclosing walls or partitions, built-in cabinets, and locations of cutouts, to indicate the following:
 - 1. Carpeting type and color.
 - 2. Type of substrate.
 - 3. Type of installation.
 - 4. Pattern type, location, and direction.
 - 5. Pile direction.
 - 6. Type, color, and location of insets and borders.
 - 7. Type, color, and location of edge, transition, and other accessory strips.
 - 8. Transition details to other flooring materials.
- C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.
- D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in sample of each different color, texture, and pattern of carpeting product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty:

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1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Procedures". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI 104, Section 5, "Storage and Handling".

1.9 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity".
- B. Environmental Limitations: Do not install carpeting until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Maintain carpeting products prior to installation at the same temperature as the space where they are to be installed.
- D. Close spaces to traffic during carpeting installation and for time period after installation recommended by manufacturer.
- E. Install carpeting products after other finishing operations, including painting, have been completed.
- F. Do not install carpeting over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by carpeting manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

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1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

- A. Manufacturer's Warranty for Carpeting: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.
- B. Warranty does not include deterioration or failure of carpeting due to unusual traffic, failure of substrate, vandalism, or abuse.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Emissions: Provide carpet that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.3 TILE CARPETING

- A. Basis of Design (Product Standard):
 - 1. Selections: As scheduled or as indicated in Design Selections.

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2.4 ACCESSORY MATERIALS

- A. Concrete Slab Primer: Non-staining type as recommended by carpeting manufacturer.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpeting manufacturer.
- C. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpeting and is recommended or provided by carpeting manufacturer.
- D. Concrete Moisture Barrier Floor Treatment:
 - 1. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.
 - a. Basis of Design (Product Standard): Bostik, Inc.; D-250.
 - 2. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.
 - a. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation" and carpeting manufacturer's written installation instructions for preparing substrates indicated to receive carpeting installation.
- C. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving carpeting.
 - 2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Unless concrete has been water-cured, then proceed with the following:
 - a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.
 - 4. Determine adhesion and dryness characteristics by performing the following tests as recommended by flooring manufacturer.
 - 5. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHHydron paper is applied. Proceed with installation only after concrete substrates pass testing.
 - 6. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf or fraction thereof. Proceed with installation only after concrete substrates pass testing.
 - a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf in 24 hours.
 - b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.
 - 7. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture barrier treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.
- D. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

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- E. Broom and vacuum clean substrates to be covered immediately before installing carpeting. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF CARPETING

- A. Scribe, cut, and fit carpeting to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- B. Extend carpeting into toe spaces, door reveals, closets, and similar openings. Extend carpeting to center of door openings.
- C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish carpeting as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.
- D. Do not bridge building expansion joints with carpet.
- E. Bind or seal cut edges as recommended by carpeting manufacturer.
- F. Install pattern parallel to walls and borders unless otherwise indicated.
- G. Hand-roll carpeting in both directions from center out to embed carpeting in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press carpeting firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF TILE CARPETING

- A. Tile Carpet at Concrete Substrates: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)" and carpet manufacturer's written recommendations for full glue-down installation of every tile with releasable adhesive.
- B. Install pattern parallel to walls and borders unless otherwise indicated.

3.6 INSTALLATION OF ADHERED SHEET CARPETING

- A. Apply concrete slab primer, if recommended by carpeting manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.
- B. Sheet Carpet at Concrete Substrates without Padding: Comply with CRI 104, Section 9, "Direct Glue-Down Installation" and carpeting manufacturer's written installation instructions for direct-glue-down installation.
- C. Adhere to concrete substrates using a full spread of adhesive applied to substrate to comply with carpeting manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

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- D. Comply with carpeting manufacturer's written recommendations for seam locations and direction of carpeting; maintain uniformity of carpeting direction and lay of pile. At doorways, center seams under the door in closed position.

3.7 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpeting:
 - 1. Remove excess adhesive and other surface blemishes from exposed surfaces using cleaner recommended by carpeting manufacturer.
 - 2. Remove yarns that protrude from carpeting surface.
 - 3. Vacuum carpeting using commercial machine with face-beater element.
- B. Protect installed carpeting to comply with CRI 104, Section 16, "Protecting Indoor Installations".
- C. Protect carpeting against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpeting manufacturer.

END OF SECTION

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SECTION 097200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Wall coverings and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.
 2. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.
- B. Shop Drawings: Show location and extent of each wall covering type. Indicate seams and termination points.
- C. Samples for Verification Purposes: Sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
1. Full-width sample, not less than 36 in long, from dye lot used for the Work.
 2. Submit sample with specified treatments applied for products specified.
 3. Show complete pattern repeat where applicable.
- D. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

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- B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components and requirements of installation.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Do not install wall coverings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
- B. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- C. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles is provided on the surfaces to receive wall covering.
- D. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on product and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Manufacturer and Product: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 WALL COVERING MATERIALS

- A. Textile Wall Coverings: Provide textile wall fabric affixed to suitable backing, and complying with requirements of ASTM F 793, Category III, Decorative with High Serviceability. Provide material which has been treated for stain and mildew resistance.

2.4 ACCESSORY ITEMS

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
- C. Comply with manufacturer's written instructions for surface preparation.
- D. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Prime new gypsum board with primer recommended by wall covering manufacturer.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.4 INSTALLATION OF WALL COVERINGS

- A. Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.
- C. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage. Install seams vertical and plumb at least 6 in from outside corners and 3 in from inside corners. No horizontal seams are permitted.
- D. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- E. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams without any overlay or spacing between strips.

3.5 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces. Use cleaning methods recommended by the wall covering manufacturer.
- B. Replace strips that cannot be cleaned.
- C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

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SECTION 099100

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and field painting of exposed interior items, exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where indicated that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, unless indicated otherwise.
 - 1. Prefinished items include the following factory-finished components:
 - a. Prefinished wood doors.
 - b. Acoustical materials.
 - c. Prefinished Architectural woodwork and cabinets.
 - d. Elevator equipment.
 - e. Finished mechanical and electrical equipment.
 - f. Light fixtures.
 - g. Distribution cabinets.
 - h. Baked enamel coated items.
 - i. Fluoropolymer coated items.
 - j. Integral colored plaster.
 - k. Integral colored PVC.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - g. Elevator shafts.

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3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
 - a. Embossed UL labels may be used and painted where acceptable to authority having jurisdiction

D. Related Sections:

1. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board assemblies.
2. Division 09 Section "High-Performance Coatings" for coatings applied over such substrates as concrete and GFRP, steel, galvanized metal, and aluminum (not anodized or otherwise coated) that are not specified in this Section.

1.2 DEFINITIONS

- A. MPI Gloss Levels: MPI Gloss and Sheen Standard values are measured per ASTM D523, Method D and are as follows:
1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees.
 2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
 3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
 4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
 5. Gloss Level 5: 35 to 70 units at 60 degrees.
 6. Gloss Level 6: 70 to 85 units at 60 degrees.
 7. Gloss Level 7: More than 85 units at 60 degrees.
- B. Exterior Painting: Generally includes surfaces located in unconditioned spaces.
- C. Interior Painting: Generally includes surfaces located in conditioned spaces.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.

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- B. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 in square.
 2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturers Project Acceptance Document: Certification that products are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that warranty will be issued.
1. Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.5 QUALITY ASSURANCE

- A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Install mockup in the location and of the size indicated or, if not indicated, as directed by Architect.
 - a. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - 1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - 2) Other Items: Architect will designate items or areas required.
 - 3) Demonstrate repair procedures for damaged surfaces.
 - b. Apply samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - c. Final approval of color selections will be based on benchmark samples.

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- 1) If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 PROJECT CONDITIONS

- A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between minimum and maximum range recommended by manufacturer.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Behr.
 2. Benjamin Moore & Co.
 3. Dunn-Edwards Corporation.

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4. Kelly-Moore Paints.
5. PPG Paints.
6. Pratt & Lambert Paints.
7. Sherwin-Williams Company (The).
8. Valspar.

B. Color and Gloss: As scheduled or as indicated in Design Selections.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Source Limitations: Obtain block fillers and field applied primers for each coating system from the same manufacturer as the finish coats.
- C. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to shop applicators to ensure use of compatible primers.

3.2 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to the following, unless otherwise specified in this Section:
1. Respective manufacturer's written installation instructions.
 2. Approved submittals.
 3. Contract Documents.
 4. MPI Architectural Painting Specification Manual" or "MPI Maintenance Repainting Manual", as applicable.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" applicable to substrates and paint systems indicated.
- C. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates, unless expressly permitted by authorities having jurisdiction for labels intended to be painted.
- D. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

3.4 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items, equipment, and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items, equipment, or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 - 5. The number of coats and film thickness required are the same regardless of application method.
 - 6. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 - 7. Omit primer over metal surfaces that have been shop primed and touchup painted.
 - 8. Allow sufficient time between successive coats to permit proper drying.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Tint per manufacturer's technical data for each type of primer or undercoat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

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- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve total dry film thickness of the entire system as recommended by manufacturer.

3.5 MECHANICAL AND ELECTRICAL WORK PAINTING AND IDENTIFICATION

- A. Painting of Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work to be done when exposed in the following locations:
 - 1. Equipment Rooms.
 - 2. Occupied Spaces.
 - 3. Exterior Walls.
 - 4. Roof Areas.
- B. Equipment includes, but is not limited to, the following:
 - 1. Uninsulated piping.
 - 2. Pipe hangers and supports.
 - 3. Tanks that do not have factory-applied final finishes.
 - 4. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 5. Equipment that is indicated to have a factory-primed finish for field painting.
- C. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces. Paint with a flat, nonspecular black paint.
- D. Pipe Identification: Conform to requirements of ANSI/ASME A13.1 "Scheme for the Identification of Piping Systems".

3.6 FIRE AND SMOKE BARRIER IDENTIFICATION

- A. Fire and smoke resistant rated walls shall be effectively and permanently identified with signs, labels or stencils in a manner acceptable to authority having jurisdiction.
 - 1. Identification shall be above decorative ceiling and in concealed spaces, on each segment of the wall and 6'-0" O.C. maximum on each side of wall.

3.7 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of paint materials with product requirements.

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3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.8 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces to match approved samples.

3.9 SPECIAL PAINT FINISHES

- A. Lime Based Paints:
 1. Basis of Design Manufacturer and Products: Graphenstone; GrafClean Premium Paints.
 - a. Selections: System and finish as scheduled or indicated in Design Selections.
 2. Substrate Preparation: Prepare substrate as recommended by manufacturer.
 3. Prime Coat: Primer as recommended by manufacturer. All surfaces shall be primed prior to applying finish.
 4. Intermediate Coat: Lime based matching topcoat.
 5. Topcoat: Lime based topcoat.

END OF SECTION

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SECTION 099413

TEXTURED INTERIOR COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes high-build, multi-textured acrylic latex interior coatings and supplementary items necessary to complete their installation.
- B. Related Sections:
 - 1. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board assemblies.
 - 2. Division 09 Section "Painting" for traditional coatings.
 - 3. Division 09 Section "Multicolored Interior Coatings" for smooth multicolored paint coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For coating system specified including primers.
 - 1. Material List: Provide a list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number.
 - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Samples for Verification: For each coating system, color, and pattern specified with a list of materials applied for each coat, labeled for location and application, and on representative Samples of actual substrates. Submit two samples showing the full range of color, texture, and pigment density expected on 12 inch square gypsum wallboard substrate with edges taped.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- B. Fire-Test-Response Characteristics: Provide coatings with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 450 or less.

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- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples of at least 100 sq. ft.
 - b. Small Areas and Items: Architect will designate items or areas required.
 2. Notify Architect seven days in advance of dates and times when mockups will be applied.
 3. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 4. After finishes are accepted, Architect will use surface to evaluate coating systems of a similar nature.
 5. Obtain Architect's approval of benchmark samples before starting textured interior coating application.
 6. Final approval of colors will be from benchmark samples.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply coatings until spaces are enclosed and weatherproof, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.5 WARRANTY

- A. Textured Coating Warranty: Submit a written warranty, executed by the applicator and manufacturer, agreeing to repair or replace textured coatings that fail within the specified warranty period. Failures include, but are not limited to, chipping, peeling, flaking or fading under anticipated conditions of exposure.
- B. Warranty Period: 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
1. Scuffmaster
 2. Textured Coatings of America, Inc.; Tex-Coat Multi-Textured/Color Wall Coating System.

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3. Triarch Industries, Inc.; Duroplex.

2.2 MATERIALS

- A. Material Compatibility: Provide fillers, primers, base-coats, finish-coats, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
1. Prime Coat: As recommended by manufacturer.
 2. Base Coat: Manufacturer's standard water-based latex acrylic base coat.
 3. Finish Coat: Manufacturer's standard high-build multi-textured latex acrylic coating with following characteristics:
 - a. Abrasion resistant.
 - b. Mold and Mildew Resistant.
 - c. Stain resistant.
 - d. Impact resistant.
 - e. Scrub resistant.
- B. Colors and Textures: As scheduled in Division 1 Section "Design Selections".
- C. Colors and Textures: Match Architect's sample.
- D. Colors and Textures: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of coatings.
1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 2. Begin coating application only after unsatisfactory conditions have been corrected and surfaces receiving coating are dry.
 3. Start of coating application indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
1. After completing coating operation in each space or area, reinstall items removed using workers skilled in trades involved.
- B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of various coatings. Remove oil and grease before cleaning.

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1. Schedule cleaning and coating so dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.
 2. Remove mildew from substrates.
- C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Apply leveling and patching compounds to uneven surfaces.
- D. Material Preparation: Prepare coating materials according to manufacturer's written instructions.

3.3 APPLICATION

- A. Apply coating according to manufacturer's written instructions. Use applicators and techniques suitable for substrate and coating material applied.
1. Do not apply coating over dirt, rust, scale, grease, moisture, or scuffed surfaces, or under conditions detrimental to forming a durable coating film.
 2. Coat exposed surfaces indicated. Exposed surfaces include areas behind movable equipment and furniture.
 3. Before installing permanently fixed equipment or furniture, coat concealed areas with prime coat only, unless otherwise indicated.
 4. Apply first-coat material to prepared surfaces as soon as practicable after preparation and before surfaces deteriorate.
 5. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where applying another coat does not cause undercoat to lift or lose adhesion.
- B. Minimum Coating Thickness: Apply coating materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of system recommended in writing by manufacturer.
- C. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated and not prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first prime coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- D. Finish Coats: Match approved Samples for color and pattern with uniform texture, finish, and appearance.
1. Provide finish coat without undercoats, stains, or other conditions showing through final coating.
 2. Provide edges, corners, crevices, welds, and exposed fasteners with a dry film thickness equivalent to that of flat surfaces.
 3. Recoat work not complying with requirements.

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3.4 CLEANING

- A. At end of each workday, remove empty cans, rags, rubbish, and other discarded coating materials from Project site.
- B. After completing coating work, clean glass and coating-spattered surfaces. Remove spattered coating by washing and scraping. Do not scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades from damage by coating. Correct damage by cleaning, repairing or replacing, and recoating, as approved by Architect.
- B. Provide temporary closure to confine spraying operation and to prevent polluting of surrounding environment.
- C. Provide "Wet Paint" signs to protect newly coated finishes.
- D. Remove temporary protective wrappings after completing coating operations.

3.6 REPAIR

- A. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION

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SECTION 099600

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and application of high-performance coating systems and supplementary items to complete the work.
 - 1. Applications include:
 - a. Surface preparation.
 - b. Prime coat at slip critical connections.
 - 2. Substrates include:
 - a. Steel.
- B. Related Section: Division 09 Section "Painting" for exterior and interior painting not specified in this Section.

1.2 DEFINITIONS

- A. DFT: Dry film thickness.
- B. Gloss Level 5 (Semigloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, preparation requirements, finishes, construction details, installation instructions, and recommendations for maintenance
- B. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 in square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

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1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - 1. Manufacturer shall certify all products comply with Federal, State and Local regulatory requirements including but not limited to OTC and VOC regulations. Notify Architect of materials not in compliance.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Not less than five (5) gallons, in one gallon cans, of each material and color applied.
- B. Containers to be tightly sealed.
- C. Label each container with color, color number, texture and locations, in addition to manufacturer's label.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
- B. Field Mockups: Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface and one plate with several bolted connections to represent surfaces and conditions for application of each coating. Demonstrate field applied coating procedures for the following:
 - a. Bolted connections.
 - b. Damaged areas.

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2. Final approval of field applied coatings will be from field mock-up.
3. Clean exposed faces of mock-up.
4. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - a. Provide required color and sheen on each surface.
6. Protect approved mock-up from the elements with weather-resistant membrane.
7. Obtain Architect's approval of mockups before starting installation.
8. Maintain mockups during construction in an undisturbed condition as a standard for review of the completed Work.
9. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and approved by Architect in writing.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

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1.9 PROJECT CONDITIONS

- A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 45 deg. F, unless otherwise permitted by manufacturer's printed instructions or written authorization from the coatings manufacturer.
- B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 deg. F above the dew point, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions or written authorization from the coatings manufacturer. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

- A. Coating Manufacturer Warranty: Submit coating manufacturer's written warranty signed by manufacturer, agreeing to repair or replace work which exhibits material defects caused by error in formulation, manufacture or design of product. "Defects" is defined to include, but is not limited to, peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.
 - 1. Warranty Period - Polyurethane System: Manufacturer shall warrant the products to be free from material Defects for a period of 5 years from date of Substantial Completion
 - 2. Warranty Period - Polysiloxane System: Manufacturer shall warrant the products to be free from material Defects for a period of 10 years from date of Substantial Completion
- B. Coatings Installer Warranty: Submit coating installer written warranty signed by installer, agreeing to repair or replace work which exhibits workmanship defects. "Defects" is defined to include, but is not limited to, peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.
 - 1. Warranty Period: Applicator shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers/fabricators listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

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1. Colors and Gloss: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide primer material produced by the same manufacturer as the finish coats. Use only thinners recommended by the manufacturer, and only within recommended limits. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Material Compatibility:
 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- C. Regulatory Requirements: Comply with federal, state, and local codes and regulations applicable to surface preparation, coating application, storage, handling, and environmental requirements, including Federal, State and Local EPA requirements for maximum VOC.
- D. Coatings Content:
 1. Zinc dust pigment used in zinc rich coatings shall conform to the requirements of ASTM D520-00, Type II.
 2. Coatings shall be free of zinc-chromate or strontium chromate.
 3. Coatings shall be free of mercury.

2.3 PERFORMANCE REQUIREMENTS

- A. General: Coatings shall comply with the following minimum performance requirements.
 1. Physical Test Result - ASTM B117 Salt Spray (Fog): No blistering, cracking, softening, or delamination of film after 2000 hours. Minimal or no rust creepage at the scribe.

2.4 PRIMERS

- A. Primer for Steel to receive Polyurethane or Polysiloxane Topcoat:
 1. Epoxy Zinc Rich: Provide factory formulated prime coat material compatible with the substrate and finish coats indicated. Primer shall be a polyamide or amine cured epoxy zinc-rich coating containing metallic (active) zinc content in the dried film > 81% by weight. Coating shall be capable of film build in a single coat. Product must qualify per AISC Specification for Structural Joints using ASTM A325 or A490 Bolts RCSC Specification for Structural Joints Table 3, Class B. Primers shall be lead hazard free.
 2. Manufacturers and Products:
 - a. PPG; Amercoat 68HS (4.0 - 5.0 mils DFT).
 - b. Carboline; Carbozinc. 859 (4.0 - 5.0 mils DFT).
 - c. Sherwin-Williams; Zinc Clad 4100 (4.0 - 5.0 mils DFT).
 - d. TNE MEC; Series 90-97 Tnemec Zinc (4.0 - 5.0 mils DFT).

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- B. Fire Resistive Materials: Unless indicated otherwise, do not prime structural steel surfaces to receive sprayed-on fire resistive materials.

2.5 POLYURETHANE TOPCOAT

- A. Polyurethane, Two Component, Pigmented: Provide factory formulated high-build aliphatic acrylic polyurethane compatible with prime coat indicated. Coating shall be capable of film build in a single coat. Coating shall not contain alkyd resins.
1. Manufacturers and Products:
 - a. PPG; Amershield (4.0 - 7.0 mils DFT).
 - b. Carboline; Carbothane 134 HB (4.0 - 5.0 mils DFT).
 - c. Sherwin Williams; Hi Solids Polyurethane (4.0 - 5.0 mils DFT).
 - d. TNEMEC; Series 1094 Endura Shield (4.0 - 5.0 mils DFT).

2.6 POLYSILOXANE TOPCOAT

- A. Polysiloxane, Pigmented: Provide factory formulated high-build epoxy polysiloxane compatible with prime coat indicated. Coating shall display weathering characteristics superior to that of high performance polyurethane. Coating shall be capable of film build in a single coat.
1. Manufacturers and Products:
 - a. PPG; PSX 700 (5.0 - 7.0 mils DFT).
 - b. Carboline; Carboxane 2000 (5.0 - 7.0 mils DFT).
 - c. Sherwin Williams; Sher-Loxane 800 (5.0 - 7.0 mils DFT).
 - d. TNEMEC; Series 740 UVX (5.0 - 7.0 mils DFT).

2.7 INTERMEDIATE AND FINAL COATING

- A. Coating For Steel:
1. Fluid-Applied Thermal Break:
 - a. Manufacturer and Product:
 - 1) TNEMEC; Series 971 Aerolon Acrylic (40 mils DFT)

2.8 REPAIR COATINGS

- A. Repair Epoxy: Provide factory formulated repair epoxy. Material shall be compatible with direct to metal application and other coatings in the system being repaired. Coating shall be capable of film build in a single coat.
1. Manufacturers and Products:
 - a. PPG; Amerlock 400/2 or Amercoat 370 (5.0 - 7.0 mils DFT).
 - b. Carboline; Carbomastic 15 Series (5.0 - 7.0 mils DFT).
 - c. Sherwin Williams; Macropoxy 646 (5.0 - 7.0 mils DFT).
 - d. TNEMEC; Series 66HS Epoxoline (5.0 - 7.0 mils DFT).

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2.9 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

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- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Steel Substrates: Surfaces to be coated must be free of any and all contaminants prior to application of protective coatings. Clean non-galvanized, ferrous metal surfaces, that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council.
 - 1. Shop-Applied Coatings:
 - a. Clean surfaces to remove grease and oil and other contaminants per SSPC-SP-1, Solvent Cleaning, or other methods recommended by coatings manufacturer.
 - b. Abrasive blast in accordance with SSPC. Refer to coating manufacturer application instructions for the required surface profile and other related information. If the surface profile is deeper than indicated on manufacturer application / product data sheet an increase in the primer dry film thickness must be made prior to applying topcoat. Applying additional topcoat to make up for deficiencies in the specified dry film thickness of the primer is not permitted.
 - 1) Inorganic Zinc Primers: SSPC-SP-10, Near White Metal Blast Cleaning.
 - 2) Organic Zinc Primers: SSPC-SP-6, Commercial Metal Blast Cleaning.
 - c. Abrasive materials used during surface preparation operations must be free of contaminants and suitable to produce the desired surface profile required by the coating manufacturer.
 - d. Apply zinc primer to all surfaces including filler plates, slip critical and bearing connections unless indicated otherwise. Allow primer to cure, then mask slip critical and bearing connection areas prior to application of topcoat.
 - e. All applied coatings shall be free of runs, sags, drops, ridges, waves, laps, bubbles, embedded foreign matter, and other indications of improper application.
 - 2. Touch-Up Procedures:
 - a. If epoxy zinc-rich metal primer is damaged or compromised, follow preparation procedures and apply spot repair coat of repair epoxy prior to topcoat application. Do not use repair epoxy on slip critical connection areas.
 - b. If galvanizing is damaged or compromised, follow preparation procedures and apply spot repair coat of repair epoxy prior to topcoat application. Do not use repair epoxy on slip critical connection areas.
 - c. Coating bolted connections:
 - 1) Clean faying surfaces per SSPC SP 1, Solvent Cleaning to remove any contaminants.
 - 2) Clean bolts and surrounding area to be coated per SSPC SP 1 using alkaline cleaner such as Amercoat 88 or solvent such as Ameron Amerase or Carboline Surface Cleaner No.3. Use SSPC SP 2, or SSPC SP 3, to remove any rust or other hard contaminants.
 - 3) Use SSPC SP 2, or SSPC SP 3, to "feather" any hard edges existing on the topcoat portion of painted members where it abuts the faying surface.

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- 4) Prime bolts with repair epoxy.
- 5) Coat connection with topcoat exercising care to "square off" tie-in areas to minimize the difference in appearance between the existing topcoat and touch-up areas. Spray application is preferred.

d. Repairing damaged areas:

- 1) Clean damaged area per SSPC SP 1, Solvent Cleaning to remove any contaminants.
- 2) Use SSPC SP 11, to remove rust at exposed steel surfaces.
- 3) Use SSPC SP 2, or SSPC SP 3, to remove any loose paint and other detrimental foreign matter.
- 4) Feather any hard edges existing on the topcoat portion of painted members where it abuts the damaged area.
- 5) Apply repair epoxy allowing an overlap on surrounding intact topcoat.
- 6) Coat damaged area with topcoat exercising care to "square off" tie-in areas to minimize the difference in appearance between the existing topcoat and touch-up areas. Spray application is preferred.

3.4 MATERIAL PREPARATION

- A. Material Preparation: Carefully mix and prepare materials in compliance with the coating manufacturer's Application Instructions using a professional mixing tool such as "Jiffy Mixer".
- B. Thin only for workability with approved thinners and in accordance with coatings manufacturer's application instructions.

3.5 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 1. Use applicators and techniques suited for coating and substrate indicated.
 2. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 3. Minimum Coating Thickness: Apply each material to provide not less than the minimum DFT recommended by the coating manufacturer. Provide total DFT for the entire system as recommended by the coating manufacturer.
 4. Mechanical Application: Use mechanical methods for coating application when permitted by the manufacturer's recommendations. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended otherwise by the manufacturer.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

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- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.
- E. Primer: Shop apply prime coat as recommended by the manufacturer, to material required to be coated or finished.
- F. Topcoats: Shop-apply topcoat as recommended by the manufacturer. Apply topcoats within re-coat window as recommended by manufacturer. Remove, refinish or re-coat work not in compliance with specified requirements

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Fabricator/applicator shall allow Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
 - 2. Paint Manufacturer's Representative shall inspect and certify that surfaces are acceptable to receive coating system.
 - 3. Installer/Applicator shall certify that materials and installation are in accordance with Manufacturer's requirements and Contract Documents.
- B. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense.
 - 1. Testing agency will perform tests for compliance with specified requirements.
 - a. Perform daily visual shop inspection of surface preparation prior to primer application.
 - b. Perform shop and field testing of DFT for each coat; not less than 1% of materials to be coated.
 - c. Perform visual inspection after final coating application.
 - d. Shop and field painting inspections shall be in accordance with ASTM 3276 Standard Guide for Painting Inspectors.
 - 2. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove non-complying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

3.7 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

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- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.8 HIGH-PERFORMANCE COATING SCHEDULE

- A. Provide the following coating systems for substrates indicated. Apply additional coats when undercoats or other conditions show through the final coat, until the cured coating system film is of uniform coating finish, color and appearance.
- B. Steel Substrates:
 - 1. Polyurethane over Zinc Rich Epoxy Primer System:
 - a. Prime Coat: Epoxy, zinc-rich.
 - b. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 5).
 - 2. Polysiloxane over Zinc Rich Epoxy Primer System:
 - a. Prime Coat: Epoxy, zinc-rich.
 - b. Topcoat: Polysiloxane, pigmented, gloss (Gloss Level 5).

END OF SECTION

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SECTION 101443

PHOTOLUMINESCENT EXIT PATH MARKING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Photoluminescent exit path marking system along with supplementary items necessary for installation of the following:
 - 1. Stair and leading edge nosing strips; if not specified in another section with cast-in abrasive nosings.
 - 2. Handrail illumination strips.
 - 3. Demarcation way finding strips.
 - 4. Obstacle markers.
 - 5. Door signage and directional signage.
- B. Related Sections:
 - 1. Division 05 Section "Metal Stairs" for photoluminescent stair nosing treads for concrete filled metal pan stairs.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
- C. Samples: 3 in long samples of each item specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:

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1. Experience: Installer's personnel with not less than 2 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 2 years of experience installing products and systems similar to scope of this Project.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion and that the photoluminescent pigment and glow properties will continue to charge and emit glow with less than a 5 percent loss of light output over a 25 year period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Balco, Inc.; IllumiTread Photoluminescent Exit Path Marking System.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Meet or exceed the following performance standards and criteria and in accordance with applicable building codes and acceptable to the authority having jurisdiction and to Architect.
 1. Brightness Rating shall be in accordance with local building code.
 2. UL 1994: Pass.
 3. ASTM E 2072, as modified by IBC Section 1024.

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4. UV Degradation: 2000 hours when tested in accordance with ASTM G155.
5. Salt Spray resistance: ASTM B117.
6. Cleaning Test: ASTM D4820, pass.
7. Rate of Burning: ASTM D635, comply.
8. Surface Flammability: ASTM E162.
9. Toxicity Testing: Bombardier SMP800-C "Toxic Gas Generation Test".
10. Radioactivity Test: ASTM D3648.

2.3 MATERIAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.4 PHOTOLUMINESCENT EXIT PATH MARKING SYSTEM COMPONENTS

- A. Abrasive Stair and Leading Edge Nosing, if not specified in another section:
1. Description: Extruded, ribbed aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder projecting 1/16 in above aluminum extrusion; with continuous anchors for embedding in concrete. Fabricate units in lengths necessary to accurately fit openings or conditions ending 1/8 in from face of stringer. Provide photoluminescent strips, minimum 1 in wide by full width of stair nosing, incorporated into abrasive surfaced nosings.
 2. Product Quality Standard: ASTM B 221 / B 221M, Alloy 6063-T6.
 3. Manufacturer and Product:
 - a. Balco, Inc.; P-3310-PL-100; color as selected by Architect from manufacturer's full range of colors.
 - b. Wooster Products Inc.; Supergrit, M231BF-NG; color as selected by Architect from manufacturer's full range of colors.
- B. Abrasive Stair and Leading Edge Nosing - Retrofit Applications Only:
1. 2-3/8 in wide, surface-mounted nosing with 1 in wide photoluminescent insert, fluted surface.
 2. Manufacturer and Product: Balco, Inc.; 4120.
- C. Handrail Illumination Strips: 1 to 2 in wide photoluminescent strip adhered to handrail with factory applied pressure sensitive adhesive.
1. Manufacturer and Product: Balco, Inc.; 4010c.
- D. Demarcation Way Finding Strips: 1 to 2 in wide photoluminescent strip adhered to flooring with factory applied pressure sensitive adhesive.
1. Manufacturer and Product: Balco, Inc.; 4211c.
- E. Obstacle Markers: 1 to 2 in wide with a pattern of 2 in photoluminescent strips alternating with 2 in black bands angled at 45 degrees adhered to all obstacles as defined by established building code.

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1. Manufacturer and Product: Balco, Inc.; 4211.
- F. Door Signage and Directional Signage: Provide at each stair exit door and where indicated in door schedule.
 1. Manufacturer and Product: Balco, Inc.; 1500 Series as applicable to layout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Verify that when installed, the photoluminescent surface of all components, including, the handrail illumination system strips and the demarcation way finding strips will have exposure to sufficient activation illumination to ensure the photoluminescent strip will be effectively charged and will meet the required brightness rating.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Governing regulations
 2. Written manufacturers installation instructions.
 3. Accepted submittals.
 4. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Stair and Leading Edge Nosing Strips: If not specified in another section, install aluminum abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width. Coat concealed aluminum surfaces that will come into contact with concrete with heavy coat of bituminous paint.
- B. Stair and Leading Edge Nosing Strips - Retrofit Applications Only: Rigidly anchor to substrate; install full width of each step and landing edge.

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- C. Handrail Illumination Strips: Handrail illumination strips shall be adhered to the handrails in accordance with the established code requirements with the factory applied pressure sensitive adhesive.
1. Install strips on the top surface of the handrail for the entire length of the handrail, including handrail extensions and newel post caps.
 2. At bends or corners, the stripe shall be as continuous as practicable with no more than a 4 in gap in the photoluminescent strip.
- D. Demarcation Way Finding Strips: Demarcation way finding strips shall be adhered in accordance with the established code requirements with the factory applied pressure sensitive adhesive. Strips shall be as continuous as practicable with no more than a 4 in gap in the photoluminescent strip.
1. Floor mounted option: shall be positioned as close to the wall as practicable but no more than 4 in away from the wall. Extend to within 2 in of the leading edge nosing. Extend across the floor in front of obstacles. Continue across all doors except door frames marked as intermediate and final exit doors.
- E. Obstacle Markings: Obstacle markings shall be adhered to the obstruction in accordance with the established code requirements. Mark all obstacles at or below for 6 ft 6 in in height and projecting more than 4" into the egress path.
- F. Door and Directional Signage: Door and directional signage shall be located and adhered in accordance with the established code requirements and at a maximum height from the floor of 18 in. Intermediate exit doors and final exit doors Intermediate exit doors are doors that lead from a vertical exit, horizontal extension in a vertical exit, horizontal exit, supplemental vertical exit, or exit passageway, but do not lead directly to the exterior or to a street level lobby. Final exit doors are doors that lead directly to the exterior or a street level lobby. Mount signs on the center of the door.
- G. Door Hardware: Door hardware shall be marked with no less than 16 sq in of photoluminescent material and the photoluminescent material shall be located behind, immediately adjacent to, or on the door handle and/or escutcheon. Panic bars shall have a 1 in (25 mm) photoluminescent strip along their entire length. The top and sides of the door frames shall be marked with a solid and continuous 1 in wide photoluminescent strip with a factory applied pressure sensitive adhesive. Install stripe on the wall surrounding the door frame.

END OF SECTION

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SECTION 102113

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Manufactured toilet compartments and supplementary items necessary to complete work required for their installation.
 - 1. Phenolic-core toilet compartments.
- B. Color Limitations and Burning Characteristics: When the manufacturer limits color selections for code compliant burning characteristics, the Contractor shall notify the Architect and provide code compliant products based on the Architect's color selection at no additional cost to the Owner.
- C. Related Requirements:
 - 1. Refer to Division 05 Section Metal Fabrications for supports that attach ceiling-anchored compartments to overhead structural system.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
 - 4. Show locations of centerlines of toilet fixtures.
 - 5. Show locations of floor drains.
 - 6. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.
- C. Samples for Verification: Actual sample of finished product for each type of toilet compartment, hardware, and accessory.
 - 1. Size: Manufacturers' standard size.
- D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

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1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate requirements for supports, blocking, reinforcing, and other supports concealed within walls or ceilings to ensure that toilet compartments can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 SOURCE LIMITATIONS

- A. Obtain toilet compartments from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84 or NFPA 286; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. NFPA 286 Room-Corner Test: Pass.
- B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

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- C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.4 PHENOLIC-CORE TOILET COMPARTMENTS

A. Manufacturers:

1. ASI Global Partitions
2. Accurate Partitions Corporation.
3. American Sanitary Partition Corporation.
4. Ampco, Inc.
5. Bobrick Washroom Equipment, Inc.
6. Bradley Corporation; Mills Partitions.
7. Columbia Partitions; a Partition Systems Inc. company
8. Flush Metal Partition Corp.
9. General Partitions Mfg. Corp.
10. Global Steel Products Corp.
11. Knickerbocker Partition Corporation.
12. Metpar Corp.
13. Sanymetal; a Crane Plumbing Company

- B. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.

- C. Entrance-Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Flat-Panel Urinal Screen: Matching panel construction.

- E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

- F. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

- H. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.

I. Phenolic Compartment Finish:

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1. Color: As scheduled or indicated in Design Selections.

2.5 COMPARTMENT DOORS

A. Door Hardware and Accessories:

1. Hinges: Manufacturer's standard, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

- ### B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.6 MATERIALS

- ### A. Aluminum Castings: ASTM B26/B26M.
- ### B. Aluminum Extrusions: ASTM B221.
- ### C. Stainless Steel Castings: ASTM A743/A743M.
- ### D. Zamac: ASTM B86, commercial zinc-alloy die castings, chrome plated.

2.7 FABRICATION

- ### A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.
- ### B. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- ### C. Door Size and Swings: Unless otherwise indicated, provide 28-inch- wide, in-swinging doors for standard toilet enclosures and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures designated as accessible.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
1. Confirm location and adequacy of blocking and supports required for installation.

3.2 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 3. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- C. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

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3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.
- B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

3.4 FINISH SCHEDULE

- A. Phenolic-Core Units:
 - 1. Color Selection: As selected from manufacturer's standard colors
 - 2. Color Selection: Special Custom Color as selected.
 - 3. Color Selection: Match Architect's sample.
 - 4. Color Selection:

END OF SECTION

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SECTION 102239

VERTICALLY RETRACTABLE ACOUSTIC PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes electrically operated, vertically retractable acoustical partition assemblies and supplementary items necessary for a complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.

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1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 2. Include data on acoustical performance, surface-burning characteristics, and durability.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, and attachments to other work. Distinguish between shop and field-assembled work.
1. Indicate installation, storage and operating clearances. Indicate location and installation requirements for hardware and blocking.
 2. Indicate dimensions; weights; conditions at openings and for storage.
 - a. Calculate requirements for supporting vertically folding panel partitions and verify capacity of components to support loads; indicate deflection limits for partition and adjacent construction.
 3. Include diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
1. Textile Facing Material: Full width by not less than 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 incheessquare.
 3. Panel Edge Material: Not less than full width by 6 inches long.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by an approved qualified testing laboratory indicating that each product complies with requirements.
- E. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.
- F. Warranty:
1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

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1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
 - 1. User Guide: Furnish Owner with three (3) copies of complete brochure including recommended maintenance procedures, spare parts list, operating instructions and name and address of nearest service agent.
 - 2. Panel face finishes and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - 3. Seals, hardware, and other operating components.
 - 4. Electric operator and controls.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.7 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months full maintenance service by Installer. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Provide parts and supplies as used in the manufacture and installation of original equipment.
- B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Current certificate holder for compliance with ISO 9001.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.

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- e. Installers of other construction interfaced with Work.
- 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
- 3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.11 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
 - 1. Preparation of opening shall conform to the criteria set forth per ASTM E557 Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions. Plenum barrier construction shall provide an STC rating greater than or equal to that of scheduled vertically folding Partitions.
- B. Environmental Conditions: Do not begin installation until permanent HVAC systems are operating properly and building temperature and humidity have stabilized at design conditions.

1.12 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.13 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of partition assemblies.

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- c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Advanced Equipment Corporation.
 - 2. Hufcor, Inc.
 - 3. Skyfold Inc. / dormakaba Group.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Basis of Design: Skyfold Inc. / dormakaba Group; Skyfold Classic Series.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Operation Cycles: Provide partition assembly components and operators capable of operating for not less than 10,000 cycles. One operation cycle is complete when the partition is opened from the closed position to the fully open position and returned to the closed position.
- C. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, seismic, and erection design loads established by authorities having jurisdiction, applicable building codes, and as indicated.
- D. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:
 - 1. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.

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- a. Review partition loading with Architect to verify that allowable deflection of supporting structure will not restrict partition operation nor affect partition acoustics.
- 2. Deflection of Supporting Structure: Partition system shall be capable of withstanding building movements within the following limitations:
 - a. Total Deflection: Not to exceed plus or minus 0.5 inch and parallel to floor.
- E. Acoustical Performance: Provide partition assemblies tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:
 - 1. Sound-Transmission Requirements: Partition assembly tested for laboratory sound-transmission loss performance in accordance with ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
- F. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 VERTICALLY RETRACTABLE ACOUSTIC PANELS

- A. Description: Complete vertically retractable (upward-folding) acoustic partition system, including panels, seals, finish facing, suspension system, operators, and accessories. In the lifted (opened) position, the partition is stored within bulkheads or ceiling storage pockets within above-ceiling plenum. In the down (closed) position, the partition is composed of two vertical planes of acoustic panels separated by an air space.
 - 1. Basis of Design: Skyfold Inc. / dormakaba Group; Skyfold Classic 55 Automatic Vertically Retractable Acoustic Wall, System STC 55.
 - a. STC: Not less than 55, when tested in accordance with ASTM E90.
 - b. NIC Field Tested: Not less than 44 minimum <Insert number>, when tested in accordance with ASTM E336.
- B. Operation: Electrically operated, continuously hinged acoustic panels that open and close sequentially in a manner similar to an accordion.

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- C. Construction: As required to support partition from suspension components and with reinforcement for hardware attachment. Fabricate acoustic panels with tight hairline joints and concealed fasteners. Fabricate acoustic panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate partition to form an assembled system of dimensions indicated and verified by field measurements.
- E. Panel Thickness: Nominal dimension of 11-3/4 inches.
- F. Panel Materials:
 - 1. Frame: Manufacturer's standard.
 - 2. Steel Face/Liner Sheets: Manufacturer's standard tension-leveled flat steel sheet with no bowing, oil canning, warping, waviness or any other surface deformation and discontinuity.
- G. Hardware: Manufacturer's standard as required to operate partition assembly and accessories.
 - 1. Hinges: Concealed (invisible).

2.5 SEALS

- A. Description: Seals that produce partition assemblies complying with performance requirements and the following:
 - 1. Manufacturer's standard automatic seals unless otherwise indicated.
 - 2. Seals made from materials and in profiles that minimize sound leakage.
 - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between partition assembly perimeter and adjacent surfaces, when partition assembly is extended and closed.
- B. Vertical End Seals: Resilient, mechanical, retractable acoustical seal exerting uniform constant pressure on end walls when extended. Once the partition reaches the full down position, the end seals shall activate automatically.
- C. Horizontal Top and Bottom Seals: Resilient, mechanical, retractable acoustical seal exerting uniform constant pressure on ceiling and floor when extended. Once the partition reaches the full down position, the top and bottom seals shall activate automatically.

2.6 PANEL FINISH FACINGS

- A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to partition assemblies with appropriate backing, using mildew-resistant non-staining adhesive as recommended by facing manufacturer's written instructions

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1. Apply facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with invisible seams, no gaps or overlaps. Horizontal butted edges or seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance
 2. Where facings with directional, repeating, or matching patterns, weave or grain are indicated, mark facing top and attach facing in same direction.
 3. Match facing pattern 72 inches above finished floor, unless indicated otherwise.
- B. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.
- C. Finish Facing Material:
1. Selections: As scheduled or indicated in Design Selections

2.7 SUSPENSION SYSTEMS

- A. Structural Support System: Mounted directly to overhead structural support, with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of partition assembly indicated.

2.8 ELECTRIC OPERATORS

- A. Factory-assembled electric operation system of size and capacity recommended and provided by partition assembly manufacturer for partition specified; with electric motor and factory-prewired motor controls, speed reducer, control stations, control devices, and accessories required for operation. Include wiring from control stations to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
- D. Motor Electrical Characteristics:
1. Horsepower: Manufacturer's standard.
 2. Volts: 208.
 3. Phase: Polyphase.
 4. Hertz: 60.
- E. Control Stations: Two single-key-operated, constant-pressure control stations located remotely from each other on opposite sides and opposite ends of partition run. Wire in series to require simultaneous activation of both key stations to operate partition. Each three-position control station labeled "Up," "Down," and "Off." One switch shall be equipped with an LED that flashes fault codes in case of a failure with the electrical system. Furnish two keys per station.
- F. Obstruction-Detection Devices: Equip each partition assembly with indicated automatic safety sensor that causes operator to immediately stop and reverse direction.
1. Sensor Edge: Contact-pressure-sensitive safety edge along partition's leading edge.

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- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop partition assembly at fully open and fully closed positions.

2.9 FABRICATION

- A. Factory-assemble all components and systems into the largest possible assemblies to minimize the amount of assembly on site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of vertically folding panel partitions.
 - 1. The partition sub-contractor shall assume responsibility for ceiling/floor void barriers, interfaces with walls, and other associated constructions that may create noise flanking paths. The overall installation shall be designed and installed in compliance with site sound separation performance requirements. The sub-contractor shall include work within the sub-contract and/or approve the design and site installation of the adjacent construction, prior to site testing, to guarantee overall performance.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Comply with ASTM E 557 Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions.
 - 2. Respective manufacturer/fabricator's written installation instructions.
 - 3. Accepted submittals.
 - 4. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

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3.4 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by vertically folding panel partition manufacturer's written installation instructions.
- B. Install vertically folding panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- D. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 ADJUSTING

- A. Adjust partition assemblies, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Verify that safety devices are properly functioning.

3.7 CLEANING AND PROTECTION

- A. Clean soiled surfaces of vertically folding panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure operable panel partitions are without damage or deterioration at time of Substantial Completion.
- C. Replace panels that cannot be cleaned and repaired, in a manner accepted by Architect, before time of Substantial Completion.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain vertically folding panel partitions.

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END OF SECTION

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SECTION 102613

WALL AND CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Impact-resistant wall protection systems, wall and corner guards, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, physical characteristics such as durability, resistance to fading, and flame resistance, construction details, installation instructions, and recommendations for maintenance
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Include for each wall protection system component to include in maintenance manuals specified in Division 1. Include recommended methods and frequency for maintaining optimum condition of plastic covers under anticipated traffic and use conditions, and precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide wall protection system components with surface-burning characteristics indicated, as determined by testing identical materials according to ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify wall protection system components with appropriate markings of applicable testing and inspecting agency.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.

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- b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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2.3 MATERIALS

- A. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
- B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.
- C. Brass: ASTM B 249/B 249M for extruded shapes and ASTM B 36/B 36 M for sheet.
- D. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.
- E. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- F. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer.

2.4 WALL AND CORNER GUARDS

- A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Manufacturers and Products: As scheduled or as indicated in Design Selections.

2.5 FABRICATION

- A. General Requirements: Fabricate wall protection system components to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.
 - 1. Preassemble components in shop to greatest extent possible to minimize field assembly.
 - 2. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 EXAMINATION

- A. Acceptance of Conditions: Examine substrate surfaces to which wall protection system components will be installed for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance.

3.5 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.
 - b. Where splices occur in horizontal runs of more than 20 ft, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 in.
 - c. Adjust end and top caps as required to ensure tight seams.

3.6 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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SECTION 102813

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Toilet accessories and supplementary items necessary for installation.

1. Refer to Drawings and Schedules for Public Area and Guestroom accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, dimensions, and profiles of individual components.
2. Include details for cutouts required in other Work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For inclusion in operation and maintenance manual as required by Division 01 Section "Operation and Maintenance Data". Include manufacturer's instructions for maintenance of installed Work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.5 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.6 COORDINATION

- A. Coordinate installation of products with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

- A. Mirror Manufacturer's Warranty: Furnish warranty for a period of 15 years from date of Substantial Completion agreeing to replace mirrors that develop visible silver spoilage defects, signed by an authorized representative using manufacturer's standard form.
- B. Hand Dryer Manufacturer's Warranty: Furnish warranty for a period of 10 years from date of Substantial Completion agreeing to repair or replace defective or faulty dryers, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Foamy iQ
 2. Hospeco
 3. Tork
 4. A & J Washroom Accessories, Inc.
 5. American Specialties, Inc.
 6. Bobrick Washroom Equipment, Inc.
 7. Bradley Corp.
 8. Brey Krause Manufacturing.
 9. GAMCO, a Division of Bobrick.

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- B. Shower Curtain Products Only:
 - 1. Barjan Manufacturing Ltd.
 - 2. Brite Inc.
 - 3. Gary Manufacturing.
- C. Child and Adult Care Products Only:
 - 1. Brocar Products, Inc. (Foundations Quality Children's Products)
 - 2. Koala Kare Products.
- D. Hand Dryer Products Only:
 - 1. American Dryer, Inc.
 - 2. Excel Dryer Inc.
 - 3. Saniflow Corporation, div of Mediclinics.
 - 4. World Dryer Corp.
- E. Basis of Design: Contract Documents are based on products specified to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. General Requirements:
 - 1. Unless otherwise indicated, fabricate units of all-welded construction, with corners and returns as indicated, tight seams and joints, and exposed edges rolled.
 - 2. Fabricate frames drawn and leveled, one-piece seamless construction.
 - 3. Hang doors and access panels with full-length, stainless-steel hinges.
 - 4. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- C. Manufacturer Names or Labels: Not permitted on exposed faces of accessories. Provide printed label or stamped metal nameplate indicating manufacturer's name and product model number on an easily noticeable interior surface or on back surface of each accessory.
- D. Keys: Provide minimum of 6 universal keys for internal access to accessories for servicing and resupplying.
- E. Accessibility Requirements: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local accessibility standards.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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2.3 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 satin finish; minimum 0.0312 in (0.8 mm) (22 gage) nominal thickness unless otherwise indicated.
- B. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 1/4 in (6 mm) thick, with silvering, electroplated copper coating, and protective organic coating.
- C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- D. HDPE Plastic: Moldable high-density polyethylene resin formulation.
- E. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of non-corrosive metal when concealed.

2.4 PAPER TOWEL DISPENSERS

- A. Drawing Designation A1 - Surface-Mounted Paper Towel Dispenser: OF/CI
 - 1. Description: Fabricated of plastic; and sized to dispense 1230 paper towels without interruption.
 - 2. Basis of Design: Tork; Tork Peak Serve 552538.

2.5 TOILET TISSUE DISPENSERS

- A. Drawing Designation B9 - Surface-Mounted Twin Jumbo Roll Toilet Tissue Dispenser:
 - 1. Description: Fabricated of plastic and holds two full high-capacity rolls.
 - 2. Basis of Design: Tork; Tork Twin Mini Jumbo 5555290.

2.6 COMBINATION TOWEL DISPENSER / WASTE RECEPTACLES

- A. Drawing Designation D1 - Semi-Recessed-Mounted Combination Towel Dispenser / Projecting Waste Receptacle:
 - 1. Description: Fabricated of stainless steel; with seamless exposed flange; towel dispenser in upper portion of unit with hinged front, equipped with full length stainless steel piano hinge, designed to dispense not less than 600 C-fold or 800 multi-fold paper towels; projecting waste receptacle in lower portion of unit secured in place by tumbler lock, provided with removable 12 gal (45.5 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks; for nominal 4 in (100 mm) wall depth.
 - 2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3944.

2.7 GRAB BARS

- A. Drawing Designation E5, E15, - Straight Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:

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1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.
 - a. Gripping Surfaces: Satin texture with peened gripping surfaces.
 - b. Shapes: Either as indicated, or as required by condition requiring grab bar.
 - c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).
 2. Basis of Design:
 - a. E5: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 42; 42 in (1050 mm).
 - b. E15: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 18; 18 in (450 mm).
- B. Drawing Designation E7, E14, E16 - Configured Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:
1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.
 - a. Gripping Surfaces: Satin texture with peened gripping surfaces.
 - b. Shapes: Either as indicated, or as required by condition requiring the grab bar.
 - c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).
 2. Basis of Design:
 - a. E7: Bobrick Washroom Equipment, Inc. Model B-6861.99 16 in x 31 in (400 mm x 775 mm) unit.
 - b. E14: Bobrick Washroom Equipment, Inc. Model B-68616.99, modified for 24 in x 42 in (600 mm x 1050 mm) unit.
 - c. E16: Bobrick Washroom Equipment, Inc. Model B-68616.99, modified for 42 in x 54 in (1050 mm x 1350 mm) unit.
- C. Drawing Designation E11, - Surface-Mounted Satin Finish Security Grab Bars with Non-Slip Gripping Surface (Psychiatric Use):
1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar; with 0.125 in (3 mm) (11 gage) stainless steel closure plate TIG welded to underside of bar and extending to wall.
 - a. Gripping Surfaces: Satin texture with non-slip gripping surfaces.
 - b. Shapes: Either as indicated, or as required by condition requiring the grab bar.
 - c. Mounting: Exposed flanged steel plate welded to end of bar; with three 1/4 in (6 mm) diameter threaded rods welded to each flange for rear mounting through wall (coordinate wall thickness); with nuts and washers; engineered to support minimum 300 lbs (136 kg).

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2. Basis of Design:

- a. E11: American Specialties, Inc. Model 163; 36 in (900 mm).

2.8 SANITARY NAPKIN DISPOSAL UNITS

A. Drawing Designation G1 - Surface-Mounted Sanitary Napkin Disposal Unit:

1. Description: Fabricated of stainless steel; with flush door equipped with continuous piano hinge and tumbler lock; self-closing disposal panel with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal; with removable 1.2 gal (4.6 L) capacity molded polyethylene receptacle.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-254.

2.9 SOAP DISPENSERS

- A. Drawing Designation J4 - Owner Furnished/ Contractor Installed Soap Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements

1. Basis of Design: Foamy iQ.

2.10 TOILET SEAT COVER DISPENSERS

A. Drawing Designation K1 - Surface-Mounted Toilet Seat Cover Dispenser:

1. Description: Fabricated of stainless steel; with opening in face for dispensing covers and concealed opening at bottom for filling; minimum 250 seat cover capacity.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-221.

B. Drawing Designation K2 - Recessed-Mounted Toilet Seat Cover Dispenser:

1. Description: Fabricated of stainless steel; with seamless exposed flange; hinged front with full length stainless steel piano hinge and tumbler lock; minimum 500 seat cover capacity; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-301.

2.11 SHOWER CURTAIN ROD, HOOKS, AND CURTAIN

A. Drawing Designation L1 - Extra-Heavy-Duty Shower Curtain Rod, Hooks, and Curtain:

1. Rod: As specified below:

- a. Description: Fabricated of stainless steel tube; 1-1/4 in (30 mm) outside diameter, 0.050 in (1.2 mm) (18 gage), satin finish; with die-formed nominal 2-1/2 in (62 mm) square minimum 0.0375 in (0.9 mm) (20 gage) stainless steel flanges with satin finish, and designed for exposed fasteners; length to accommodate opening width.
- b. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-6047.

2. Hooks: As specified below:

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- a. Description: Fabricated of stainless steel; 0.09 in (2 mm) diameter spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod size; one hook per curtain grommet.
 - b. Basis of Design: Bobrick Washroom Equipment, Inc. Part 204-1.
3. Curtain: As specified in Division 01 Section "Interior Design Selections".
- B. Drawing Designation L2 - Ceiling-Mounted Breakaway Shower Carriers: Refer to Division 10 Section "Cubicles" for ceiling-mounted shower curtain tracks for detention or psychiatric use.
1. Curtain: As specified in Division 01 Section "Interior Design Selections".

2.12 SOAP DISHES

- A. Drawing Designation M1 - Surface-Mounted Soap Dish:
- 1. Description: Fabricated of stainless steel; one-piece with drain holes; welded to support arm anchored to wall with 0.050 in (1.25 mm) (18 gage) concealed mounting bracket.
 - 2. Basis of Design: Gamco, Model 76807.

2.13 FOLDING SHOWER SEATS

- A. Drawing Designation N1 - Surface-Mounted Folding Shower Seat:
- 1. Description: Fabricated of stainless steel minimum 0.0625 in (1.6 mm) (16 gage) square tubing and with 0.050 in (1.25 mm) (18 gage) round tubing; reversible L-shaped hinged seat made of phenolic or polymeric composite of either slat type or one-piece construction, with support braces, hinges, and frame designed to fold up against wall when not in use; color as selected by Architect from selections available. Shower seat shall comply with barrier-free accessibility guidelines.
 - 2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-5181.
- B. Drawing Designation N2 - Surface-Mounted Folding Shower Seat:
- 1. Description: Fabricated of stainless steel minimum 0.0625 in (1.6 mm) (16 gage) square tubing and with 0.050 in (1.25 mm) (18 gage) round tubing; one piece, rectangular-shaped hinged seat made of phenolic or polymeric composite of either slat type or one-piece construction, with support braces, hinges, and frame designed to fold up against wall when not in use; color as selected by Architect from selections available. Shower seat shall comply with barrier-free accessibility guidelines.
 - 2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-5193.

2.14 MOP AND BROOM HOLDERS

- A. Drawing Designation P1 - Surface-Mounted Mop and Broom Holder with Utility Shelf:
- 1. Description: Fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick shelf with returned edges, and support brackets for wall mounting; with three 0.0625 in (1.6 mm) (16 gage) stainless steel rag hooks on front of shelf, together with four spring-loaded, rubber hat, cam-type mop/broom holders; 1/4 in (6 mm) diameter stainless steel drying rod suspended beneath shelf; 36 in (900 mm) long.

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2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-224 X 36.

2.15 CHILD CARE PRODUCTS

A. Drawing Designation Q1 - Surface-Mounted Diaper Changing Station:

1. Product Quality Standard: ASTM F 2285.
2. Description: Fabricated of molded HDPE body with bed folding from vertical stored position to horizontal use position; with steel mounting plates; with concealed dampened pneumatic cylinder for controlled, slow opening and closing speed, and steel hinge mechanism fully concealed to eliminate potential for pinning; project not more than 4 in (100 mm) from wall when closed; engineered to support minimum 250 lbs (113 kg) when opened; with nylon or vinyl safety strap, hooks for hanging purse and bags, self-latching lock requiring no keys, built-in sanitary liner dispenser, and universal instruction graphics and safety messages.
3. Manufacturers and Products:
 - a. Basis of Design: Koala Kare Products Model KB-300 series.

2.16 SHELVING UNITS

A. Drawing Designation Q8 - Surface-Mounted Shelf:

1. Description: Fabricated of stainless steel with satin finish, minimum 0.050 in (1.25 mm) (18 gage) thick shelf with 0.0625 in (1.6 mm) (16 gage) thick brackets; minimum 18 in (450 mm) wide by 8 in (200 mm) deep.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-298 X 18.

2.17 MIRRORS

A. Drawing Designation R3 - Surface-Mounted Stainless Steel Framed Mirror Full Length:

1. Description: Fabricated of stainless steel; exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), and with hanging brackets; glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-290 2472.

B. Drawing Designation R7 - Surface-Mounted Frameless Stainless Steel Security Mirror (Detention / Psychiatric Use):

1. Description: Fabricated of stainless steel, hand-selected, and stretcher leveled, with return edges, bonded to 1/4 in (6 mm) thick tempered hardboard backing; with bright polished finish.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-1556 2436.

2.18 ROBE HOOKS

A. Drawing Designation V1 - Surface-Mounted Single Robe Hook:

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1. Description: Fabricated of stainless steel; rectangular profiled pin welded to backplate, with cover anchored with set-screws; project nominal 1-1/2 in (38 mm) from wall surface.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-76717.

2.19 MISCELLANEOUS ACCESSORIES

A. Drawing Designation Y1 - Semi-Recessed-Mounted Hand Dryer:

1. Description: Cover is 18-8 , type 304, 18 gauge stainless steel with matte black finish; UL listed; electronic sensor automatically turning dryer on when hands cross path of sensor and shutting off when hands are either removed or dryer operates for maximum 90 seconds; project maximum 2 in from wall surface; voltage indicated on Electrical Drawings.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3725.MBLK 115v.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, install toilet accessories according to the following, unless otherwise specified in this Section:
 1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. General Requirements: Install toilet accessories level, plumb, and firmly anchored in locations and at heights indicated. Use fasteners that are appropriate to substrate indicated and as recommended by respective product manufacturer.
- B. Grab Bars: Install to withstand downward load of minimum 250 lbf (1.10 kN) according to ASTM F 446.

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- C. Accessories within Shower and Tub Alcoves: Set flanges of accessories in sealant, install sealant in screw holes prior setting screws, and cover screw head prior to snapping on cover, to prevent water infiltration.
- D. Mirrors: Secure to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws.

END OF SECTION

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SECTION 104116

EMERGENCY KEY CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Emergency key cabinets and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturers technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Samples for Verification Purposes: 3 in square sample of exposed metal to indicate compliance with finish specified.

1.3 QUALITY ASSURANCE

- A. Local Authority Approval: Obtain approval of local fire department for keyway access and exact location and type of emergency key cabinet mounting prior to Product Data submittal.
- B. Emergency key cabinet will be required at building entrance(s) designated by the fire department or at the building's fire control room; as appropriate.

1.4 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Knox Company.

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 EMERGENCY KEY CABINET

- A. Product Standard: Knox Company; Knox-Box 3200 Series Hinged or Lift-Off Door Model, as required by local jurisdiction. 1/4 in thick steel plate housing, 1/2 in thick steel door with interior gasket seal and stainless steel door hinge. Box and lock shall be UL Listed.
1. Lock shall have 1/8 in thick stainless steel dust cover with tamper seal mounting capability.
 2. Lock shall have double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
 3. Coordinate other necessary requirements with local fire department.
 4. Provide UL Listed alarm tamper switches as required by local fire department.
- B. Size: One of the following, recessed or surface mount; as indicated on drawings:
1. Recessed Mount: 7 in wide by 7 in high by 3 in deep.
 - a. Provide manufacturers standard recessed mounting kit (RMK) including shell housing and mounting hardware for cast-in construction.
 2. Surface Mount: One of the following as required by local jurisdiction:
 - a. Hinged Door Model: 5 in wide by 4 in high by 3-3/4 in deep.
 - b. Surface Mount - Lift-Off Door Model: 4 in wide by 5 in high by 3-3/4 in deep.
- C. Finish: Manufacturers standard weather resistant polyester powder coat.
1. Color: As selected by Architect from manufacturers standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturers written installation instructions.
 2. Accepted submittals.

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3. Contract Documents.

- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturers instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF EMERGENCY KEY CABINETS

- A. Install in accordance with manufacturer's latest published requirements.
- B. Recess Mount Units: Securely attach recessed mounting kit within cast-in wall construction. Shell housing box shall be flush with face of finished wall and plumb and level to ensure vertical alignment of box.
- C. Tamper Switches: Install switches, including control wiring, as follows:
 - 1. Refer to Division 26 Sections for connection to electrical power distribution system.
 - 2. Coordinate tamper switches with building security system.

END OF SECTION

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SECTION 104400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes fire protection specialties (fire extinguishers, cabinets, accessories) and supplementary items necessary to complete their installation.
- B. Cabinets for fire protection standpipe and hose systems are specified in Division 21.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Fire Extinguishers: Include rating and classification.
 - 3. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.4 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 2. Larsen's Manufacturing Company.
 3. Potter Roemer LLC.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666/A 666M, Type 302 or Type 304 alloy.

2.4 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
- B. Multipurpose Dry Chemical Type; typical unless otherwise indicated or specified: UL-rated 2A:10B:C, 5-lb nominal capacity, in enameled steel container.

2.5 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
- B. Cabinet:
1. Material:
 - a. Stainless steel.
 2. Type: Suitable for 10 lb. Fire extinguisher.
 3. Mounting:
 - a. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 4. Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth. Same metal and finish as door.

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- a. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1) Square-Edge Trim: 1-1/4 in to 1-1/2 in backbend depth.
- 5. Door Material:
 - a. Stainless steel.
- 6. Door Glazing: Manufacturer's standard tempered float glass (clear).
- 7. Door Style: Manufacturer's standard vertical duo panel design.
- 8. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected. Provide minimum 1/2 in thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
- 9. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.6 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish. Provide brackets for extinguishers not located in cabinets.
- B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
 - 1. Bracket-Mounted Extinguishers: Identify with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
 - 2. Fire Extinguisher Cabinet: Identify with the words "FIRE EXTINGUISHER" in black die cut vinyl letters applied to door.

2.7 GENERAL FINISH REQUIREMENTS, FIRE-PROTECTION CABINETS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STAINLESS-STEEL FINISHES, FIRE-PROTECTION CABINETS

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

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- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.
- B. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
 - 2. Fasten cabinets to structure, square and plumb.

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3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 104450

AUTOMATED EXTERNAL DEFIBRILLATORS (AED)

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes cabinets and devices for automated external defibrillators (AED) and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTAL

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for AED devices and cabinets.
 - 1. AED Devices: Include manufacturer, model and rating information.
 - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Verification: For each type of exposed cabinet finish required, prepared on 6 by 6 in square samples and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued. That all components meet the requirements of the specifications and are acceptable to the authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain AED devices and cabinets through one source from a single manufacturer.
- B. Regulatory Approval: Approved by the United States FDA and acceptable to authorities having jurisdiction.

1.5 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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1.6 WARRANTY

- A. **Manufacturer's Warranty:** Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to the following:
 - 2. **Warranty Period:** Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.
- B. **Battery Replacement:** Warranty shall include replacement of batteries that fail within the manufacturer's printed battery life warranty.
- C. **Accessories:** Manufacturer standard warranty for accessories.
- D. **Extension of Warranty:** Provide Owner with the option to purchase extended warranty on devices beyond the manufacturer standard warranty on all components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. **Acceptable Manufacturers:** Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Philips Healthcare; Heartstart Onsite AED.
 - 2. Cardiac Science; Powerheart G3 Plus AED.
 - 3. Defibtech; Lifeline AED.
 - 4. ZOLL Medical Corporation; AED Plus.

2.2 MATERIALS

- A. **Cold-Rolled Steel Sheet:** Carbon steel, complying with ASTM A 1008/A 1008M, commercial quality, stretcher leveled, temper rolled.

2.3 AED DEVICES

- A. **Automated External Defibrillators:** Portable devices capable of detecting cardiac arrhythmias and if necessary delivering automatic synchronized shock to victims of sudden cardiac arrest with the following minimum features:
 - 1. **Design Standards:** Meet the applicable requirements of UL 2601, AAMI DF-39, IEC 601-2-4, EN60601-1, IEC60601-1-2.
 - 2. **Device Classification:** Class II and internally powered per EN60601-1.
 - 3. Display written instructions to user through the rescue process.
 - 4. Battery status indicator.

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5. Automated synchronization features.
6. Programmable.
7. Pacemaker pulse detection feature.
8. Pediatric capability.
9. User replaceable batteries.

2.4 AED CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
- B. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
 1. Construct fire-rated cabinets with double walls fabricated from 0.0478 in thick, cold-rolled steel sheet lined with minimum 5/8 in thick, fire-barrier material.
 2. Provide factory-drilled mounting holes.
- C. Cabinet:
 1. Material: Steel sheet.
 2. Mounting: Semi Recessed Cabinet: Recess cabinets in walls of sufficient depth to suit style of trim indicated.
 3. Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth. Same metal and finish as door.
 - a. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Rolled-Edge Trim: backbend depth as standard with the manufacturer, but not exceeding 2 in .
 4. Door Material: Steel sheet.
 5. Door Glazing: Manufacturer's standard tempered float glass (clear).
 6. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected. Provide minimum 1/2 in thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
 7. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

2.5 ACCESSORIES

- A. Signage and Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Standard industry accepted signs must mark the location of the AED.
- B. Alarm: If required by the authorities having jurisdiction, provide strobes and local audible alarm at each location. Provide all electrical rough-in required and coordinate all electrical requirements for strobes and alarms.
- C. Cabinet Label: "EMERGENCY DEFIBRILLATOR".

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2.6 AED CHARGING STATION

- A. Provide at least one charging station compatible with AED device rechargeable batteries.

2.7 GENERAL FINISH REQUIREMENTS, AED CABINETS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of emergency equipment cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL FINISHES, AED CABINETS

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils .
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified.
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
 - 2. Fasten cabinets to structure, square and plumb.

3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 10 5129

PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: solid Phenolic resin lockers and supplementary items necessary for installation.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
1. Include manufacturer's specifications for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fasteners, and accessories, and recommendations for maintenance.
- B. Shop Drawings: Include plans, elevations, sections, numbering, colors, details, and anchorages/ attachments to other work. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- C. Samples for Verification Purposes: Submit two 6 in (150 mm) square Samples of each color and finish.
- D. Maintenance Instructions: Provide manufacturer's printed instructions for cleaning and maintenance of installed Work.
- E. Qualification Data: For manufacturer and installer.
1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
 2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.
- F. Warranty: Sample of warranty.
1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with experience in successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects, and with sufficient production capability, facilities, and personnel to produce required Work.

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B. Installer Qualifications:

1. Experience: Installer with experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in manufacturer's original packaging in accordance with manufacturer's instructions. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.
- B. Protect finished surfaces from soiling and damage during handling and installation. Cover with polyethylene film or other protective covering.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and wall openings to ensure actual dimensions correspond to Established Dimensions

1.6 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor defects for a period of 20 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Hollman
2. Accu Tec Manufacturing.
3. ASI Storage Solutions Inc.
4. Columbia Lockers, a Division of PSiSC
5. Summit Lockers Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Flame Spread: When tested in accordance with ASTM E 84, solid phenolic material shall meet or exceed all requirements for Class B finish and shall carry a Class B Fire Rating Certification in accordance with the requirements of NFPA and ICC. Class B Fire Rating Certification shall be in the name of the Locker Manufacturer and shall be less than six (6) months old.

1. Flame Spread: Shall not exceed 75.
2. Smoke Developed: Shall not exceed 450.

- B. Solid Phenolic material shall comply with the following requirements:

1. Graffiti Resistance: Shall prove resistant to all chemicals tested for a period of 1 to 10 minutes and shall leave no mar or blemish on the surface when cleaned, per ASTM D 6578.
 - a. Material shall have guaranteed surface clean ability from permanent markers and shall have Non-Ghosting properties
2. Scratch Resistance: Shall prove to be scratch resistant when the maximum Load Value exceeds 10 kilograms, per ASTM D 2197.
3. Impact Resistance: Shall withstand an Impact Force Value in excess of 45 inch-lbs, per ASTM D 2794.
4. Screw Holding Strength: Shall withstand a direct pull force that exceeds 2,500 lbs per fastener, per ASTM D 1037.
5. Tensile Strength: Modulus of Elasticity of 1.55 Million PSI.
6. Shear Strength: 2,000 PSI minimum.
7. Compression Strength: 24,000 PSI minimum.
8. Water Absorption: Shall have a Water Absorption Rate of less than 0.37%, per ASTM D 570.

2.3 MATERIALS

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

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- B. Material: Solid phenolic with a high pressure melamine matte finish surface made as an integral part of the core material. Surface and edges shall be non-porous and shall not support fungus or bacteria. Provide material which has been selected for uniform color, surface flatness and smoothness. The following conditions are not acceptable:
1. Laminated surfaces.
 2. Exposed surfaces which exhibit discolorations, pitting, seam marks, roller marks, stains, telegraphing of core material, or other imperfections on finished units.
 3. Defects such as chipping along edges and corners.
- C. Minimum Finished Thicknesses:
1. End Panels and Toe Kick Plates: 0.75 in (19 mm).
 2. Tops, Bottoms, and Shelves: 0.75 in (19 mm).
 3. Sides and Locker Backs: 0.3125 in (8 mm).
- D. Colors: As indicated in Division 01 Section "Interior Design Selections".

2.4 FABRICATION

- A. General: Provide factory pre-assembled locker units. Lockers shall be complete with all hardware and accessories listed above. Knock down units are unacceptable.
- B. Locker Body: Mortise and tenon construction, with components mechanically fastened together with stainless steel fasteners.
- C. Locker Shelves: Mortised into side walls of at location determined by Architect. Relocation of shelves in the field shall be possible without the need for special tools or welders.
- D. Slope Tops, End Panels, and Toe Kick Plates: Shall be manufactured of the same color and material as the Locker Doors:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standard: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

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3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Installation of phenolic lockers:
 - 1. Install Lockers rigid, straight, plumb, and level.
 - 2. Scribe and cut millwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 3. Through bolt locker boxes together with stainless steel theft proof Torx head with pin, through bolts.
 - 4. Anchor locker boxes to substrate with provided anchor devices.
 - 5. Install slope tops, end panels, filler strips and accessories in accordance with written instructions.

3.5 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust hardware according to manufacturer's written instructions for proper operation.

3.6 PROTECTION

- A. Provide final protection and maintain conditions that ensure lockers are without damage or deterioration at the time of Substantial Completion. Clean all exposed surfaces of lockers and hardware.

END OF SECTION

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SECTION 105713

WALL MOUNTED COAT RACK AND SHELF

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Wall mounted coat rack and shelf along with supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1.3 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.4 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. EMCO Specialty Products, Inc.; Model R1, satin finish; identified on the drawings as Miscellaneous Specialty and Equipment item CR.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
 - 1. Install wall blocking as required.

3.4 INSTALLATION

- A. Install coat rack and shelf level and plumb, according to manufacturers instructions.
 - 1. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer.
- B. Install wall strip using fasteners required for wall type. Height to be based on specified height of shelf.
- C. Install brackets, slat and rod using fasteners approved by manufacturer.

END OF SECTION

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SECTION 111300

LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes loading dock equipment and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Include accessories, details of construction relative to materials, dimensions of individual components, profiles, and finishes.
 - 1. Dock Lift: Include rated capacities for each unit.
- B. Shop Drawings: Show details of fabrication and installation. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts anchored to permanent construction.
 - 2. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring for the following:

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For loading dock equipment to include in the maintenance manuals specified in Division 01. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of loading dock equipment manufacturer for both installation and maintenance of the type of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Dock Lift Standard: Comply with MH 29.1, "Safety Requirements for Industrial Scissors Lifts."
- C. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of the various items of loading dock equipment and are based on the specific types and models indicated. Similar equipment by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.
- D. Preinstallation Conference: Conduct conference at Project site.

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1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of loading dock equipment.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.5 WARRANTY

- A. Warranty Period: Two years from date of Substantial Completion.

1. Warranty shall be for unlimited usage of the leveler for the specified rated capacity over the term of the warranty.

1.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of dock equipment Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.
1. Perform maintenance, including emergency callback service, during normal working hours.
- B. Continuing Maintenance Service: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain each loading dock equipment component as a complete unit from one source and by a single manufacturer.

2.3 TRUCK RESTRAINTS

- A. General: Provide manufacturer's standard mechanical device designed to engage truck's rear-impact guard and hold truck at loading dock. Restraint shall consist of an iron or steel restraining arm that raises until contacting rear-impact guard. Arm shall move vertically, automatically adjusting to varying height of truck due to loading and unloading operations.

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- B. Automatic Operating System: Provide manufacturer's standard electrically or hydraulically powered restraint, activated by a remote-control station.
 - 1. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system. See Division 26 Sections.
 - 2. Remote-Control Station: Provide a single-button station of the constant-pressure type, enclosed in a NEMA ICS 6, Type 12 box. Engage restraint by holding the button depressed, and release restraint by releasing button.
- C. Operating Range: Restrain rear-impact guard within a range from 11 to 30 in vertically above driveway, and from 0 to 12 in horizontally in front of dock bumpers.
- D. Mounting: Provide manufacturer's standard mounting method as follows:
 - 1. Wall Mounted: Unit with mounting plate, designed for attachment to dock face by welding or bolting.
- E. Restraining Capacity: Not less than 30,000 lb.
- F. Communication System: Provide manufacturer's standard system, as follows:
 - 1. Warning Signs: Set of surface-mounted signs.
 - 2. Signal Lights: Set of illuminated exterior and interior signal lights to indicate device's status to both controller and truck driver.
 - a. Lights shall be activated automatically when device engages rear-impact guard.
 - 3. Alarm: Audible and visual system indicating that rear-impact guard is not engaged.
- G. Interlocks: Interconnect truck restraint with dock leveler to permit simultaneous activation of leveler and truck restraint.
- H. Finish and Color: Manufacturer's standard paint applied to factory-assembled and -tested truck restraints before shipping. Paint surfaces in manufacturer's standard color.
- I. Manufacturers:
 - 1. Blue Giant Equipment Corporation
 - 2. Kelley
 - 3. McGuire
 - 4. Pioneer Loading Dock Equipment
 - 5. Poweramp Systems, Inc.
 - 6. Rite-Hite Corporation
 - 7. Serco

2.4 DOCK LIFTS (SCISSORS LIFTS)

- A. General: Provide manufacturer's standard hydraulic dock lift of capacity, size, and construction indicated, consisting of a nonslip steel platform with beveled toe guards on all four sides, steel scissor legs, and hydraulic operating system, complete with controls, safety devices, and accessories required.

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- B. Type: Provide stationary single-scissors-type hydraulic dock lift designed for permanent, recessed installation in a preformed concrete pit at location indicated.
- C. Rated Capacity: Provide lifting capacity of not less than 8000 lb with 6500 lb axle load at ends and 5000 lb axle load at sides.
- D. Vertical Travel: Provide maximum vertical travel of 60 in from a lowered height of 12 in for a raised height of 72 in.
- E. Travel Speed: Nominal raising speed of 8 fpm to 12 fpm.
- F. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.
 - 1. Platform: Fabricate platform from heavy steel plate with beveled toe guards on all four sides to comply with requirements of MH 29.1. Provide matching, hinged, throw-over bridge where indicated and removable handrails.
 - a. Platform Surface: Nonskid, safety-tread deck plate.
 - b. Platform Size: 6 ft wide by 10 ft long.
 - 2. Hinged Bridge: Provide hinged, throw-over bridge bolted to full-length, heavy-duty, piano-type hinge welded to toe guard at end of platform. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of bridge to minimize obstructing wheels of material-handling vehicles.
 - a. Bridge Material: Nonskid, safety-tread steel plate.
 - b. Bridge Size: 18 in long by 6 ft wide.
 - 3. Scissors Mechanism: Fabricate leg members from heavy, steel-formed tube or plate members to provide maximum strength and rigidity.
 - 4. Cylinders: Equip lift with not less than two heavy-duty, high-pressure, hydraulic, ram-type cylinders. Rams shall be either direct-displacement plunger or rod-and-piston type with positive internal stops as standard by manufacturer. Cylinder rods shall be chrome plated and polished to prevent rusting.
 - 5. Bearings: Provide pivot points with permanently lubricated antifriction bushings or sealed ball bearings for minimum maintenance.
- G. Operation: Provide manufacturer's standard, self-contained, electric, hydraulic power unit for raising and lowering lift, controlled from a remotely located push-button station.
 - 1. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system. See Division 26 Sections.
 - 2. Power Unit: Provide manufacturer's standard, self-contained, remotely located power unit of size, type, and operation needed for capacity of lift indicated. Power unit shall consist of a continuous-duty motor, high-pressure gear pump, valve manifold, oil-line filters, and oil reservoir.
 - a. Manifold shall contain a relief valve, check valve, pressure-compensated flow-control valve and solenoid valve, and provisions for lowering lift manually if power fails.

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- b. Oil-line filters shall include one for the oil reservoir, one for the valve manifold, and one for the lift itself.
 - c. Rate of Descent Protection: Provide manufacturer's standard pressure compensated flow control to limit down speed.
- 3. Remote-Control Station: Provide a weatherproof, multibutton control station of the constant-pressure type with up and down push buttons. Controller shall consist of a magnetic motor starter with three pole-adjustable overloads and 24-V control transformer with a 4-A, fused secondary prewired to terminal strips and enclosed in a NEMA ICS 6, Type 12 box.
 - a. Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.
- H. Safety Devices: Provide manufacturer's standard and optional safety devices as follows:
 - 1. Removable Handrails: Provide removable handrails on two sides of platform with a single, removable chain across each end. Handrails shall be 42 in high with a midrail and 4 in high kick plate at bottom. Mount rail sockets flush with platform surface.
 - 2. Maintenance Leg: Provide manufacturer's standard, removable, safety maintenance leg.
 - 3. Toe Protection: Provide manufacturer's standard toe protection along entire unprotected side of lifts.
- I. Finish and Color: Manufacturer's standard paint applied to factory-assembled and -tested dock lifts before shipping. Paint toe guards yellow with black stripes to comply with ANSI Z535.1, and paint remainder of surfaces in manufacturer's standard color.
- J. Manufacturers:
 - 1. Advance Lifts, Inc.
 - 2. Autoquip Corporation
 - 3. Blue Giant Equipment Corporation
 - 4. Kelley
 - 5. Serco

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate surfaces to receive loading dock equipment and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.
- B. Examine roughing-in for electrical systems for dock equipment to verify actual locations of connections before installation.
- C. Examine walls and floors of pits for suitable conditions where recessed dock equipment is to be installed. Pits shall be plumb and square, and properly sloped for drainage from back to front of dock.

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3.2 PREPARATION

- A. General: Coordinate installation of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
- B. Clean recessed pits of debris.

3.3 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's detailed written instructions for installing loading dock equipment.
 - 1. Install equipment, motor, pump, control stations and wiring, safety devices, and accessories as required for a complete installation.
- B. Electrical Connections: Rough-in electrical connections according to requirements in Division 26.

3.4 TRUCK RESTRAINT INSTALLATION

- A. Attach truck restraints in a manner that complies with requirements for arrangement and height required for device to engage vehicle rear-impact guard.
 - 1. Anchor restraint to dock face with expansion anchors and bolts.
- B. Interconnect control panel and signals according to manufacturer's written installation instructions.

3.5 DOCK LIFT (SCISSORS LIFT) INSTALLATION

- A. Coordinate forming recessed pit for dock lifts to ensure that depth is adequate to accommodate lift in proper relation to loading platform.

3.6 ADJUSTING

- A. Adjust loading dock equipment for safe, efficient operation.

3.7 CLEANING AND PROTECTING

- A. Restore marred, abraded surfaces to their original condition.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure loading dock equipment is without damage or deterioration at the time of Substantial Completion.

3.8 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

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1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

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SECTION 112400

BUILDING MAINTENANCE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Building maintenance equipment system and supplementary items necessary for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
- C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.
- D. Coordination of Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.

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1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 1. Locate anchorages to suit maintenance equipment to be used on the Project. Considerations shall be made addressing such items as reach, rigging, spacing, roof edge condition, and other similar items.
 2. Design anchor components to provide adequate attachment to the building structure that is suited to suspended maintenance industry practices and to ensure compatibility with equipment to be provided in this Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer/fabricator's Project Acceptance Document: Certification by the manufacturer/fabricator that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
 1. Posted Record Drawings: Provide plastic laminate encased record roof plan at each point of access to roof indicating equipment locations and details.
 2. Inspection Forms: Copy of Equipment Manual & Inspection Log Book including completed "Initial Inspection - Certification for Use" and "Inspection Sign-Off" forms.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
 1. Insurance Coverage: Manufacturer/fabricator shall carry specific liability insurance (products and completed operations) in the amount of \$10,000,000.00 to protect against product / system failure of building maintenance equipment.
 2. Litigation Disclosure: If any, submit written explanation of nature of litigation resulting in failure of equipment.
- B. Installer Qualifications:

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1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
1. HighRise Systems, Inc.
 2. Guardian Fall Protection.
 3. Pro-Bel Enterprises, Ltd.
 4. Rooftop Anchors, Inc.
 5. Spider, a Division of SafeWorks, LLC.
 6. Sky Rider Equipment Co., Inc.
 7. Tractel Group, Swingstage Division.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.
- B. Design Loads: Engineer to withstand design loads including but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable local building codes, and as indicated. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.
- C. Delegated Engineering Quality Standards: Determine allowable working stresses of materials according to authorities having jurisdiction, applicable local building codes, or information indicated, or, if standard not indicated, use latest editions of following:
1. Structural Steel: AISC S342L with Supplement No. 1, "Load and Resistance Factor Design Specification for Structural Steel Buildings".
 2. Aluminum: AA ADM-1.
 3. Window Cleaning Safety: ANSI/IWCA I-14.1 and OSHA 1910, Subpart D.
 4. Electrical: NEC with UL listed devices.
- D. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

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- E. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.
 - 1. Equipment Layout and Coordination: Locate anchorages to suit suspension equipment that will be used on building with respect to items such as reach, rigging, spacing, roof edge condition, and similar items. Coordinate components with architectural and structural concept expressed in Contract Documents. Changes to Contract Documents, including reinforcing and concrete materials and installation, necessitated by equipment shall be considered as a substitution.
 - 2. Interface with Roof Coverings: Exposed portion of roof mounted components shall not be less than height indicated so that it is suitable for enclosure by sheet metal flashing.

2.4 MATERIALS

- A. Metal Material Qualities: Metal used for components with not less than strength and durability properties required to fulfill performance requirements for components.
- B. Steel Plates, Shapes, and Bars: ASTM A 36 / A 36M.
- C. Steel Pipe: ASTM A 53 / A 53M.
- D. Aluminum:
 - 1. Extruded Bars, Tubes and Shapes: ASTM B 221 / B 221M.
 - 2. Plate and Sheet: ASTM B 209 / B 209M.
 - 3. Drawn Seamless Tubes: ASTM B 483 / B 483M.
 - 4. Castings: ASTM B 26 / B 26M.
- E. Stainless Steel:
 - 1. Tubing: ASTM A 554, Grade MT 304.
 - 2. Pipe: ASTM A 312 / A 312M, Grade TP 316.
 - 3. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316.
 - 4. Bars and Shapes: ASTM A 276, Type 316.
 - 5. Castings: ASTM A 743 / A 743M, Grade CF 8 or CF 20.
 - 6. Wire Rope: ASTM A 492, Type 316 wire, stranded according to engineered design.
- F. Welding Rods and Bare Electrodes: Selected according to AWS specifications for metal alloy to be welded.

2.5 FASTENERS

- A. Fastener Materials: Stainless steel fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items, including to other types of construction indicated.
- B. Stainless Steel Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

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2.6 COMPONENTS

- A. Component Quality: Size, thicknesses, and materials with not less than strength and durability properties required by delegated engineering.
- B. Davit Base:
 - 1. Roof Mounted: Assembly composed of welded steel plates and steel pipe suitable for bolted or welded anchoring to building roof structure; capable of receiving and supporting davit arms and socket housing; galvanized after fabrication.
 - 2. Wall Mounted: Assembly composed of welded steel plates and steel pipe suitable for bolted or welded anchoring to building wall or parapet; capable of receiving and supporting davit arms and socket housing; galvanized after fabrication.
- C. Davits:
 - 1. Arms: High profile type tall enough to allow platform to be swung over building parapet into working position and back.
 - a. Assembly composed of treated structural aluminum sections of sufficient length and size equipped with carrying handles to allow movement to be accomplished by not more than 2 people.
 - b. Capable of rotating 360 degrees.
 - c. Permanently attached bearing assembly consisting of cast aluminum housing and bearing system transmitting bending and vertical load to socket housing.
 - d. Separate mechanical safety cable mounted in davit between wire rope rigging point and davit bearing block.
 - e. Rotation locks.
 - 2. Socket Housing: Assembly composed of welded steel plates and hard rubber wheel suitable for moving from davit base to davit base; capable of receiving and supporting davit arms; galvanized after fabrication.
 - 3. Data Plate: Permanent, non-corrosive plate clearly stating maximum service capacity and allowable number of users; prominently displayed at access points to system.
- D. Safety Tiebacks:
 - 1. Wall Mounted: Minimum 3/4 in diameter stainless steel bar, formed in minimum 1- 1/2 in U-shape eye opening, welded to stainless steel base plate suitable for bolted mounting indicated.
 - 2. Roof Mounted: Minimum 3/4 in diameter stainless steel bar, formed in minimum 1-1/2 in U-shape eye opening, welded to stainless steel cap attached to galvanized steel pipe; field welded to either steel building structure, or steel embed plates in concrete.
- E. Rigging Sleeves: Galvanized steel pipe, not less than 6 in inside diameter, with flanges for mounting indicated, with removable galvanized steel cap assembly tethered to pipe assembly.
- F. Intermittent Stabilization Anchors:
 - 1. Surface Mounted Buttons: Exposed stainless steel rod with button-like head with threaded anchoring device of size and configuration for attachment to building facade.

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2. Recessed Mounted Detent Pins: Recessed stainless steel insert with outside end machined to receive detent pin and inside end with threaded anchoring device of size and configuration for attachment to building facade.
- G. Accessories: Stainless steel brackets, shims, clips, and other items as required for complete assemblies. Pins and fittings subject to removal secured by wire rope lanyards.

2.7 FABRICATION

- A. Shop Assembly: Preassemble components in shop to greatest extent possible.
- B. Cutting and Forming:
 1. Cut, drill, and punch metals cleanly and accurately.
 2. Remove burrs and ease edges to a radius of approximately 1/32 in, unless otherwise indicated.
 3. Remove sharp or rough areas on exposed surfaces.
 4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
 5. Form exposed Work true to line and level with accurate angles and surfaces and straight edges.
- C. Welding:
 1. Weld continuously using materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Assembling:
 1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 2. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated.
 3. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water; provide weep holes where water may accumulate.

2.8 FINISHES

- A. Galvanized Steel: After fabrication of component, apply zinc-coating by hot-dip process complying with following requirements:
 1. ASTM A 153 / A 153M for galvanizing iron and steel hardware.
 2. ASTM A 123 / A 123M for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 in thick and heavier.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform building maintenance equipment Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's installation written instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF BUILDING MAINTENANCE EQUIPMENT

- A. Install components in locations shown on shop drawings in plumb and true vertical and horizontal alignment.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Load Testing: After installation, conduct full live load and operational tests under maximum design live loading conditions, according to ANSI/IWCA I-14.1. Operate over full range (horizontally and vertically) of building surfaces for which equipment was intended to maintain.
- C. Repairs and Corrections: Correct component deficiencies to assure compliance. Retesting and/or reinspection failing to meet specified requirements shall be done at no additional cost to Owner.

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3.6 DEMONSTRATION

- A. Operational and Maintenance Training: Provide on-site instruction by factory-trained and certified technicians for Owner's personnel. Provide bound copies of training materials for each attendee.

END OF SECTION

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SECTION 115213

PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

- A. Perform work required to complete the projection screens indicated by the contract documents and furnish supplementary items necessary for their proper installation.

1.2 ACTION SUBMITTALS

- A. Samples: Submit for approval samples of screen materials showing construction and finish specified.
- B. Shop Drawings: Submit manufacturer's literature and mark sufficiently to indicate compliance with these specifications. Show locations, methods of supporting, methods of anchoring and finishes of each projection screen.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Da-Lite Screen Company
 - 2. Draper Inc.
 - 3. Stewart Filmscreen Corporation

2.2 MATERIALS

- A. Projection Screens (Electrically Operated): Da-Lite Screen Co., Inc., "Professional Electrol" Automatic Electric Projection Screen, size as indicated on the drawings.
 - 1. Screen shall be electrically operated with a 120 volt AC2.4 amp, three (3) wire quick reversal motor, especially designed for the purpose. Motor shall be ball bearing type, and oiled for life, with automatic thermal overload cut-out and integral interlocking gears.
 - 2. Screen operating system shall have pre-set but accessible limit switches to automatically stop screen fabric in the "up" and "down" positions. Stop action shall be positive, to prevent coasting.
 - 3. System shall include a rigid metal roller at least 3 in diameter (to be used for screens 12' or less in width), or 5-3/4 in diameter (to be used on screens 14' to 18' in width), or 7 in diameter (to be used on screens where either height or width exceeds 20'). Roller shall be mounted on two cast aluminum brackets equipped with self-aligning bearings.

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4. Screen surface shall be flame retardant and mildew resistant, black masking borders, and with the following viewing surface:
 - a. Matte white.
 5. Case shall be of wood with double top for extra rigidity and sound deadening.
 6. Case shall be finished with a primer coat, ready to accept final finish by others.
 7. Heavy metal adjustable brackets shall be furnished for mounting screen as follows:
 - a. Ceiling.
 - b. Walls.
 - c. Structure above ceiling.
 8. System shall be complete with three (3) position control switch in box with cover plate.
 9. The complete screen unit shall be "Listed by Underwriters' Laboratories, Inc.", and shall bear the re-examination markers of the Underwriters' Laboratories, Inc.
- B. Projection Screens (Manually Operated): Da-Lite Screen Co., Inc. Model "Video B", manually operated spring roller type Screen, size(s) as indicated.
1. Case: Heavy gage octagon shape steel case with flat back design with baked enamel finish, fitted with heavy duty chrome case end caps concealing roller ends with integral bearing surface or steel inner caps to support roller.
 2. Mounting Brackets: Plated steel brackets attached to end caps for wall mounting by means of slotted screw holes and ceiling mounted by means of plated steel hanger rings. Furnish heavy angle adjustable steel extension wall brackets.
 3. Screen Fabric:
 - a. Viewing surface shall be as follows with masking borders on flame retardant and mildew resistant fabric.
 - 1) Matte white.
 - 2) Glass-beaded.
 - b. Bottom of fabric shall be mounted into a metal strip in a tubular steel slat finished in baked enamel. Ends of slat shall be protected by plastic caps.
 - c. Fabric shall be mounted into a metal strip in a metal "camlok" roller system without tape, glue, staples or cords, so that fabric may be easily replaced yet, cannot be pulled from roller.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be as indicated on the Drawings.
- B. Installation shall be in accordance with the manufacturer's latest published requirements, specifications and details.

END OF SECTION

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SECTION 11 5300

LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cabinet, Lead-Lined
2. Cabinet, Tall Flammable Storage
3. Ice Machines
4. Shelving, Floor Mounted Wire
5. Table, Optical
6. Decontamination Sink

1.2 RELATED SECTIONS

- A. Division 22: Furnishing and installation of plumbing utilities and final connections to service fittings.
- B. Division 23: Furnishing and installation of exhaust ductwork and equipment, and final connection to exhaust devices.
- C. Division 26: Furnishing and installation of electrical utilities and final connections to casework and accessory equipment.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.
 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination of Contract Documents and Work:
 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

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2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data for each component and item of laboratory equipment specified. Include component dimensions, configurations, construction details, joint details, and attachments. Indicate location, size and service requirements for each utility connection.
- B. Manufacturer's operating and maintenance manuals.
- C. Warranty: Sample warranty.
 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 QUALITY ASSURANCE

- A. Manufacturer shall have at least 5 years' experience in the fabrication of the specified equipment and shall have 10 installations of equal or larger size.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Schedule delivery of equipment so that spaces are sufficiently complete and that material can be installed immediately following delivery.
- B. Handling: Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.

1.7 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met:
 1. Windows and doors are installed, and the building is secure and weathertight.
 2. Ceiling, overhead ductwork, and lighting are installed.
 3. All painting is completed, and floor tile is installed.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials

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and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.
- C. Factory Applied Finish Warranty: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.
1. Coverage includes but is not limited to the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 1 year from date of Substantial Completion.
- D. If exploratory work is required to determine the cause of the defects, the cost of such work shall be borne by the Contractor if the work is found to be defective as judged by the Architect.
- 1.9 COORDINATION
- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers/Fabricators and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers/fabricators listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 CABINET, LEAD-LINED

- A. Manufacturers:

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1. Biodex Medical Systems, Inc. (Model Lead Lined Laboratory Furniture)
2. NucleMed nv/sa
3. Reich Consulting Services, Inc.

- B. Size: Radioisotope storage cabinet, sink and waste cabinet; size as indicated on drawings. Radioisotope preparation enclosure base cabinet; size as indicated on drawings.
- C. Construction: Cabinets shall be constructed as specified for laboratory casework and shall be lined with 1/4 inch(6 mm) thick x-ray quality, 99.9 percent lead, free of cuts, punctures, and gouges. Lining shall be lapped 1 inch(24 mm) at corners and door lining shall overlap cabinet interior lining.
- D. Finish: Powder coat finish. Color shall be a custom color as selected by the architect.

2.3 CABINET, TALL FLAMMABLE STORAGE

- A. Acceptable Manufacturers:
1. Justrite Manufacturing Company, L.L.C.
 2. Eagle Manufacturing Company
 3. Securall
- B. Design: Construct cabinet in accordance with OSHA Regulations and the requirements of NFPA 30, National Fire Protection Association, Flammable and Combustible Liquids Code. Cabinets shall limit the internal temperature at the center 1 inch(24 mm) from the top to not more than 325 degrees Fahrenheit(165 degrees Celsius) when subjected to the fire test for storage cabinets as described in NFPA 30.
- C. Casing: Bottom, top, back, door, and sides of cabinet shall be at least 18 gage(1.2 mm) sheet steel, double walled with 1-1/2 inch(36 mm) air space. Joints shall be welded airtight. Provide with adjustable zinc plated leveling legs.
- D. Door: Provide with continuous piano hinge and a 3-point latch arrangement with door sill raised at least 2 inches(50 mm) above the bottom of the cabinet to retain spilled liquid within the cabinet. Provide self-closing self-latching door(s) with fusible link(s) to hold doors wide open and melt at 74 degrees Celsius for automatic closure. Provide with keyed lock.
- E. Ventilation: Do not ventilate cabinet unless required by local authorities. Seal vent openings with plugs, supplied by the manufacturer.
- F. Shelving: Provide with three 18 inch(450 mm) deep, full width adjustable shelves.
- G. Grounding: Provide a grounding lug connection at back of cabinet.
- H. Identification: All flammable storage cabinets shall be marked with conspicuous red lettering on a contrasting background: FLAMMABLE—KEEP FIRE AWAY.
- I. Color: Selected by the Owner's Representative
- J. Finish: Finish as specified for metal laboratory casework except interior shall be triple epoxy coated.

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2.4 ICE MACHINE

A. Acceptable Manufacturers:

1. Hoshizaki America
2. Scotsman Ice Systems
3. Manitowoc Ice

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Basis of Design product: Hoshizaki America (Model F-500BAJ)

C. Size: 30-3/8 inches(770 mm) high with legs, by 17-5/16 inches(440 mm) wide, by 20-1/2 inches(520 mm) deep.

D. Capacity: Ice making capacity of 55 pounds(25 kg) in 24 hours with a bin capacity of 28 pounds (12.5 kg).

E. Refrigeration System: 1/5 horsepower(150 watts) compressor with air cooled condenser.

F. Electrical: 120/60/1, 6.1 amp. Provide with grounded cord and plug.

2.5 SHELVING, FLOOR MOUNTED, WIRE

A. Available Manufacturers:

1. InterMetro Industries Inc. (Model Super Erecta)
2. Eagle Group (Model QuadTruss)

B. Size: 74 inch(1880 mm) high, widths are 18 inch(450 mm) and/or 24 inch(600 mm), lengths are 30 inch(760 mm), 36 inch(915 mm), 42 inch(1060 mm), 48 inch(1220 mm) maximum width to create the lengths of run as shown on the drawings. Provide each shelf unit with 5 tiers

C. Construction:

1. Open wire shelves, adjustable on 1 inch(25 mm) centers, constructed of 9 gage(3.8 mm) wire ribs, perpendicular support ribs, and side reinforcing members all around. Provide four 1 inch(25 mm) diameter vertical support posts with ringed grooves 1 inch(25 mm) apart for each unit.
2. Materials: Shelves and posts of Type 304 stainless steel.

2.6 TABLE, OPTICAL

A. Acceptable Manufacturers:

1. Newport Corporation Model (Table M-ST-UT2-410-12 Legs I-2000-N23.5)
2. Kinetic Systems Inc. Model (Add Model Number)
3. Thorlabs Model (Add Model Number)

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B. Tabletop:

1. Size: 30 inches(3000 mm) Deep by 5 Feet(1200 mm) Wide by 30 Inches 305 mm High.
2. Flatness: ± 0.004 Inches over 24 Inches 0.1 mm over 600 mm) square.
3. Construction: Honeycomb core, vertically bonded closed cell, 0.25 mm steel sheet materials, 0.76 mm triple core interface.
4. Working surface: 400 Series ferromagnetic stainless steel, 4.8 mm thick with integrated damping layer.
5. Tuned Damping: Narrowband hydraulic vibration absorbers.
6. Broadband Damping: Constrained layer core damped working surface and composite edge finish.
7. Mounting Hole Pattern: M6-1.0 holes on 25 mm grid.
8. Maximum Dynamic Deflection Coefficient: 0.8×10^{-3}
9. Maximum Relative Motion Value: $<4.0 \times 10^{-7}$ mm
10. Hole/Core Sealing: Easy clean conical cup 19 mm deep, non-corrosive high impact polymer material.

C. Legs: Self-leveling, self-centering pneumatic vibration isolators 597 mm high.

1. Maximum Load Capacity (set of Four): 3600 kg.
2. Height Adjustment: 0.5 Inches (33 mm).
3. Valves: Provide leveling valves.
4. Re-Leveling Accuracy: ± 0.25 mm.
5. Setting Time: 1.5 seconds typical.
6. Maximum Air Pressure: 90 psi (1.4 – 6.0 kg/cm²).
7. Vertical Isolation:
 - a. Resonant Frequency: 1 Hz
 - b. Transmissibility at 5Hz: 94 Percent
 - c. Transmissibility at 10Hz: 98 Percent
 - d. Amplification at Resonance: 13 dB
8. Horizontal Isolation:
 - a. Resonant Frequency: 1.5 Hz
 - b. Transmissibility at 5Hz: 85 Percent
 - c. Transmissibility at 10Hz: 95 Percent
 - d. Amplification at Resonance: 13 dB
9. Finish: Black paint.

2.7 DECONTAMINATION SINK

- A. Basis of Design: abc-actini; Sink Model 100 liters/day: abc-actini.com.
1. High risk model for effluent of higher criticality (BSL3)
- B. Material: Type 316L stainless steel.
- C. Operating Conditions:
- D. Treated Product: Liquid biohazardous effluent.

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E. Treated Conditions:

1. Outlet temperature: <75 degrees C with the High Risk Biowaste.
 - a. Doubled valves with safety chamber with temperature measurement in-between.
2. Flow rate: 100 liters per day.
3. Number of cycles: 27 cycles per day.

F. Utilities Requirements:

1. Available voltage: 110 V, 60 Hz.

G. Dimensions:

1. Width: 24 inches.
2. Length: 28 inches.
3. Height: 49 inches, faucet included.

H. Options: Add Remote Access.

2.8

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

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- A. Miscellaneous laboratory equipment shall be installed in strict accordance with the manufacturer's recommendations, including recommended operating and servicing clearances.
- B. Plumbing hookups under Division 22.
- C. Mechanical hookups under Division 23.
- D. Electrical hookups under Division 26.
- E. Check project for conditions that affect work. Do not begin installation until unsatisfactory conditions are corrected.

3.5 ADJUSTING

- A. Repair or remove and replace defective work as directed by Owner's Representative upon completion of installation.
- B. Adjust moving or operating parts to function smoothly.

3.6 CLEANING AND PROTECTION

- A. Clean shop finished equipment, touch up as required, and remove and refinish damaged or soiled areas.
- B. Cover equipment for protection against soiling and deterioration during the remainder of construction period.
- C. Equipment shall be protected before, during and after installation. Damaged materials due to improper protection shall be cause for rejection.

END OF SECTION

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SECTION 11 5313

LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Benchtop Chemical Fume Hoods
2. Radioisotope Fume Hoods
3. ADA Accessible Fume Hoods
4. Fume Hood Base and Special Cabinets

B. Related Sections:

1. Section 123553.33: Laboratory Casework and Furnishings.
2. LEED Certification Procedures.
3. Division 22: Furnishing and installation of plumbing utilities and final connections to fume hoods.
4. Division 23: Furnishing and installation of exhaust duct work and equipment, and final connection of fume hoods.
5. Division 23: Furnishing and installation of exhaust controls and final connections to hoods.
6. Division 26: Furnishing and installation of electrical utilities and final connections to fume hoods.

1.2 DESIGN REQUIREMENTS

A. Factory UL 1805 Classified.

B. Fume hoods shall function as ventilated, enclosed work spaces, designed to capture and confine exhaust fumes, vapors and particulate matter produced or generated within the enclosure.

C. Manufacturers to provide high performance fume hoods. Hoods which achieve a reduction in volumetric flow by restricting the sash opening area do not qualify as High Performance fume hoods unless they also meet the performance requirements through the maximum sash opening. The "maximum sash opening" shall be considered a vertical sash opening not less than 25 inches high off the fume hood work surface.

1. High Performance Fume Hoods are hood designs that provide a reduction in the required exhaust air volume, when compared to the volume required for the same size fume hood to operate with a face velocity of 100 FPM through a fully opened vertical sash and provides containment levels equivalent or superior to ASHRAE 110 tracer gas test ratings of 4.0 AM 0.05, and 4.0 AI/AU 0.10, with a face velocity of 60 FPM or less through the fully opened vertical sash.

D. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 10 percent of the average face velocity at any designated measuring point as defined in this section.

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- E. Average illumination of work area: Minimum 80 footcandles(860 lx). Work area shall be defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches(710 mm).
- F. Maximum average static pressure loss readings taken three diameters above the hood outlet from four points, 90 degrees apart not to exceed:

Face Velocity	Measured Static Pressure Loss (W.G.)
75 FPM	0.18 inches
100 FPM	0.30 inches
125 FPM	0.45 inches
150 FPM	0.60 inches

- G. Fume hoods shall be constructed in such a manner as to cause no perceptible increase in sound pressure level over the mechanical exhaust system.
- H. Fume hood to have set baffle system. No adjustable baffles allowed.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination of Contract Documents and Work:
 - 1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 - 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 SUBMITTALS

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- A. Product Data: Submit manufacturer's data for each type of hood specified. Include component dimensions, configurations, construction details, joint details, and attachments. Indicate location, size, and service requirement for each utility connection.
 - B. Shop Drawings:
 - 1. Provide 3/8 inch = 1'-0" (1:33) scale minimum elevations of individual and battery of hoods showing cross sections, rough-in and anchor placements, tolerances, and clearances. Indicate relation to other laboratory equipment, surrounding walls, windows, doors, and other building components.
 - 2. Provide 1/8 inch = 1'-0" (1:100) scale minimum rough-in plan drawings for coordination with trades.
 - 3. Provide 1 set electronically.
 - C. Top Samples: Submit product sample of each type of benchtop.
 - D. Finish Samples: Submit 3 inch by 5 inch (75 mm by 125 mm) samples of color of finish for fume hoods, work surfaces and for other prefinished equipment and accessories for selection by the Owner's Representative.
 - E. Certifications: All manufacturers to test and certify their products to meet UL1805, ASHRAE 110 and SEFA 1.
 - F. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
 - G. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
 - H. Life Cycle Tests: Provide independent test data for sash hardware components such as chain and sprockets.
 - I. Maintenance Manuals: Provide written instruction manuals outlining operating and safety instructions and proper maintenance procedures.
 - J. Qualification Data: For manufacturer/fabricator, installer and professional engineer.
 - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
 - 2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.
 - K. Warranty: Sample of warranty.
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.
- 1.5 QUALITY ASSURANCE
- A. Single Source Responsibility: Fume hoods, casework, work surfaces, laboratory furnishings, and accessories shall be furnished by a single laboratory furniture company.

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- B. Manufacturer's Qualifications: Modern plant with proper tools, dies, fixtures, and skilled production staff to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:
 - 1. Ten years or more experience in manufacture of laboratory casework and equipment of type specified.
 - 2. Ten installations of equal or larger size and requirements.
- C. Installer's Qualifications: Factory trained and certified by the manufacturer.

1.6 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.
 - 1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including superintendent.
 - d. Installer, including project manager and supervisor.
 - e. Manufacturer/fabricator's qualified technical representative.
 - f. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Review required inspection, testing, certifying, and material usage accounting procedures.
 - f. Review environmental conditions and procedures for coping with unfavorable conditions.
 - g. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.
 - 3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on

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Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Do not deliver or install equipment until the following conditions have been met:

1. Building areas requiring the installation of laboratory casework shall be dry and unexposed to adverse weather conditions which may damage finished materials.
2. Interior building temperatures shall not register below 65 degrees Fahrenheit (18 degrees Celsius) in areas of casework installation to permit the proper curing of epoxy sealants and adhesive.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 SEQUENCING AND SCHEDULING

- A. All overhead mechanical, electrical and plumbing rough-in work shall be complete prior to laboratory casework deliveries.
- B. All mechanical, electrical and plumbing rough-in work required along walls and service islands, where lab furnishings are to be installed, is to be complete prior to delivery of materials.
- C. Walls and partitions must be in place and finished with at least the primer coat of paint. If finish painting is to take place after lab furnishing installation, protect the casework and furnishings by covering and masking prior to commencement.
- D. All necessary wood or metal blocking must be installed within partitions prior to delivery of casework and furnishings.
- E. Overhead soffits and ceiling grid must be in place prior to casework installation.
- F. Overhead lighting must be installed and connected prior to casework installation.
- G. All flooring required to be placed under lab casework and furnishings must be installed prior to material delivery.
- H. Concrete floors must be level within 1/8 inch (3 mm) of level per 10 foot (3 m) run, nonaccumulative, when tested with a straight edge in any one direction.
- I. Wet operations to be performed must be complete prior to material deliveries.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:

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2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.
- C. If exploratory work is required to determine the cause of the defects, the cost of such work shall be borne by the Contractor if the work is found to be defective as judged by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers/Fabricators and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers/fabricators listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. A.T. Villa Inc., Ergolab, www.atvilla.com
 2. Kewaunee Scientific Equipment Corp., Supreme Air, www.kewaunee.com
 3. Lab Crafters, Air Sentry, www.lab-crafters.com
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 1. Basis of Design product: Lab Crafters, Air Sentry, www.lab-crafters.com
- C. Casework, furnishings and equipment specified in the following sections shall be furnished and installed by the same supplier.
 1. Section: Laboratory Casework and Furnishings.
 2. Section: Movable Laboratory Benches.

2.2 MATERIALS

- A. Sheet Steel:
 1. Metallic Furniture Stock: ASTM A-1008 mild steel, cold rolled, pickled, double annealed, and free from rust, scales, scratches, buckles, ragged edges, and other defects.
 2. Minimum Gages:
 - a. All gages indicated shall be US Standard.
 - b. 18 gage(1.2 mm) thick exterior casing, ceiling closure panels, and bottom sash rail.

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3. Finish: Powder coat finish. Color shall be a custom color as selected by the architect.

B. Stainless Steel:

1. Type 304: ASTM A240; 16 gage(1.6 mm); exposed surfaces ground and polished to a Number 4 finish.
2. Type 316: ASTM A240; 16 gage(1.6 mm); exposed surfaces ground and polished to a Number 4 finish.
3. Welding: All stainless steel welding material shall be of type similar to sheet material. Welds shall be made without discoloration; ground, polished, and passivated to blend harmoniously with a Number 4 satin finish.

C. Epoxy Resin Sheets:

1. Molded from modified epoxy resin that has been especially compounded and cured to provide optimum physical and chemical resistance required of a heavy duty laboratory working surface. Uniform mixture throughout, not dependent on a surface coating.
2. Physical Properties:
 - a. Compressive Strength (ASTM D695): 30,600 psi(211,000 kPa).
 - b. Flexural Strength (ASTM D790): 12,800 psi(88,200 kPa).
 - c. Tensile Strength (ASTM D638): 10,100 psi(69,600 kPa).
 - d. Heat Distortion (ASTM D648): 330 degrees Fahrenheit(165 degrees Celsius).
 - e. Water Absorption (ASTM D570): 0.018 percent.
 - f. Fire Resistance (ASTM D635): Self Extinguishing.

- D. Glass: 7/32 inch(6 mm) clear laminated safety glass.

2.3 BENCHTOP CHEMICAL FUME HOODS

- A. Factory UL 1805 Classified. Provide each fume hood with UL 1805 Classified labeling.

B. Superstructure:

1. Wall: Rigid, self supporting assembly of double wall construction, nominal 5 inches(125 mm) thick. Double wall shall consist of a sheet steel outer shell and a corrosion resistant inner liner and shall house and conceal steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Hoods shall be completely factory assembled to form a rigid, self-supporting structure.
2. Face Opening Perimeter Edge: Air foil or streamlined shape with all right angle corners radiused or angled.
3. Interior Hood Height: 60 inches(1524 mm) minimum to hood roof.
4. Exterior Bypass: Low resistant down draft type. Bypass air shall enter at horizontal full length opening at the top front superstructure to enter hood in a down flow direction. Directional louvers are not acceptable.
5. Interior Bypass:
 - a. Restricted Bypass: Provide an interior bypass plate with 1 inch(24 mm) minimum continuous slot at sash header on all variable volume or constant volume hoods with combination sashes and on all variable volume hoods with a vertical rising sash.

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6. Ceiling Enclosure Panel: Used to enclose space between top of fume hood and ceiling on all exposed or open sides. Minimum 18 gage(1.2 mm) thick, finish to match hood. Provide 4 inches above ceiling for suspended ceiling to abut into and with a lower removable front panel for access to hood lights, piping and exhaust duct connections.
7. Fastenings:
 - a. Interior fastening devices concealed. Exposed screws not acceptable.
 - b. Exterior panel member fastening devices concealed. Exposed screws not acceptable.
 - c. Exterior structural members attachments: Sheet metal screws, zinc plated.

C. Sill:

1. Bypass type designed to prevent reverse air flows or air eddies at the fume hood work surface. Sill to include an integral spill trough with hinged louvered horizontal panels that allows pass thru of hospital grade electrical plugs. Mount sill assembly flush with bottom of fume hood work surface. Provide a chemical resistant sealant between sill and work surface.
 - a. Hinged slot panels patterns and size as follows:
 - 1) 48 inch(1.22 m) wide fume hood: Two 19 inch(480 mm) long panels
 - 2) 72 inch(1.83 m) wide fume hood: Two 31 inch(790 mm) long panels.
 - 3) 96 inch(2.44 m) wide fume hood: Three 28-1/2 inch(725 mm) long panels.
2. Material: All components 16 gage(1.6 mm) thick Type 304 stainless steel, with an acid and abrasion resistant electrostatic epoxy or urethane powder coating. Color to be selected by the Owner's Representative.

D. Sash:

1. Full view type with clear, unobstructed, side to side view of fume hood interior and service fixture connections. Vertical rising or combination vertical rising/horizontal sliding. Refer to Fume Hood Schedule for type and height of sash at each fume hood.
2. Vertical rising sash: 2 inches(48 mm) maximum height bottom sash rail, 18 gage(1.2 mm) thick steel with a polyurethane powder coat finish. Provide integral formed flush pull the full width of bottom rail. Set safety glass into rails in deep form, extruded polyvinyl chloride glazing channels. Open and close sash against rubber bumper stops.
3. Vertical rising sash operation: Provide sash stops at the design sash opening. Refer to the Fume Hood Schedule for sash stop height. Counterbalanced chain and sprocket system. Sash shall move smoothly without tilting or binding and shall remain at rest in any open position.
4. Sash glass: 7/32 inch(6 mm) thick laminated safety glass.
5. Sash guides: Corrosion resistant polyvinyl chloride.
6. Electrically actuated mechanism designed to engage both sides of the sash evenly to ensure smooth sash movement.
 - a. Mechanism to utilize no more than 1 amp AC when actuated.
7. Incorporate infrared light curtain detection system which stops the sash from closing and turns on a red obstruction indicator light.

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- a. Infrared light curtain must detect any obstruction in the path of the sash from full-open to full-close.
 - b. Red obstruction indicator light will turn off when the reset button is pressed.
 - c. Provide additional switch to engage and disengage the sash operator.
8. Provide by fume hood manufacturer and install in fume hood manufacturing facility.
- a. Pre-wire mechanism to the top of the fume hood along with other electrical devices on the hood.

E. Liners:

1. Polyester liner: Reinforced glass polyester panel; smooth finish and white color in final appearance. Flexural strength: 21,000 psi(144,790 kPa). Flame spread: 25 or less per UL 723 and ASTM E84-80. Manufactured by WS Hampshire Inc. "Wesliner 1125". Provide gasketed access panels in the liner for access to valves and fixtures. Panels shall be of the same material as the liner and be provided with a PVC gasket to eliminate air leakage and retain liquids inside the hood.

F. Baffles:

1. Provide fixed baffles to control air vectors into and through the fume hood. Fabricate of the same material as the liner. All baffle supports and brackets to be non-metallic.
2. Baffle designs which permit close off of all slots are not acceptable.
3. Must comply with OSHA Lab Standard Guidelines.

G. Work Surfaces:

1. Molded epoxy resin: For hoods with Poly resin liners. Color to be selected by the Owner's Representative from the manufacturer's standard black, gray or white colors. Work surface as manufactured by Durcon Laboratory Tops; Kewaunee Scientific, Epoxyn Products; or, equal. 1-1/4 inches(30 mm) thick surface, dished 1/4 inch(6 mm) to contain spills.

H. Service Fixtures and Piping

1. Factory pre-pipe hoods compliant to all state and local codes with services indicated on the drawings, to a point of connection 2 inches(48 mm) above hood roof. Provide, per Division 22 the piping material and installation of each service type. Pressure test all prepped lines in the factory.
2. Provide service fixtures within fume hoods with color coded, acid and solvent resistant plastic coating, applied over fine sandblasted surface, properly cleaned then sprayed and baked three times. With a minimum coating thickness of 6 mil.
3. Control Valves: Straight or 45 degree angle mounted fixtures on the front panel of the fume hood. Provide panel mounted or rod-type control valves as indicated on the Drawings. Mount the centerline of the valve inlet and outlet parallel and 1-1/8 inches(27 mm) apart. Provide valves with a threaded collar to hold the valve in place.
4. Color coding of hood interior service fixtures and remote control valves as specified for Laboratory Service Fixtures in Section: Laboratory Casework and Furnishings.
5. On fume hoods with pre-punched service fixture holes, provide metal or plastic plugs in color to match fume hood, for all unused holes.

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I. Electrical:

1. Factory install receptacles, lighting, electrical fixtures and wiring in accordance with all applicable state and local codes and Division **26** specifications. Terminate wiring in a single service junction box on top of fume hood roof for in-the-field point of connection. All electrical fixtures shall be UL listed and labeled.
2. Wiring:
 - a. Minimum #12 copper, type THHN/THWN insulation. Wire color coding shall be black for current carrying conductors, white for neutral conductors and green for ground conductors.
3. Conduit:
 - a. Unless noted or required otherwise, ½ inch flexible metal or PVC conduit. Secure conduit to superstructure framework with conduit clamps. Conduit to light fixture to have a pigtail for ease of lamp maintenance.
4. Receptacles:
 - a. Provide each hood with the receptacle quantities as follows:
 - 1) For 48 inch(1200 mm) wide hoods: Provide one duplex receptacle each side post near the bottom.
 - 2) For 60 inch(1500 mm) wide and greater hoods: Provide two duplex receptacles each side post near the bottom. Receptacles on each side shall be wired alternately.
 - 3) Provide a dedicated receptacle on top of all hoods for safety monitor and alarm.
 - b. Receptacle: NEMA-5-20R, three wire grounding type receptacles rated at 120 VAC at 20 AMP with Ground Fault Interruption, Gray in color with stainless steel brushed finish flush face plate. Install receptacles with the ground outlet above the power slots. Label each receptacle with the associated circuit number.
5. Lighting:
 - a. Fixture: Two lamp, rapid start, UL listed fluorescent light fixture with sound rated ballast installed on exterior of fume hood roof. Provide light fixture isolated from the hood interior by 1/4 inch thick laminated safety glass cemented and sealed to the hood roof. The lighting shall be serviceable from outside the fume hood interior.
 - b. Interior of fixture: White, high reflecting plastic enamel.
 - c. Size: Largest possible up to 48 inches(1.2 m) for hoods with superstructures up to 6 feet(1.8 m). Provide Two 36 inches(0.9 m) fixtures for hoods with 8 foot(2.4 m) superstructures.
 - d. Lamps: Include lamps with fixtures. Lamps and ballast to be the same type as specified in Division 26 for overhead lighting in laboratory spaces.
 - e. Illumination: 80 footcandle(860 lx) minimum average at the worksurface.
 - f. Light Switch: Toggle type, single pole 120 VAC, 20 AMP, Gray in color with stainless steel brushed finished flush face plate. Mount on left side of fume hood side post.

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J. Exhaust Outlet:

1. Rectangular or round collar; 18 gage(1.2 mm) thick, Type 316 stainless steel.
2. For hoods with rectangular duct collars, provide exhaust duct transition from the hood rectangular exhaust collar to the building exhaust system round duct connection. Round duct size as indicated in the Fume Hood Schedule. Fabricate transition of the same material as the exhaust outlet.

K. Safety Monitor/Alarm System:

1. Variable volume hoods: Equip each fume hood with a velocity control and safety alarm unit which is provided under Division 23. Provide factory cut outs in the front of the hood for field mounting of the unit. Coordinate location and size of cut out with Division 23. Connection of control and safety alarm unit to sensors and control valves under Division 23.

L. Fume Hood Signage:

1. Operation Instructions: Provide a permanent acid resistant decal or plate attached to fume hood exterior with condensed information covering recommended locations for apparatus and accessories, baffle settings, use of sash, and recommended safe operating procedures.
2. Vertical Sash Stop Decal: Provide an acid resistant decal as detailed on the Drawings. Exact location to be determined when the fume hood is balanced.
3. Fume Hood Information/Certification Holder: Provide a 4 inch by 6 inch(100 mm by 150 mm) corrosion resistant metal or plastic frame attached to front face of fume hood exterior with plastic or glass glazing to contain a removable data card to identify hood and show hood characteristics and field test data.

2.4 RADIOSOTOPE FUME HOODS

- A. Radioisotope fume hoods shall be as detailed on the Drawings and as described under Article 2.3, Benchtop Chemical Fume Hoods, unless modified under this Article.

B. Superstructure:

1. Interior Bypass: Provide the bypass area with a 14 inch(360 mm) high opening on all constant volume hoods with a vertical rising sash.

C. Sill:

1. Bottom foil constructed of Type 304 stainless steel with a Number 4 finish.

D. Sash:

1. Vertical rising sash: Constructed of Type 304 stainless steel with a Number 4 finish.
2. Sash pull: Constructed of Type 304 stainless steel with a Number 4 finish.

E. Liner:

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1. Type 304 stainless steel with a Number 4 finish: 16 gage(1.6 mm) thick, welded seamless construction. All vertical and horizontal corners and seamless joints between work surface and sides and back coved to a 1/2 inch(12 mm) radius, continuous welded, ground and blended to a fine grained finish. Seams between working surface and sides and back are not acceptable. Provide gasketed stainless steel access panels in the liner for access to valves and fixtures.

F. Work Surface:

1. Type 304 stainless steel with a Number 4 finish, 16 gage(1.6 mm) welded seamless construction with a raised 1/4 inch(6 mm) anti-spill edge, reinforced with 16 gage(1.6 mm) steel channels, with an overall thickness of 1 inch (25 mm).
2. Reinforce work surface to handle loads of 200 pounds per square foot(976 kg per square meter).

G. Exhaust Outlet:

1. Constructed of Type 304 stainless steel welded in place.

H. Safety Monitor/Alarm Systems:

1. Provide fume hood monitor with audible and visual alarm signals to activate if face velocity drops below 80 fpm(40.6 cm per second) or rises above 180 fpm(91.4 cm per second). Provide field adjustable alarm setpoints.
2. Audible alarm signal tone: A minimum of 85 decibels at 10 centimeters. Provide visual alarm signal as a flashing or continuous glowing red light. Provide alarm design to permit silencing of tone signal, but maintain glow of red visual signal light until unsafe condition is corrected. Provide with circuitry and a pushbutton to test alarm circuits.
3. Monitor: Utilize thermal sensors, located in the monitor, to determine hood face velocity.
4. Provide with input/output accessory to send alarm signal to a remote location and for silencing alarm remotely.
5. Electrical: 9 volt DC, maximum of 1 amp. Provide 120 VAC to 9 VDC transformer, UL listed.

I. Isotope Filter

1. Stainless steel filter assembly with rough and HEPA filter. Provide stainless steel housing.
2. Capacity: 1300 cfm(610 pounds per second) at 1.6 inches (0.40 kPa) static pressure with clean filters.
3. Size: Overall dimensions 24-1/2 inches(620 mm) wide, 24 inches(610 mm) high, 25-1/4 inches (640 mm) deep, with a 12 inch (300 mm) diameter inlet and outlet.
4. Provide manometer mounted on housing to indicate filter pressure drop and report on filter condition.
5. HEPA Filter: Provide tested and rated at 99.9 percent efficiency, minimum for particles 0.3 to 0.5 microns in diameter. Provide stainless steel housing.

2.5 ADA ACCESSIBLE FUME HOODS

- A. ADA accessible fume hoods: Provide adjustable height base stand, height adjustable; 26 – 34 inches; with leg levelers.

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- B.** Gas outlets and light switch: Mount on left side of fume hood side post at maximum 48 inches above finished floor.

2.6 FUME HOOD BASE AND SPECIAL CABINETS

A. Undercounter Flammable Storage Cabinets:

1. Design: Construct cabinets in accordance with OSHA Regulations and the requirements of NFPA 30, National Fire Protection Association, Flammable and Combustible Liquids Code. Provide cabinets Factory Mutual (FM) approved or Underwriters Laboratories (UL) listed. Cabinets shall limit the internal temperature at the center 1 inch(25 mm) from the top to not more than 325 degrees Fahrenheit(165 degrees Celsius) when subjected to the fire test for storage cabinets as described in NFPA 30.
2. Casing: Bottom, top, back, door, and sides of cabinet shall be at least 18 gage(1.2 mm) sheet steel, double walled with 1-1/2 inch(36 mm) air space. Provide with adjustable zinc plated leveling legs.
3. Door: Provide with continuous piano hinge and a 3-point latching arrangement with door sill raised at least 2 inches(50 mm) above the bottom of the cabinet to retain spilled liquid within the cabinet. When more than 1 door is used, there shall be a rabbetted overlap of not less than 1 inch(25 mm). Provide self-closing, self-latching door(s) with fusible link(s) to hold doors wide open and melt at 165 degrees Fahrenheit(73.8 Celsius) for automatic closure. Provide with keyed lock.
4. Shelving: Provide each cabinet with a full width adjustable shelf.
5. Grounding: Provide a grounding lug connection at back of cabinet.
6. Identification: Mark all flammable storage cabinets with conspicuous red lettering on a contrasting background: FLAMMABLE - KEEP FIRE AWAY.
7. Color: Selected by the Owner's Representative.
8. Color: Manufacturer's standard yellow.

B. Undercounter Corrosive Storage Cabinets:

1. Design: Construct cabinets in accordance with OSHA Regulations and the requirements of International Fire Code, Chapter 27 Hazardous Materials – General Provisions. Provide cabinets Factory Mutual (FM) approved or Underwriters Laboratories (UL) listed.
2. Casing: Bottom, top, back, door, and sides of cabinet shall be at least 18 gage(1.2 mm) sheet steel, double walled with 1-1/2 inch(36 mm) air space. Provide with adjustable zinc plated leveling legs.
3. Door: Provide with continuous piano hinge and a 3-point latching arrangement with door sill raised at least 2 inches(50 mm) above the bottom of the cabinet to retain spilled liquid within the cabinet. When more than 1 door is used, there shall be a rabbetted overlap of not less than 1 inch(25 mm). Provide self-closing, self-latching door(s) with fusible link(s) to hold doors wide open and melt at 165 degrees Fahrenheit(73.8 Celsius) for automatic closure. Provide with keyed lock.
4. Ventilation: Provide a 2 inch(50 mm) polypropylene vent pipe at the outside rear of the cabinet with 2 inlets, 1 high and 1 low. Extend vent pipe to 4 inches(100 mm) above the hood work surface.
5. Shelving: Provide each cabinet with a full width adjustable shelf.
6. Liner: Provide cabinet with ChemCor thermoplastic coating on all interior surfaces as provided on the Justrite Centura line.
7. Bottom Pan: Provide with 1/4 inch(6 mm) thick heat welded, polypropylene or ABS plastic pan, liquid tight, removable, 1 inch(25 mm) deep.
8. Hardware: All exposed to outside and inside of cabinet shall be Stainless Steel.

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9. Identification: Mark all undercounter ventilated cabinets with conspicuous red lettering on a contrasting background: HAZARDOUS – KEEP FIRE AWAY.
10. Color: Selected by the Owner's Representative.
11. Color: Manufacturer's standard dark blue.

C. Vacuum Pump Cabinets

1. Construction: Construct as specified for metal laboratory casework and as detailed on drawings.
2. Vacuum Pump and Cabinet Exhaust: Provide a 2 inch(50 mm) polypropylene exhaust pipe from inside cabinet to 6 inches(150 mm) above ceiling as details on the Drawings. Secure vent pipe inlets to back of cabinet with polypropylene locking nuts.
3. Doors: Provide air gap between back of door and toe kick panel.
4. Interior: Provide rigid, aluminum-faced acoustical insulation on all sides, back, top, and doors.
5. Pull-out Shelf on Casters: Provide with a removable 18 gage(1.2 mm) minimum galvanized metal pan, full depth and width of cabinet, with a 1 inch(25 mm) lip all around, and four swivel type casters. Mount toe kick panel to front edge of shelf.
6. Vacuum Line Pass-Through: Provide a 1 inch(25 mm) hole in back of cabinet for the vacuum piping provided by Division 22. Final connection to O.F.O.I. pumps by owner.
7. Electrical: Factory install switch, receptacle, wiring, and all required electrical fittings in accordance with applicable codes and Division 26 specifications. Final connection to back of cabinet by electrical contractor.
8. Finish: Color selected by Owner's Representative.

2.7 METAL FINISH FOR FUME HOOD, AND FUME HOOD BASE AND SPECIAL CABINETS

- A. As specified for Metal Finish in Section: Laboratory Casework and Furnishings.

2.8 SOURCE QUALITY CONTROL TESTING OF EPOXY RESIN WORK SURFACE

- A. As specified for Source Quality Control Testing of Epoxy Resin Work Surface in Section: Laboratory Casework and Furnishings.

2.9 SOURCE QUALITY CONTROL TESTING OF POLY RESIN LINER

- A. Test Procedure:

1. Test Number 1 - Spills and Splashes:
 - a. Suspend in a vertical plane a 42 inch(1070 mm) horizontal by 12 inch(300 mm) vertical panel divided into 3/4 inch(20 mm) wide vertical columns.
 - b. Apply 5 drops of each reagent listed with an eye dropper.
 - c. Apply liquid reagents at top of panel and allow to flow down full panel height. "CAUTION! Flush away any reagent drops."
2. Test Number 2 - Fumes and Gases:
 - a. Divide 24 inch by 12 inch(600 mm by 300 mm) panel into 2 inch(50 mm) squares.
 - b. Place 25 milliliters of reagent into 100 milliliter beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.

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3. After 24 hours remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.
- B. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:
1. No Effect: No detectable change in surface material.
 2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
 3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
 4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
 5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.
- C. Test Results: Submit a report of the test results. The results shall be equal to or better than the following:

	<u>Reagent List</u> <u>Concentrations by Weight</u>	<u>Test1</u> <u>Rating Spills</u>	<u>Test 2</u> <u>Fumes</u>
1.	Sodium Hydroxide	No Effect	No Effect
2.	Sodium Hydroxide, 40%	No Effect	No Effect
3.	Sodium Hydroxide, 20 percent	No Effect	No Effect
4.	Sodium Hydroxide, 10 percent	No Effect	No Effect
5.	Ammonium Hydroxide, 28 percent	No Effect	No Effect
6.	Methylene Chloride	No Effect	No Effect
7.	Chloroform	No Effect	No Effect
8.	Carbon Tetrachloride	No Effect	No Effect
9.	Monochlorobenzene	No Effect	No Effect
10.	Tincture of Iodine	No Effect	Good
11.	Methyl Alcohol	No Effect	No Effect
12.	Ethyl Alcohol	No Effect	No Effect
13.	Butyl Alcohol	No Effect	No Effect
14.	Phenol, 85 percent	No Effect	Excellent
15.	Cresol	No Effect	No Effect
16.	Sodium Sulfide	No Effect	No Effect
17.	Furfural	Excellent	Excellent
18.	Dioxane	No Effect	No Effect
19.	Zinc Chloride	No Effect	Excellent
20.	Benzene	No Effect	No Effect
21.	Toluene	No Effect	No Effect
22.	Xylene	No Effect	No Effect
23.	Gasoline	No Effect	No Effect
24.	Naphthalene	No Effect	No Effect
25.	Methylethyl Ketone	No Effect	No Effect
26.	Acetone	No Effect	No Effect
27.	Ethyl Acetate	No Effect	No Effect
28.	Amyl Acetate	No Effect	No Effect
29.	Ethyl Ether	No Effect	No Effect
30.	Silver Nitrate, 10 percent	Excellent	Excellent
31.	Dimethylformamide	Excellent	Excellent

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32.	Formaldehyde, 37 percent	No Effect	No Effect
33.	Formic Acid, 88 percent	No Effect	Excellent
34.	Acetic Acid, Glacial	No Effect	No Effect
35.	Dichloroacetic Acid	No Effect	Excellent
36.	Chromic Acid, 60 percent	No Effect	No Effect
37.	Phosphoric Acid, 85 percent	No Effect	No Effect
38.	Sulfuric Acid, 33 percent	No Effect	Excellent
39.	Sulfuric Acid, 77 percent	No Effect	No Effect
40.	Sulfuric Acid, 93 percent	No Effect	No Effect
41.	Hydrogen Peroxide, 30 percent	No Effect	No Effect
42.	Acid Dichromate	No Effect	No Effect
43.	Nitric Acid, 20 percent	No Effect	Excellent
44.	Nitric Acid, 30 percent	No Effect	No Effect
45.	40 & 47 Equal Parts	No Effect	Good
46.	Nitric Acid, 70 percent	No Effect	Good
47.	Hydrofluoric Acid, 48 percent	No Effect	Excellent
48.	Hydrochloric Acid, 37 percent	No Effect	Excellent

2.10 SOURCE QUALITY CONTROL TESTING OF FUME HOODS

- A. Test one fume hood of each type and size specified in accordance with the method prescribed in American National Standard ANSI/ASHRAE 110-1995 or latest edition. The minimum overall performance rating of each test, 4.0 AM 0.05 with 4.0 the tracer gas release rate in liters per minute, AM identifying an "as manufactured" test, and 0.05 indicating the maximum level of tracer gas, in parts per million, in the breathing zone.
- B. Hood test: In the manufacturer's test facility with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer.

2.11 SOURCE TESTING OF FUME HOOD SOUND LEVELS

- A. Provide the following historic certified sound test data for each size and type of fume hood:
 - 1. Background sound pressure level readings for the test facility with exhaust system operating but without connection to the fume hood.
 - 2. A second set of readings recorded with the fume hood connected and operating and the sensor located 36 inches(900 mm) in front of the sash assembly.
 - 3. Certified report: Octave band sound pressure level, Db re 20 micro Pa in the 31.5 to 8,000 Hertz frequency range, for the fume hood operating.

PART 3 - EXECUTION

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3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

- A. Installation
 - 1. Install fume hoods and equipment in accordance with manufacturer's instructions.
 - 2. Install equipment plumb, square, and straight with no distortion and securely anchored as required.
 - 3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
- B. Accessory installation: Install accessories and fixtures in accordance with manufacturer's recommendations.

3.5 FIELD QUALITY CONTROL TESTING OF FUME HOODS

- A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
- B. Owner's Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

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C. ADP FH Testing Companies

1. B & V Testing, Inc.
2. Exposure Control Technologies, Inc.
3. Indoor Air Professionals
4. Safety Plus LLC
5. Technical Safety Services, Inc.

D. Testing Requirements

1. Commission each fume hood in accordance with the test procedures prescribed in American National Standard ANSI/ASHRAE 110-1995 or latest edition.
2. The fume hood commissioning agent: A third party and not a representative of the manufacturer or installation contractor.
3. Provide the Owner's Representative two weeks prior notice of the testing start date.

E. Testing Conditions

1. Conduct tests under conditions as specified under Paragraph 5.1.1 of ANSI/ASHRAE 110-1995 or latest edition.
2. Commence fume hood commissioning immediately after the final Test and Balance Report has been approved and before the Owner has occupied the laboratory.
3. Verify that the building makeup air system is in operation, the doors and windows are in normal operating position, and that all other hoods and exhaust devices are operating at design conditions.
4. Correct any unsafe conditions disclosed by these tests before request of test procedures.

F. Instrumentation and Equipment

1. Employment instrumentation and equipment as specified under Article 4 of ANSI/ASHRAE 110-1995 or latest edition.

G. Flow Visualization Test

1. Conduct both Local Visualization and Large Volume Visualization Tests in accordance with ANSI/ASHRAE 110-1995, Article 6.1 or latest edition.
2. If there is visible smoke flow out of the front of the hood, the hood fails the test.

H. Face Velocity Test

1. Provide face velocity measurements as outlined in Articles 6.2, 6.3 and 6.4 of ANSI/ASHRAE 110-1995 or latest edition.

I. Tracer Gas Test

1. Provide a tracer gas test for each fume hood in accordance with the procedures specified under Article 7 of ANSI/ASHRAE 110-1995 or latest edition.
2. Hoods shall achieve a rating of 4.0 AI 0.10, with 4.0 being the tracer gas release rate in liters per minute, AI identifying an "as installed" test, and 0.10 indicating the maximum level of tracer gas, in parts per million, in the breathing zone.

J. Test Reports

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1. Provide a test report for each test for each hood. Include in report a record of all measurements and an indication of test "pass" or "failure".
2. Submit six (6) copies of the test report for approval.

3.6 ADJUSTING

- A. Repair or remove and replace defective work, as directed by the Owner's Representative upon completion of installation.
- B. Adjust sash, fixtures, accessories and other moving or operating parts to function smoothly.

3.7 CLEANING

- A. Clean equipment, touch up as required.

3.8 PROTECTION OF FINISHED WORK

- A. Provide all necessary protective measures to prevent damage to equipment from exposure to other construction activity.
- B. Advise Contractor of procedures and precautions for protection of material and installed fume hoods from damage by work of other trades.

END OF SECTION

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SECTION 11 5319

LABORATORY STERILIZERS, GLASSWARE WASHERS AND DRYERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steam Sterilizers
2. Undercounter Glassware Washer and Dryer
3. Modular Wall Assemblies.

B. Related Sections:

1. Division 22: Furnishing and installation of plumbing utilities and final connections to equipment.
2. Division 23: Furnishing and installation of exhaust ductwork and final connection to equipment.
3. Division 26: Furnishing and installation of electrical utilities and final connections to equipment.

1.2 REFERENCES

A. The following industry, association and government codes and standards are cited in this Section. They shall be followed as applicable to the design, fabrication, assembly and testing of the specified equipment.

1. American Society for Testing and Materials (ASTM).
2. Federal Occupational Safety and Health Act (OSHA).
3. National Fire Protection Association (NFPA).
4. Underwriters Laboratories, Incorporated (UL).
5. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section IX.
6. National Electric Manufacturers Association (NEMA).
7. National Electric Code (NEC).
8. American Society of Mechanical Engineers (ASME), Unified Pressure Vessel Code, Section VIII.
9. American Welding Society (AWS).
10. American National Standards Institute (ANSI).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data for each item of equipment specified. Include dimensions, configurations, construction details, and attachments. Indicate location, size, and service requirements for each utility connection.

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- B. Shop Drawings: Provide large scale plans and sections showing rough-in and anchor placements, clearances, and location of utilities for coordination with other trades.
- C. Test Reports: Submit test reports verifying conformance to specified performance tests.
- D. Manufacturer's operating and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Modern plant with proper tools, dies, fixtures and skilled workers to produce high quality equipment and meeting the following minimum requirements:
 - 1. Ten years or more experience in manufacture of the type of equipment specified.
 - 2. Ten installations of equal or larger size.
- B. Installer's Qualifications: Factory trained and/or certified by the manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.
- B. Handling: Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.

1.6 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met:
 - 1. Windows and doors are installed and the building is secure and weathertight.
 - 2. Ceiling, overhead ductwork and lighting are installed.

1.7 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to the following:
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

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1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.
- C. For ASME stamped sterilizer pressure vessels, provide a 15 year warranty against structural failure. Warranty shall start at completion of installation and startup.

PART 2 - PRODUCTS

2.1 MEDIUM STEAM STERILIZERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Basis-of-Design: Consolidated Sterilizer Systems: www.consteril.com. Provide indicated product, or comparable product by the following:
 1. Steris Corporation (Amsco 250LS)
 2. Getinge/Castle, Inc.
 3. Primus Sterilizer Co. Inc.
- C. Sterilizer Operation: Sterilizer uses steam-under-pressure as sterilizing agent and is designed to sterilize certain materials used in laboratories and research facilities. Unit is capable of both gravity and prevacuum cycles and is used to sterilize wrapped loads, nonporous heat- and moisture-stable goods, liquids and vented glass containers, and decontamination of instruments used after surgical procedures. Unit is capable of sterilizing loads from both sides of the chamber in either a double door, pass-through or single door operation.
- D. #1 Steam Sterilizer Characteristics:
 1. Model PT-SSR-3A
 2. Sterilizer Cycles: Pre vacuum, gravity, liquid, leak test, Bowie-Dick.
 3. Interior Chamber Size: 20W x 20H x 38L inches.
 4. Door Configuration: Double door, vertical sliding, manually operated.
 5. Installation Method: Recessed through two walls with bioseal.
- E. #2 Steam Sterilizer Characteristics:
 1. Model PT-SSR-3A
 2. Sterilizer Cycles: Pre vacuum, gravity, liquid, leak test, Bowie-Dick.
 3. Interior Chamber Size: 20W x 20H x 38L inches.
 4. Door Configuration: Single door, vertical sliding, manually operated.
 5. Installation Method: Recessed through one wall.
- F. Manual Door Lock Mechanism (Hinged-Door Models): Door is locked or unlocked using a single 30 deg. handle motion.
- G. Resistive Thermal Detectors (RTD): For temperature control within sterilizer chamber and within jacket space.

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1. Software Calibration: Performed in service mode, using touch screen displays

H. Construction:

1. Chamber and Jacket: Type 316L stainless steel chamber. Welded pressure vessel construction in accordance with the requirements of ASME Code, Section VIII for unfired pressure vessels. Design for a minimum working pressure of 40 psig(275 kPa) and full vacuum. The vessel shall be stamped and a signed copy of the U-1 form furnished. Provide vessel with an ASME approved and stamped safety valve.
2. Insulation: Minimum 1 inch(25 mm) thick foil backed glass fiber to cover the jacket of the assembly.
3. Doors: Type 316L stainless steel. Provide with self aligning gasket for a positive seal when the door is closed. Design to lock automatically when chamber pressure is positive and to unlock only when pressure is reduced to approximately atmospheric.
4. Support Structure: Provide with height adjustable steel stand with floor pads and leveling screws. Stand to have corrosion resistant coating.

I. Enclosure:

1. Facia and enclosure material: Type 304 stainless steel polished to a Number 4 finish; minimum 16 gage(1.6 mm).
2. Single door, one wall recessed, unexposed: Door facing and front finishing panels. Enclosure not required if in service chase.
3. Double door, two walls recessed unexposed: Door facing and front finishing panels at both ends. Enclosure not required if in service chase.
4. Provide sealing gaskets to ensure a close, neat fit of sterilizers to partition walls.
5. Provide service access panels in all enclosed units.
6. Door swings shall be as indicated on the Drawings.

J. Control System:

1. Microprocessor based system to monitor and control all phases of the sterilizer operation.
2. Provide control panel with window display and touch pad controls. Display shall indicate sterilizer status, time of day, cycle times, temperature, pressure, and any warnings or instructional message.
3. Mount panel on operating end of unit and provide front panel service access to microprocessor control boards and associated electronics.
4. The control system shall be factory programmed with standard sterilizing cycles. Each cycle shall be field adjustable, through cycle selector and value change touch pads, to meet specific processing requirements. The system shall provide the operator with the capability to change cycle parameters from the control panel.
5. Provide control system with a printer to continuously record on a strip chart cycle identification, cycle progression, selected parameters, date, time, chamber temperature, chamber pressure, alarms, and diagnostics.
6. Provide Ethernet Port for exporting data including remote Monitoring with Alarms/alerts sent via e-mail or text messages. Also include USB drive for printer report data.
7. Provide the following cycle safeguards:
 - a. Cycle inoperative unless doors are closed and locked.
 - b. Rejection of incorrect cycle parameters.

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- c. Automatic condensing of chamber steam and disposal of condensate to waste. Condensate discharge temperature shall not exceed 140 degrees Fahrenheit(60 degrees Celsius).
- 8. Control system shall include a security access code to prevent cycles and cycle values from being changed by unauthorized personnel.
- 9. Provide the control system with nonvolatile memory storage or battery backup to protect all cycle memory.
- K. Safety Devices:
 - 1. Control lockout switch: Provide on chamber door to prevent cycle from starting until door is closed and seal is energized.
 - 2. Chamber float switch: Install to abort cycle and vent chamber if excessive condensate is detected in the chamber.
 - 3. Pressure relief valve: Provide to limit the internal pressure from exceeding the pressure rating of the vessel. Pipe from outlet of valve down to floor sink with proper air gap.
- L. Piping:
 - 1. Terminate all connections within the confines of the sterilizer, accessible from the front and side of the unit.
 - 2. Steam Piping: Provide with shutoff valve, steam strainer, pressure regulator, and control valves.
 - 3. Water Piping: Provide with shutoff and control valves.
 - 4. All pipework, fittings, valves and components that come into contact with high purity feed water or generated pure steam shall be constructed of Type 316L stainless steel.
 - 5. For units requiring compressed air for operation of door, door seals, or controls, if compressed air is not available then provide integral air compressor with the unit.
- M. Options at BSL-3 Laboratory:
 - 1. Cross Contamination Seals: Provide at non-operating end of double door units only.
 - 2. Biologic Sealing Flange: at control end / load end.
 - 3. Effluent Decontamination Cycle: For sterilizing all effluent prior to exhausting to drain. Provide a HEPA filtered steam jacketed system included in the effluent process.
 - 4. Steam Inlet Filter Assembly: To clean dirty steam from facility steam sources.
 - 5. Load Probe: Provide temperature probe permitting placement in the load to be sterilized.
 - 6. Automatic Jacket Blowdown: Provide exhaust from jacket to prevent liquid loads from boiling over.
 - 7. Multi-Rate Liquid Exhaust: Optimize the exhaust rate to prevent boil over of liquids and reduce cycle time.
- N. Accessories:
 - 1. Provide rack with 3 shelves constructed of stainless steel or monel metal, for 20x20x38(510x510x965) sterilizers.
 - a. Quantity: Single door units provide one loading car and carriage for each unit. Double door units provide two loading cars and carriages for each unit.
- O. Integral Electric Clean Steam Generator:

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1. Provide an integral electrically powered clean steam generator for 20x20x38(510x510x965) size units.
2. Electrical Power: As scheduled on the drawings.
3. Control Power: As scheduled on the drawings.
4. Construct of carbon steel in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section 1, Miniature Boilers.
5. Include a turbine type feed water pump powered by a continuous duty 3-phase motor.
6. Feed water piping shall include shutoff valve, strainer and vacuum breaker.
7. Steam generator and feed water pump shall operate automatically whenever the sterilizer is on. Interface generator with sterilizer flood fail safe controls.
8. Provide unit with operating and safety controls, including low water cutoff, boiler feed water valve, and ASME approved safety valve.
9. Provide an automatic blowdown that incorporates a motorized ball shutoff valve that automatically uses steam pressure to minimize mineral accumulation in the steam boiler. Provide with a seven-day timer that allows the user to select a time each day to schedule the blowdown function.

P. Interconnecting Steam Piping:

1. Provide interconnecting steam piping from the stand-alone steam generators to the associated sterilizers. Connect piping to steam generators and sterilizers in accordance with the manufacturer's recommendations. All piping connections shall be orbital welded.
2. Pipe Size: One inch O.D.
3. Pipe Material: Black steel, ASTM A53 or A120.
4. Pipe Insulation: Two inch thick, two-piece, 4.2 pounds per cubic foot density fiberglass, vapor barrier jacket with pressure sealing lap adhesive.

2.2 UNDERCOUNTER GLASSWARE WASHERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
- C. Acceptable Manufacturers:
1. Labconco (Model Flaskscrubber 44203)
 2. Lancer U.S.A., Inc. (Model 820 UP)
 3. Miele (Model PG 858304)
 4. Steris Corporation (Model Reliance 100)
- D. Construction: Interior and exterior of 16 gage(1.6 mm), Type 304L stainless steel, fully insulated double wall construction. Automatic water softener, removable debris screen, peristaltic pump, circulation pump, drain pump, water filters, and drying cycle heating element and fan, drain discharge cool down. Sound level of 63 dB or less.
- E. Controls: Electronically programmable microprocessor controller for up to 40 programs.

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- F. Electrical: As scheduled on the drawings.

2.3 MODULAR WALL ASSEMBLIES

- A. Provide a two sided wall constructed of 0.050 inch(1.2 mm) thick Type 304 stainless steel panels with a Number 3 finish. The wall panels are to be secured to vertical metal column supports on each side and are to be finished on each exposed side. Provide shims for leveling of vertical panels to accommodate uneven floors.
- B. The wall panels are to be supported with 0.060 inch(1.5 mm) thick hot rolled steel, 1-1/2 inch(36 mm) square support columns. Support columns are to be anchored to the building ceiling structure and to the floor and bolted to the vertical panels. Enclose wall openings remaining after equipment has been set in place.
- C. Between each stainless steel panel, provide sound deadening mineral fiber, asbestos free, insulation.
- D. Provide stainless steel trim angles to conceal clearance opening between panels and adjacent building walls and ceiling.
- E. Provide horizontal support angles bolted to the top of panels to provide a surface to which ceiling trim angles can be connected and which also provide additional support for the entire wall.
- F. Panels shall be predrilled for installation of adjacent panels.
- G. Applied base molding shall match base molding on adjoining walls.
- H. Hinged Access Doors: Constructed of double wall pans with sound-deadening insulation between. Provide a spring-lock assembly with key access on the outside and a manual release on the inside. Provide as left or right hinged as indicated on plans.
- I. Transfers Grills.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.

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3. Contract Documents.

3.3 INSTALLATION

- A. Deliver to job site, uncrate, place in location, and assemble all equipment specified herein. Remove all debris and crating materials.
- B. Install equipment in strict accordance with the manufacturer's recommendations, including maintaining recommended operating and servicing clearances.
- C. Provide shutoff valves in all utility supply piping to the units.
- D. Provide and install with a seismic tie-down kit.

3.4 FIELD QUALITY CONTROL

- A. Include the services of the manufacturer's factory trained field representative to inspect and provide written approval of the installation.
- B. Include the services of the manufacturer's representative to start up and test the equipment, and to instruct the Owner or the Owner's operating personnel in the proper care and operation of the unit. The manufacturer shall certify in writing that the equipment is operating according to specifications.

3.5 ADJUSTING

- A. Repair or remove and replace defective work, as directed by the Owner's Representative upon completion of the installation.
- B. Adjust equipment to function smoothly.

3.6 CLEANING

- A. Clean equipment, touch up as required.

3.7 PROTECTION OF FINISHED WORK

- A. Provide all necessary protective measures to prevent damage to equipment from exposure to other construction activity.

END OF SECTION

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SECTION 11 5353

BIOLOGICAL SAFETY CABINETS

PART 1 - General

1.1 SUMMARY

- A. Section Includes:
 - 1. Biological Safety Cabinets (Class II, Type A2)

1.2 REFERENCES

- A. National Institutes of Health (NIH), Specification NIH 03-112C.
- B. Underwriters Laboratory, Inc. (UL), for electrical safety and integrity.
- C. National Sanitation Foundation International Standard/American National Standard NSF/ANSI 49-2011 for Class II Biosafety Cabinetry.
- D. Federal Standard 209E.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data for each item of equipment specified. Include dimensions, configurations, construction details, and attachments. Indicate location, size, and service requirements for each utility connection.
- B. Shop Drawings: Provide large scale plans and sections showing rough-in and anchor placements, clearances, and location of utilities for coordination with other trades.
- C. Quality Control Submittals
 - 1. Certified copies of the test report for each Class II biological safety cabinet indicating compliance with Standard NSF/ANSI 49-2011; Section 6, Performance Criteria and Annex A, Performance Tests.
 - 2. Certified copies of the field test report for each biological safety cabinet, performed in accordance with the criteria and procedures set forth in Annex F of Standard NSF/ANSI 49-2011.
- D. Manufacturer's operating and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Laminar airflow equipment and accessories shall be furnished by a single manufacturer.
- B. Manufacturer's Qualifications:

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1. Ten years or more experience in manufacture of laminar airflow equipment of type specified.
2. Ten installations of equal or larger size and requirements.

C. Installer's Qualifications: Factory trained and/or certified by the manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.
- B. Handling: Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.

1.6 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met:
 1. Windows and doors are installed and the building is secure and weathertight.
 2. Ceiling, overhead ductwork and lighting are installed.
 3. All painting is completed and floor tile is installed.

1.7 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Coverage of warranty includes but is not limited to the following:
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

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- B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. The Baker Company
2. Nuaire, Inc.
3. Esco Lifesciences

- C. Size and classification of biological safety cabinets at each location shall be as shown on the Drawings.

2.2 BIOLOGICAL SAFETY CABINETS (CLASS II, TYPE A2)

A. Design

1. Maintain a minimum calculated or measured average air inflow velocity of 100 fpm(0.5 meters per second) through the work area access opening.
2. HEPA filtered downflow air from a common recirculation/exhaust plenum (70 percent of air recirculated).
3. Discharge all exhaust air to the atmosphere after HEPA filtration (30 percent of air exhausted).
4. All biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.

B. Construction

1. Interior: Minimum 16 gage(1.6 mm) Type 304 stainless steel. Work area shall be provided with radius or rounded corners with side walls and rear wall of one piece construction.
2. Exterior: Construct of at least 18 gage(1.2 mm) sheet steel with surface finished in a baked enamel. Color shall be selected by the Owner's Representative from one of the manufacturer's standard colors.
3. Unit shall have all permanent metal air plenums.
4. Viewscreen: Sliding or hinged and constructed of 1/4 inch(6 mm) safety glass. The viewscreen shall be capable of being fully closed and of being opened to 19 inches(480 mm) for setups.
5. Cabinet shall have sealed construction, pressure tested on each unit and shall be capable of being easily fumigated employing an established procedure recommended by NIH or NSF.
6. Provide each unit with an adjustable height stand to allow work surface to be set from 30 to 36 inches(760 to 900 mm) above finished floor.

C. Airflow and Filtration

1. Supply and exhaust filters shall be HEPA type and rated 99.99 percent efficient for 0.3 micron particulates by DOP test. Perforated stainless steel screens shall be provided to protect the filters. Both exhaust and supply filters shall be front loading.
2. Unit shall have an 8 inch(200 mm) high front access opening with a calculated intake velocity of 100 fpm(0.5 meters per second).
3. Air balancing: Damper shall be located in the filter housing area to be used when filters are changed to maintain design criteria with varying differences in filter resistance.

D. Controls and Alarms

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1. The unit motor/blower shall provide a constant volume of air with increasing resistance caused by filter loading.
2. The unit speed controller shall automatically compensate for voltage change to maintain constant voltage to the motor.
3. Alarms: Equipped with an audible alarm which sounds when the viewscreen is not at its proper operating height.
4. A magnehelic gage shall display the pressure drop over the supply HEPA filter.
5. All controls to be at a maximum height of 48"(1220mm) above finished floor.

E. Electrical

1. Power: Provide a single 10 foot(3 m), 3 wire cord with a molded plug, suitable for a single 20 amp, 120/60/1 receptacle.
2. Two electrical circuits: 1 for blower/lights and 1 for duplex outlets. Each circuit shall be protected by a circuit breaker located in the instrument panel. Work area shall be provided with 2 GFI duplex outlets, one on each side, with drip proof covers and circuit breakers.
3. LED lighting: Externally mounted and shall provide 90 footcandles to 120 footcandles(970 lx to 1290 lx) on the work surface, inside the cabinet.

F. Accessories

1. Provide piped services on the left or right side of the cabinets, as indicated on the Drawings.
2. Stainless steel ball type drainage valve for safe and effective drainage of the drain pan.

2.3 SOURCE QUALITY CONTROL TESTING - BIOLOGICAL SAFETY CABINETS

A. Tests

1. Factory test each Class II biological safety cabinet in accordance with the requirements of Standard NSF/ANSI 49-2011; Section 6, Performance Criteria and Annex A, Performance Tests.
2. Submit certified copies of all test reports.
3. A representative of the Owner may elect to witness the performance tests. Notify the Owner 10 days in advance of any tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

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1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 INSTALLATION

- A. Install biological safety cabinets in strict accordance with the manufacturer's recommendations.
- B. Provide and install each cabinet with a seismic tie-down kit.
- C. Set adjustable height stand to allow work surface to be 30 inches(760 mm) above finished floor unless otherwise noted on the drawings.

3.4 SUPERVISION AND STARTUP

- A. Provide the services of the manufacturer's factory trained field representative to inspect and provide written approval of the installation.
- B. Include the services of the manufacturer's representative to start up and test the equipment, and to instruct the Owner's operating personnel in the proper care and operation of the units.

3.5 BIOLOGICAL SAFETY CABINET FIELD TESTS

- A. Field test each Class II biological safety cabinet in accordance with the methods and acceptance criteria described in Annex F of Standard NSF/ANSI 49-2011.
- B. Perform the following tests on site:
 1. Downflow velocity profile test
 2. Inflow velocity profile test
 3. Airflow smoke patterns
 4. HEPA filter leak test
 5. Cabinet leak test
 6. Electrical leakage, ground circuit resistance, and polarity tests
 7. Lighting intensity test
 8. Vibration test
 9. Noise test
- C. Submit certified copies of all test reports.

3.6 ADJUSTING

- A. Repair or remove and replace defective work, as directed by the Owner's Representative upon completion of the installation.
- B. Adjust equipment to function smoothly.

3.7 CLEANING

- A. Clean equipment, touch up as required.

3.8 PROTECTION OF FINISHED WORK

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- 3.9 Provide all necessary protective measures to prevent damage to equipment from exposure to other construction activity.

END OF SECTION

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SECTION 122413

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Roller window shades and supplementary items necessary to complete their installation.
 - 1. Motor-operated roller shades.
- B. Related Requirements:
 - 1. Motorized Units: Division 26 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
 - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 in square. Mark inside face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 in wide by 36 in long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 in long.
- D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports - Motor Operated Shades: Written report of testing and inspection required by "Field Quality Control".

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C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1. Methods for maintaining roller window shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

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- a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer/fabricator's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document Requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.
3. Record discussions, including decisions and agreements reached and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
1. Coverage of warranty includes but is not limited to the following:
 - a. Fabric failure includes deterioration, sag, warp, fade or will not remain fit for use.

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2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for the following periods from date of Substantial Completion
 - a. Manual operating components: 10 years.
 - b. Shade Cloth: 10 years.
 - c. Motors and electronic components: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Draper Inc.
 2. Hunter Douglas Contract.
 3. Lutron Electronics Co., Inc.
 4. Mariak Contract
 5. MechoShade Systems, Inc.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 1. Manufacturer and Product: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 SHADE SCHEDULE

- A. RS-04 - Shade Type 4: Motorized, light filtering shadebands. Include related motor control systems.

2.4 MOTOR-OPERATED

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

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- a. Electrical Characteristics: Single phase, 110 V, 60 Hz, unless recommended otherwise by manufacturer.
3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - a. Individual Switch Control Station: Momentary-contact, three -position, rocker-style, wall-switch-operated control station with open, close, and center off functions.
 - b. Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
 - c. Color: As selected by Architect from manufacturer's full range.
4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:
 - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
- B. Rollers - Single: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Roller Drive-End Location: As indicated on Drawings.
 2. Direction of Shadeband Roll: Regular, from back of roller, unless otherwise indicated.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

2.5 SHADEBANDS AND ACCESSORIES

- A. Shadebands - Single Roller:
 1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or as indicated in Design Selections.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material, unless otherwise indicated.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- B. Installation Accessories:
 1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 6 in
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

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2. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: As indicated on Drawings.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

2.6 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Shade Band Material: Manufacturer's standard PVC-free shade band material.

2.7 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material. Obtain approved locations from Architect prior to fabrication.
 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.3 ROLLER-SHADE INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Opaque Shadebands: Located so shadeband is not closer than 2 in to interior face of glass. Allow clearances for window operation hardware.
- C. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.4 FIELD QUALITY CONTROL - MOTOR OPERATED SHADES

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 - 1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.5 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

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3.6 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

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SECTION 12 3553.13

MOVABLE LABORATORY BENCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes steel support frames, work surfaces and shelving including supplementary items necessary to complete the Work required for installation.

1.2 REFERENCE STANDARDS

- A. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
- B. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
- C. SEFA 8M - Laboratory Grade Metal Casework.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. For each type of moveable bench laboratory casework unit specified. Include product test reports from and based on tests performed by a qualified independent testing laboratory evidencing compliance of moveable bench casework system finishes with requirements specified for chemical and physical resistance.
- B. Shop Drawings: For moveable bench casework system showing plans, elevations, cross-sections, service run spaces, location and type of service fittings, together with connection for laboratory service fittings..
 - 1. Scale: 3/4 inch = 1 ft.; provide 1/4 inch = 1 ft. rough-in plan drawings for coordination with trades.
 - 2. Include details and location of anchorages and fitting to floors and walls, including required blocking or back blocking.
 - 3. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
 - 4. Coordinate shop drawings with other work involved.
 - 5. Include manufacturer's recommendations for blocking and securing of moveable bench casework system units and fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

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C. Manufacturer's Installation Instructions:

D. Qualification Data:

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

E. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Data: Manufacturer's recommendations for care and cleaning.

1.6 CONCURRENT SUBMITTALS

A. Concurrent Submittals: Submittals for the following Sections shall be coordinated and submitted simultaneously.

1. Section 12 3553.13 - Metal Laboratory Casework.
2. Section 12 3653 - Laboratory Casework Tops

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Product Standard: Comply with SEFA 8M.
4. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
5. Work shall be manufacturer's standard construction unless otherwise shown or specified. Laboratory furniture is to be re-locatable and fit harmoniously with any assembly or combination of cabinets, shelves, tables, desks, and miscellaneous equipment.
 - a. Moveable bench casework system shall integrate with fixed metal laboratory casework system creating the appearance of fully integrated laboratory casework system

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- C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
 4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
 5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 3. Record discussions, including decisions and agreements, and prepare report.

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1.9 PROJECT CONDITIONS

- A. Field Measurements: Where moveable bench casework system is indicated to fit to other construction and equipment, coordinate dimensions of adjacent equipment and verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Environmental Limitations: Do not deliver or install moveable bench casework system until building is enclosed, wet work and utility roughing-in are complete, finish flooring is installed, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to the following:
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 years from date of Substantial Completion.
- B. Defects include, but are not limited to:
 - 1. Ruptured, cracked, or stained coating.
 - 2. Weld or structural failure.
 - 3. Warping or unloaded deflection of components.
 - 4. Discoloration or lack of finish integrity.
 - 5. Cracking or peeling of finish.
 - 6. Visible weld marks.
 - 7. Sealant deterioration, shrinkage, or failure.

1.12 EXTRA MATERIALS

- A. Furnish complete touch-up kit for each type and color of moveable bench casework item provided. Kit to include touch-up paint and other materials necessary to perform permanent spot repairs to damaged casework finish

PART 2 - PRODUCTS

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2.1 MANUFACTURERS AND PRODUCTS

- A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Basis of Design product: Lab Crafters, I-FLEX System, www.lab-crafters.com
- B. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. A.T. Villa Inc., Ergolab, www.atvilla.com
 - 2. Kewaunee Scientific Equipment Corp., Evolution, www.kewaunee.com
 - 3. Lab Crafters, I-FLEX System, www.lab-crafters.com
- C. Provide laboratory casework with tops, sinks, and service fittings, manufactured or furnished by same laboratory furniture manufacturer for single responsibility Casework, furnishings and equipment specified in the following sections shall be furnished and installed by the same supplier..
 - 1. Section: Laboratory Fume Hoods.
 - 2. Section: Laboratory Casework and Furnishings.
- D. Catalog Standards:
 - 1. Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain laboratory casework. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet.
 - 2. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Catalog Standards:
 - 1. Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain laboratory casework. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet.
 - 2. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable

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manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.

2.3 PERFORMANCE REQUIREMENTS

A. System Structural Performance: In addition to the requirements of SEFA 3, SEFA 7, SEFA 8M, laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Work Surface and Support Framing: 100 lbs/lineal ft. applied over 7 foot wide work surface for total uniformly distributed load of 1500 lbs at the work surface. Deflection not to exceed 0.125 inch, measured at center of span of work surface.

B. MANUFACTURERS

2.4 SYSTEM DESIGN FEATURES

1. Adaptable Casework System: Modular system to be made of tubular style framing combined with rectangular formed steel uprights.
 - a. Tubular Frames / Table Supports to be adjustable height in 1 inch increments and complete with levelers.
 - b. Rear frame to be used for carrying services and electrical conduit.
 - i. Rear upright supports to be equipped with slots for adjustable shelving and levelers.
 - ii. All services supplied with hose and quick disconnect to reach ceiling panel supply.
 - c. Assembled frame to be self-supporting without requiring to be anchored to structure.
 - d. The modular system shall ship complete from the factory with minimal on-site assembly.

2.5 ADAPTABLE SYSTEM STRUCTURE

1. Rear Support Structure:
 - a. Bench Frame Dimensions:
 - i. Widths: 42, 48, 60, and 72 inches.
 - ii. Depth: 3 inches.
 - b. Rear Uprights:
 - i. 2 inch by 3 inch 14 ga. cold rolled steel.
 - ii. 2 inch diameter nylon leveling glide 3/8" x 2-1/2" long threaded stem.
 - c. Upper Cross Rail: 16 ga. cold rolled steel.
 - d. Load Capacity: Rear Upright shall support up to 3 shelves loaded to a combined maximum of 300 pounds.
 - e. Shelves (2): At 200 lbs. each, total 400 lbs.
 - f. Uprights to house services, electrical and data cables: High voltage cabling to be in a separate upright from gas piping.
 - g. Wire management tray shall be under countertop.

h. Rear uprights shall have slots punched on 1 inch centers starting at nominal 59 inches above finished floor and continuing to top of upright to accommodate adjustable shelving.

- a. Nominal Table Assembly Dimensions:
 - i. Widths: 42, 48, 60, and 72 inches.
 - ii. Depth: 23 inches or 29 inches, as indicated on Drawings.
 - iii. Adjustable Heights: 29 and 36 inches above finished floor, not including work surface.
- b. Base: Integrated heavy duty leveling castors.
 - i. The table is equipped with leveling casters that can support 1,100 pounds.
- c. Tubular Table Legs:
 - iv. 2 inch outside square, 14ga. cold rolled steel outer leg.
 - v. Fabricated using extruded aluminum (6005-T) materials and heat-treated (T5) to withstand a load capacity of 2,600 pounds when fully loaded
 - vi. 1-3/4 inch outside square, 11ga. cold rolled steel inner telescoping leg.
 - vii. 2 inch diameter nylon leveling glide 3/8" x 2-1/2" long threaded stem
- d. Capable of vertical height adjustment in 1 inch increments.
- e. Table assembly to be fastened to rear upright with two (2) hex 3/8" socket head bolts.
- f. Hanging Rails: Front apron and rear support are to have rails to allow hanging of suspended cabinets.
- g. Leveling Bolt: Frame to be fitted with a leveling bolt which will allow the legs to be adjusted for proper alignment of work surface height.
- h. Load Capacity: Table frame to support 1500 lbs. at work surface plus (+) 200 lbs. at two (2) shelves equals 1900 lb. rating including work surface.

- a. Depth: 12 inches, unless otherwise indicated.
- b. Shelf requirements:
 - ii. Shelves: Minimum 0.0474 cold rolled steel.
 - iii. Shelves to be flush with face of rear rectangular posts.
 - iv. Shelf Brackets: Minimum 0.118 inch cold rolled steel.
 - v. Load Capacity: 200 lbs. per shelf at (2) shelves.
 - vi. Bottom and middle shelves to have 1 inch high rear retaining lip. Retaining lip not required at top shelf.
 - vii. Vertical Shelf Adjustment: One inch increments.
 - viii. One inch tall x 5/16 inch dia. shelf retainer rods, Type 304 stainless steel.

- a. Power, data devices and plumbing fixtures to be column/post mounted.
- b. Electrical, data and plumbing services to terminate with cable or hose coming out of the top of the rear support upright.
- c. Electrical services to have a 20 amp cord extending 4 feet above the top of the upright.
- d. Data services to have a male plug extending 4 feet above the top of the upright.

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5. Electrical power and data services shall be distributed to the bench through either a power pole and/or a horizontal hook-on power raceway, as depicted in the drawing package.
 - a. Receptacles shall be 20-amp, 125 volt, NEMA 5-20R straight blade commercial grade, self-grounding devices unless otherwise noted. Device color as noted on the drawings. If no color indicated the device shall be white. Receptacles shall be UL listed.
 - b. Receptacles shall be mounted to the pole and/or raceway from the rear through double-d cut outs in the sheet metal and do not require a faceplate.
 - c. Receptacles shall be wired to a 12/3 White SO cord with L5-20P twist lock plugs for connection to the ceiling service panels. No more than 4 duplexes or 8 individual devices shall be wired to a single circuit.
 - d. Data receptacles shall be furnished and installed in the same pole and/or raceway as line voltage electrical devices. Data devices and wiring shall be sufficiently spaced, routed away from and/or physically partitioned from electrical line voltage wiring to prevent signal interference.
 - e. Unless otherwise noted, data devices shall be Hubbell C6ESRW CAT 6E UTP cable with a Hubbell HXJ6W jack on one end and a Hubbell RJ45 plug for connection into a mating jack the ceiling service panel (mating jack furnished and installed by others in the ceiling service panel).

2.6 CONNECTIONS FOR GASES AND ELECTRICAL

- A. General: Gases and power terminate at top of upright supports.
- B. The upright frame structure shall house a maximum of three plumbing services.
- C. Plumbing Lines: 1/4-inch o.d. by 0.035-inch wall thickness, Type 316 stainless steel tubing with quick disconnect attached to tube with compression fittings at top of upright. Each half of quick disconnect, coupler and nipple, are valved. Quick disconnects are arranged so services cannot be intermixed.
- D. Service valves and quick connects shall be media keyed and color coded to prevent accidental switching.
- E. Electrical Connections: Location, type, and quantity are shown on Drawings.
- F. Circuiting: Provide one 120V, 20A circuit on double pole breaker at each bench. Coordinate circuiting with receptacle configuration in Ceiling Utility Panels. Provide locking plug (NEMA L 14-20P) with 4 foot whip
- G. Receptacles within 6 feet of sinks shall be GFIC type.
- H. Data Connections: Provide knockouts for data device, by others, as indicated on Drawings

2.7 SERVICE FITTINGS

- A. Utility poles and raceways shall be used to provide point-of-use services at the laboratory bench.

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- B. Plumbing utility poles shall include panel mount laboratory plumbing service fixtures from WaterSaver Faucet Co.
1. Standard plumbing services shall use WaterSaver model L4880-225WSA model fixture with 5/8" O.D. Reinforced PVC hose. The hose shall connect directly to the valve and on the other end include a male quick connect fitting to connect to the building service via a ceiling service panel.
 2. High Purity plumbing services shall use WaterSaver model L4880-225WSA model fixture that has been factory oxygen cleaned. The hose shall be stainless steel braid over a PTFE core that has been factory oxygen cleaned. The hose shall connect directly to the valve and on the other end include a male quick connect fitting to connect to the building service via a ceiling service panel.
 3. Burning gas plumbing services shall use WaterSaver model L4260-158WSA model fixture. The valve shall be piped with black iron or stainless steel pipe within the utility pole. The internal pipe shall be connected to a stainless steel hose with corrugated stainless steel core. The hose shall include a male quick connect fitting to connect to the building service via a ceiling service panel.
 4. The male end of the quick connect shall be color coded to match the service. The quick connects shall be keyed differently to prevent connecting hose designated for one media to the female quick connect of a different media.
 5. The plumbing utility pole shall accommodate up to five unique plumbing services.
 6. Should a blank utility pole be required to support adjustable shelving or other accessories, the blank pole shall be a plumbing pole with the holes for mounting plumbing fixtures capped.

2.8 SHELVING

- A. Metal Shelving: Cold-rolled steel sheet with powder-coated urethane finish; minimum 18 gauge. Rear corners of shelves are notched to fit profile of upright tube. Shelves can be mounted to rear post assemblies, wall frames, and wall standards.
1. Depth: 12 inches, unless otherwise indicated.
 - i. Shelf requirements:
 - ii. Shelves: Minimum 0.0474 cold rolled steel.
 - iii. Shelves to be flush with face of rear rectangular posts.
 - iv. Shelf Brackets: Minimum 0.118 inch cold rolled steel.
 - v. Load Capacity: 200 lbs. per shelf at (2) shelves.
 - vi. Bottom and middle shelves to have 1 inch high rear retaining lip. Retaining lip not required at top shelf.
 - vii. Vertical Shelf Adjustment: One inch increments.
 - viii. One inch tall x 5/16 inch dia. shelf retainer rods, Type 304 stainless steel.
 2. Nominal Dimensions: 29, 35, and 42 inches wide; 12 and 15 inches deep.
 3. Shelf extends 2 inches beyond rear face of upright tube.
 4. Lower and middle shelves have removable 18 ga. steel back rail which acts as back stop and can be turned upside down to provide flush work surface when units are back-to-back. Upper shelf has removable 18 ga. steel back rail.
 5. Shelf Brackets: 11 gauge cold rolled powder-coated steel. Brackets mount to tubular uprights. Brackets extend above shelf surface except for top-most shelves that have bracket extending below shelf surface.
 6. OPTION, as selected by the Architect: Bottom shelf shall feature magnetic LED task light. The on/off switch and occupancy sensor (if required) shall be located within the task light

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housing. Task light shall be mounted flush within steel shelves. LED shall plug into a receptacle on an adjacent power pole or raceway.

2.9 CEILING SERVICE PANELS:

1. Ceiling service panels shall be fabricated from 18g steel formed for a depth of 1.75" with return flanges on all four sides. The panel shall be sized according to the project drawings with cutouts for utilities as shown.
2. The finish shall be powder-coat, with color selected from manufacturer's standard offering.
3. The plumbing quick connects required for the ceiling service panels shall be factory mounted.
4. The electrical receptacles and face plates required for the ceiling service panels shall ship loose for field installation by others. Back boxes shall be factory mounted.
5. The data services shall be furnished and installed in the field by others.
6. The ceiling service panels shall be set into the existing grid (grid by others) and secured to the grid with screws. Any other overhead support shall be by others.
7. The connection of building service feeds to the ceiling panel is by others.

2.10 CASEWORK

- A. The adaptable bench system shall integrate with floor mounted, mobile, and/or suspended styles of casework.
1. Mobile casework shall be laboratory grade in accordance with SEFA 8M with casters.
 2. Mobile cabinet bodies are fully welded with a finished metal top and back.
 3. Casters shall be 3" double wheel, swivel, with front two casters having brakes.
 4. Mobile cabinets with more than one drawer shall have interlocking drawer tracks that prevent more than one drawer from being opened simultaneously.
 5. Mobile cabinets shall include a counterweight to prevent tipping over if required when tested to the ANSI/BIFMA X5.9 standard.
 6. Cabinet Hinges shall be stainless steel pivot hinges meeting requirements of SEFA 8M.
 7. Cabinet pulls shall be 4" wide raised bar pulls.
 8. Cabinet drawer tracks shall be full extension rated for 200#, except for 3" drawers which shall be rated for 100#.
 9. All cabinets drawer bodies shall be type 304 stainless steel with a 2B finish.

2.11 WORK SURFACES, SPLASH GUARDS, AND SHELVING

- A. Phenolic Resin: Phenolic Resin board material shall consist of layers of phenolic impregnated kraft papers that are compressed in a flat press at pressures exceeding 100 psi (685.9kPa) and at 300 deg. F (149 deg. C). The top surface layer shall contain the required color pigmentation. Tabletops shall be 1" thick, with drip grooves provided on the underside at front edge. Color shall be Black, White, or Gray, all with a black edge.

2.12 MODESTY PANELS

- A. Modesty Panels: Painted steel sheet; mounts directly to rear frame using simple clamp mechanism requiring simple hand tool.
- B. Nominal Dimensions:

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1. Widths: 42, 48, 60, 72, and 84 inches.
2. Height: 19 inches; mounts directly below work surface.

2.13 ACCESSORIES

- A. Plug Mold: UL-approved, plug-in strip with single grounding type 20 amp outlets at 6 inches o.c. single circuit, 8 foot power cord with grounding type plug, metal housing, 2 inches by 3 inches nominal, length to match cart, color white with white cord.
- B. Task Lighting: Provide surface mounted LED fixtures.
 1. UL listed for 120V, 60Hz operation.
 2. Ballast electronic type with "A" sound rated ballast.
 3. 0.033 inch cold-rolled steel with reinforcement and end caps secured with concealed fasteners white in color.
 4. Acrylic lens, opaque front task lens.
 5. White 3 foot cord set with plug and on/off rocker switch.

2.14 FINISH FOR STEEL COMPONENTS

- A. Metal Finish Performance Requirements:
 1. Abrasion resistance: Maximum weight loss of 5.5 mg. per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrase #CS10 wheel.
 2. Humidity resistance: Withstand 1000 hour exposure in saturated humidity at 100 deg F.
 3. No visible effect to surface finish following 100 hour continuous application of a water soaked cellulose sponge, maintained in a wet condition throughout the test period.
 4. Salt Spray: Withstand minimum 200 hour salt spray test.
- B. Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
- C. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- D. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 2. Powder coat finish: Custom color as selected by architect.

2.15 STAINLESS STEEL FINISHES

- A. Finish designations prefixed by AISI conform with the American Iron and Steel Institute for designating finishes for stainless steel.

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- B. Remove or blend tool and die marks and stretch lines into finish.
- C. Grind and polish surfaces to produce uniform, directional, textured, and polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 1. Provide No. 4 Satin finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 INSTALLATION OF MOVABLE LABORATORY BENCHES

- A. Frames: Install frames plumb, level, true and aligned with no distortions.
 - 1. Adjust frame leg levelers to achieve level and plumb installation.
 - 2. Connect side-to-side and back-to-back frame units together.
 - 3. Erect frame units to a maximum tolerance from vertical of 1/4 inch in up to 7 feet of height.
- B. Prior to Substantial Completion, verify casework hardware has been properly installed. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind.
- C. Fastening of Work Surfaces:
 - 1. Phenolic Tops: Secure work surfaces to rear post assembly and table frame using manufacturer's brackets.
 - 2. Tolerance: Install work surfaces with not more

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3.4 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.5 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed upon completion of installation.
- B. Clean factory- and shop-finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as acceptable to .
- C. Protection: Provide a suitable covering over work surfaces to prevent marring of surface due to impact, or staining due to corrosive materials; tape to underside of work surface. Protect installed movable bench laboratory casework and fittings from damage by work of other trades until date of Substantial Completion.

END OF SECTION

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SECTION 12 3553.14

STAINLESS STEEL LABORATORY CASEWORK

PART 1 - GENERAL

1.1 SECTIONS INCLUDES

- A. Work required for this section includes stainless steel laboratory casework with supplementary items necessary to complete their installation.
 - 1. Stainless Steel Laboratory Casework.
 - 2. Hardware.
 - 3. Knee Opening/Frames.
 - 4. Filler Panels.
 - 5. Countertops, Sinks, and Shelving

1.2 RELATED SECTIONS

- A. Section: Laboratory Casework and Furnishings.
- B. C-Frame Laboratory Furniture System.
- C. Section: Laboratory Fume Hoods.
- D. LEED Certification Procedures.
- E. Division 22: Furnishing and installation of plumbing utilities and final connections to service fixtures.
- F. Division 23: Furnishing and installation of exhaust ductwork and equipment, and final connection to exhaust devices.
- G. Division 26: Furnishing and installation of electrical utilities and final connections to casework and accessory equipment.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.
- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.
 - 1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordination of Contract Documents and Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 REFERENCES

- A. Americans with Disabilities Act (ADA).
- B. American Society for Testing and Materials (ASTM).
 1. ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 2. ASTM A666 – Stainless steel
- C. Business and Institutional Furniture Manufacturers Association (BIFMA).
- D. Factory Mutual (FM).
- E. Leadership in Energy and Environmental Design (LEED II).
- F. National Electrical Manufacturers Association (NEMA).
 1. NEMA LD3-2000 - High-Pressure Decorative Laminates.
- G. National Fire Protection Association (NFPA).
 1. NFPA 30 - Flammable and Combustible Liquids Code.
- H. Office of Safety and Health Administration (OSHA).
- I. Scientific Equipment and Furniture Association (SEFA).
 1. SEFA 8 - Laboratory Furniture Casework, Tables, and Shelving Recommended Practices Testing.
- J. Underwriters Laboratories (UL).

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's data for each item of laboratory furnishings and equipment. Include component dimensions, configurations, construction details, joint details, and attachments. Indicate location, size, and service requirement for each utility connection.

- B. Shop Drawings:
 - 1. Provide 3/8 inch = 1 foot 0 inches(1:33) scale minimum elevations of individual and battery of casework units showing cross sections, rough-in and anchor placements, tolerances, and clearances. Indicate relation of units to fume hoods, other laboratory equipment, surrounding walls, windows, doors, and other building components.
 - 2. Provide 1/4 inch = 1 foot 0 inches(1:50) rough-in plan drawings for coordination with trades. Rough-in shall show free area.
 - 3. Provide 1 set of reproducible prints.
- C. Qualification Data: For manufacturer and installer.
 - 1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
 - 2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.
- D. Samples for Initial Selection: For factory-applied finishes and other materials requiring color selection.
- E. Samples for Verification: : Unless otherwise directed, approved full-size Samples may become part of the completed Work, if in an undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations. If not incorporated into the Work, retain acceptable full-size Samples at Project site and remove when directed by Architect.
 - 1. Top Samples: Submit product sample of each type of benchtop.
 - 2. Hardware Samples: Provide samples of door and drawer pulls, locks, casters, and hinges.
 - 3. Finish Samples: Submit 3 inch by 5 inch(75 mm by 125 mm) samples of each color of finish for casework, work surfaces and for other prefinished equipment and accessories for selection by the Owner's Representative.
- F. Test Reports: Submit test reports verifying conformance to specified performance tests.
- G. Maintenance Manual: Provide written instruction manual with proper maintenance procedures.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide casework, work surfaces, laboratory furnishings, and accessories, all furnished by a single laboratory furniture company.
- B. Manufacturer/Fabricator Qualifications: Manufacturer/fabricator with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
 - 1. Modern plant with proper tools, dies, fixtures, and skilled production staff to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:

- a. 5 years or more experience in manufacture of laboratory casework and equipment of type specified.
- b. 10 installations of equal or larger size and requirements.

C. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

D. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installation of products and systems similar to this Project and has a record of successful in-service performance.

E. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

F. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Schedule delivery of casework and equipment so that spaces are sufficiently complete that material can be installed immediately following delivery.

- B. Handling: Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating. Protect all work surfaces from damage throughout construction period. Do not allow standing on work surfaces during the construction period. Provide signage marked in large lettering that reads: "NO STANDING".

1.8 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met:
 - 1. Building areas requiring the installation of laboratory casework: Dry and unexposed to adverse weather conditions which may damage finished materials.
 - 2. The air conditioning or heating system: On and functioning in areas of casework installation to maintain the temperature between 60 and 85 degrees Fahrenheit(16 and 30 degrees Celsius) with the relative humidity between 45 percent and 65 percent.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 SEQUENCING AND SCHEDULING

- A. All overhead mechanical, electrical and plumbing rough-in work: Complete prior to laboratory casework deliveries.
- B. All mechanical, electrical and plumbing rough-in work required along walls and service islands, where lab furnishings are to be installed: Complete prior to delivery of materials.
- C. Walls and partitions must be in place and finished with at least the primer coat of paint. If finish painting is to take place after lab casework and furnishings installation, protect the casework and furnishings by covering and masking prior to commencement.
- D. All necessary wood or metal blocking must be installed within partitions prior to delivery of casework and furnishings.
- E. Overhead soffits and ceiling grid must be in place prior to casework installation.
- F. Overhead lighting must be installed and connected prior to casework installation.
- G. All flooring required to be placed under lab casework and furnishings must be installed prior to material delivery.
- H. Concrete floors must be level within 1/8 inch(3 mm) of level per 10 foot(3 m) run, nonaccumulative, when tested with a straight edge in any one direction.
- I. Wet operations to be performed must be complete prior to material deliveries.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to the following:
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
 - 1. Basis of Design product: Lab Crafters, www.lab-crafters.com
- B. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. A.T. Villa Inc., www.atvilla.com
 - 2. Kewaunee Scientific Equipment Corp., www.kewaunee.com
 - 3. Lab Crafters, www.lab-crafters.com
- C. Furnish and install casework, furnishings and equipment specified in the following sections by the same supplier.
 - 1. Section 115313 - Laboratory Fume Hoods.
 - 2. Section 123553.13 – Mobile Laboratory Benches
 - 3. Section 123553.33 - Laboratory Casework and Furnishings.

2.2 CASEWORK DESIGN: STAINLESS STEEL

- A. Flush Overlay Construction: Overlay case body with door and drawer fronts.
- B. Self Supporting Units: Completely welded shell assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit.

- C. Interior of Case Units: Easily cleanable, flush interior. Base cabinets, 30 inches(750 mm) and wider, with double swinging doors shall provide full access to complete interior without center vertical post.
- D. Drawers: Sized on a modular basis for interchange to meet varying storage needs, and designed to be easily removable in field without the use of special tools.
- E. Case Openings: Rabbeted-like joints all 4 sides of case opening for hinged doors and 2 sides for sliding doors in order to provide dust resistant case.
- F. Secure intersection of case members with spot and arc welds.
- G. Testing of Casework, Tables, and Shelving: Meet or exceed SEFA 8.

2.3 MATERIALS

A. Sheet Steel:

- 1. Type: Mild, cold rolled and leveled Type 304 stainless steel, unless otherwise noted on Drawings or elsewhere in this Section.
- 2. Finish: Exposed surfaces ground and polished to a Number 4 satin finish. Provide Type 304 with a tumbled finish approximating a Number 4 finish for nuts, screws, bolts, and rivets. Provide the grain finish direction as follows:
 - a. Vertical on door and drawer fronts
 - b. Vertical on tall storage cabinets door fronts and end panels.
 - c. Horizontal on all other exterior surfaces.
- 3. Welding: Provide all stainless steel welding material of type similar to sheet material. Provide welds made without discoloration; ground, polished, and passivated to blend harmoniously with a Number 4 satin finish.

B. Glass:

- 1. Laminated safety glass: Two outer plies of glass with a vinyl interlayer, nominal 1/4 inch (6 mm) thick.

2.4 CASEWORK FABRICATION: STAINLESS STEEL

A. Floor Mounted Base Cabinets:

- 1. End Panels and Backs
 - a. 18 gage(1.2 mm) stainless steel.
 - b. End panels and back formed from a single stainless steel sheet with front edges formed to a channel shape and further offset to form a strike for doors and drawers.
 - c. Reinforce at front and rear corners with 18 gage(1.2 mm) full upright posts containing shelf adjustment holes, maximum 1/2 inch(12 mm) on centers.
 - d. Provide removable backs on all base cabinets, except units with security panels and sink cabinets, to allow access to service piping from the front of the unit
 - e. All sink cabinets to have partial height back panels to allow passage of drain line and piping to service chase.
- 2. Bottoms:

- a. 18 gage(1.2 mm) stainless steel.
 - b. Bottom and bottom rail formed from a single piece of metal with both sides and back formed up with a radius between flange and bottom for ease of cleaning. Form front rail to provide a strike for doors and drawers.
 - c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
3. Front Top Rails:
 - a. 16 gage(1.2 mm) stainless steel.
 - b. Provide flush at face of cabinet and interlock within the flange at the top of the end panels. Form front of rail to provide a strike for doors and drawers.
 - c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
4. Adjustable Shelves:
 - a. 20 gage(1.0 mm) stainless steel.
 - b. Form front and back edges down 3/4 inch(19 mm) and returned back 3/4 inch(19 mm). Form ends down 3/4 inch(19 mm).
 - c. For shelves over 36 inches(915 mm) long or 16 inches(400 mm) deep, reinforce with a welded hat channel for the full length of the shelf.
 - d. Adjustable on 1/2 inch(12 mm) centers.
 - e. Front edge of shelf to be within 1 inch(25 mm) of inside face of door.
5. Hinged Doors:
 - a. 3/4 inch(19 mm) double wall assembly with 18 gage(1.2 mm) exterior panel and 20 gage(1.0 mm) interior panel.
 - b. Reinforce interior of front panel with welded stainless steel hat channels. Prepaint and sound deaden interior. Weld outer corners and grind smooth.
 - c. Secure hinges with screws to internal 14 gage(2.5 mm) reinforcing in case and door. Hinges shall be removable; welding of hinges is not acceptable.
 - d. Doors shall close against rubber bumpers.
6. Drawers:
 - a. Drawer front: 3/4 inch(19 mm) double wall assembly, 20 gage(1.0 mm) interior and exterior panels, prepaint prior to assembly and sound deaden, weld top front corners and grind smooth.
 - b. Drawer body: 20 gage(1.0 mm) stainless steel, one-piece construction including bottom, 2 sides, back, and inner front. Fully coved at interior bottom.
 - c. Drawers shall close against rubber bumpers.
 - d. Provide security panels for drawers with keyed different locks.
- B. Drawer and Hinged Door Pulls: 3/8 inch(10 mm) diameter stainless steel wire pull, 4-3/4 to 5-1/16 inches(120 mm to 128 mm) center to center with radiused corners and a projection of 1 inch to 1-1/2 inches(25 mm to 40 mm). Model 115.61.602 as manufactured by Hafele America (800) 423-3831, Lamp Model SST-30L as manufactured by Sugatsune America, Inc. (800) 562-5267, Model 1.381.128 as manufactured by Ironmonger Inc. (800) 621-1937, or Model DP57C as manufactured by Mockett (800) 523-1269.
- C. Door Catches: Roller type, adjustable, operating with a built-in tension spring. Provide all parts of zinc plated steel except roller. Attach to top of base cabinet doors, the bottom of wall cabinet doors, and at the top and bottom of tall cabinet right-hand doors. Provide an elbow catch for the left-hand door of tall cabinets at the fixed center shelf.

- D. Shelf clips: Die formed steel, zinc plated, to engage in shelf adjustment holes on nominal 1/2 inch(12 mm) centers.

2.5 KNEE OPENING FRAMES:

A. Components:

1. Perimeter Rails: 3/4 inch by 4-1/8 inches(19 mm by 105 mm) stainless steel C-channel with a maximum span of 72 inches(1829 mm).
2. Reinforcing Cross Rails: 3/4 inch by 4-1/8 inches(19 mm by 105 mm) stainless steel C-channel at intervals not more than 33 inches(840 mm) on centers.
3. Legs: 2 inch by 2 inch(50 mm by 50 mm) stainless steel tube legs with welded leg bracket. one leg front and one leg rear at end and intermediate locations. Attach legs with 2 bolts to front and back aprons and weld to end rails. Provide a coved vinyl or rubber leg shoe, 2 inches(50 mm) in height.
4. Leveling Glides: 2 inch(48 mm) diameter, two-piece pivot construction, stainless steel housing, nonmarring, phenolic or translucent plastic insert, 1/2 inch(12 mm) diameter, minimum 1-1/2 inch(36 mm) long zinc plated stems on each leg.

B. Construction:

1. For KO's between two cabinets or cabinet and wall, provide front and back perimeter rails. Provide reinforcing cross rails as required. Attach with stainless steel angles to adjacent cabinets or wall.
2. For KO's at the end of a bench, provide front, back, and side perimeter rails. Provide reinforcing cross rails as required. Attach with steel angles to cabinets and steel corner braces, grooved and screwed into both rails at each corner.
3. For KO benches with no adjacent cabinets or walls, provide front, back, and side perimeter rails. Provide reinforcing cross rails as required. Attach with steel corner braces, grooved and screwed into both rails at each corner.

2.6 FILLER PANELS:

- A. Provide filler panels and pipe chase enclosure panels at exposed to view areas between back of cabinets and walls, between backs of cabinets at end of island or peninsula benches, and at any other area necessary to enclose gaps. Provide all filler panels with bottom 6 inches(152 mm) fixed and the top portion removable.

B. Materials:

1. Minimum 18 gage(1.2 mm) stainless steel.
2. Grind edges and radius corners to eliminate sharp edges.

- C. Secure to frame and/or cabinet back and wall with stainless steel angle and oval head screws with finishing washers.

2.7 COUNTERTOPS, SINKS, AND SHELVING

- A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects. Ease exposed edges and corners. Provide front and end overhang of 1 inch over base cabinets.

- B. Stainless-Steel Tops: Made from 0.0625-inch- thick, stainless-steel sheet, ASTM A 666, Type 316 with No. 4 satin finish, and complying with the following:
1. Weld shop-made joints, and grind and polish surfaces to produce uniform, directional, textured, polished finish indicated, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 2. Where field-made joints are permitted, provide welded joints.
 3. Extend top down to provide a 1-inch thickness and a 1/2-inch return flange under frame. Sound deaden entire undersurface with heavy-build mastic coating.
 4. Form backsplash coved to and integral with top surface.
 5. Provide rolled edge, unless otherwise indicated.
 6. Provide raised marine edge around perimeter of tops containing sinks; pitch 2 ways to sink to provide drainage without channeling or grooving.
 7. Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit, grind welds smooth, polish, passivate, and rinse.
- C. Stainless-Steel Sinks: Made from 0.050-inch thick, stainless-steel sheet, ASTM A 666, Type 316. Fabricate with corners rounded and coved to at least 5/8-inch radius. Slope sink bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch diameter. Provide continuous butt-welded joints, grind smooth, and polish surfaces to produce finish indicated, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
1. Provide factory punchings for fittings.
 2. Apply approximately 1/8-inch thick, heat-resistant, sound-deadening coating to undersink surfaces.

2.8 SOURCE QUALITY CONTROL TESTING OF STAINLESS STEEL FINISH

- A. Meet or exceed the latest edition of the following Section and Articles of SEFA-8 Recommended Practices;
- B. Testing Requirements: Provide a third party tester that is not a representative of the Manufacturer or Installation Contractor
1. Test Results: Submit a certified report providing test results and indicating the finish conforms with or exceeds the above SEFA-8 Recommended Practices.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 INSTALLATION

A. Casework Installation:

1. Install, plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Securely anchor to building structure. Where laboratory furniture abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.
2. Installation of each individual bench run shall start at the high point of the floor under that bench run with levelers screwed in as much as possible.
3. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch(1.5 mm).
4. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by Manufacturer.
5. Securely fasten tall cabinets, fume hood superstructures and tall flammable storage cabinets to solid support material near top of cabinet.
6. Reinforcement of stud walls to support cabinets, shelving, and other wall mounted laboratory furnishing items: Done during wall erection by trade involved. Laboratory furniture company/supplier is responsibility for indicating on Shop Drawings the accurate location and sizing of reinforcement.

B. Wall Cabinet Installation:

1. Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets.
2. Reinforcement of stud walls to support wall mounted cabinets: Done during wall erection by trade involved. Laboratory furniture company/supplier is responsibility for indicating on Shop Drawings the accurate location and sizing of reinforcement.

C. Work Surface Installation:

1. Field jointing where practicable: Made in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by Manufacturer. Locate field joints as shown on accepted Shop Drawings, factory prepared so that there is no job site processing of top and edge surfaces.
2. Abut top and edge surfaces in 1 true plane, with internal supports placed to prevent any deflection.

3. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Prior to making openings, verify size of opening with actual size of equipment to be used. Form inside corners to a radius of not less than 1/8 inch(3 mm). After sawing, rout and file cutouts to ensure smooth, crack free edges. Seal exposed edges after cutting with a waterproofing material recommended by manufacturer.
4. Secure tops to support with concealed Z-Type, angle type fastening or equivalent devices spaced no more than 3 feet(0.9 m) on center.
5. Epoxy Resin & Phenolic Work Surface Joints: 3/32 inch(2.38 mm) flush and smooth.
6. Stainless Steel Work Surface joints: Electrically weld all shop and field joints; grind smooth and polish.
7. Caulk joints between curb and walls, fume hoods, and cabinets with acid-resistant silicone caulk.

- D. Sink Installation: Set in chemical resistant sealing compound sinks which were not factory installed and secured and supported per manufacturer's recommendations.
- E. Accessory Installation: Install accessories and fixtures in accordance with manufacturer's recommendations.

3.4 ADJUSTING

- A. Repair or remove and replace defective work, as directed by Owner's Representative upon completion of installation.
- B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.5 CLEANING AND PROTECTION

- A. Clean shop finished casework, touch up as required, and remove and refinish damaged or soiled areas.
- B. Cover casework for protection against soiling and deterioration during remainder of construction period.
- C. If steel wool is used in cleaning stainless steel, use only stainless wool.
- D. Protect casework before, during, and after installation. Materials damaged due to improper protection are cause for rejection.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
- B. Owner's Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

END OF SECTION

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SECTION 12 3553.33

LABORATORY CASEWORK AND FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes [metal] [wood] [plastic laminate] laboratory casework with with supplementary items necessary to complete their installation.

1. Metal Laboratory Casework.
2. Hardware.
3. Knee Openings.
4. Filler Panels.
5. Service Chase Pipe Support Assembly.
6. Vacuum Pump Cabinets
7. Movable Tables.
8. Stainless Steel Bench.
9. Finishes.
10. Work surfaces.
11. Sinks.
12. Laboratory Service Fixtures.
13. Emergency Shower and Eye Wash Units
14. Umbilicals.
15. Shelving.
16. Drying Racks.
17. Splash Guard
18. Gas Cylinder Restraints
19. Sleeves in Countertops.
20. Height Adjustable Microscope Table.

1.2 RELATED SECTIONS

- A. Laboratory Fume Hoods.
- B. LEED Certification Procedures.
- C. Division 22: Furnishing and installation of plumbing utilities and final connections to service fixtures.
- D. Division 23: Furnishing and installation of exhaust ductwork and equipment, and final connection to exhaust devices.
- E. Division 26: Furnishing and installation of electrical utilities and final connections to casework and accessory equipment.

1.3 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.

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- B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.
1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination of Contract Documents and Work:
1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
 2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 REFERENCES

- A. Americans with Disabilities Act (ADA).
- B. American National Standards Institute (ANSI)
1. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.
- C. American Society for Testing and Materials (ASTM).
1. ASTM A240 - Chromium and Chromium-nickel Stainless Steel Plate, Sheet, and Strip for pressure Vessels and General Applications.
 2. ASTM A366 - Withdrawn, Replaced by ASTM A1008.
 3. ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 4. ASTM D570 - Water Absorption of Plastics.
 5. ASTM D635 - Rate of Burning and/or Extent and Time of Burning of Plastics in Horizontal Position.
 6. ASTM D638 - Tensile Properties of Plastic.
 7. ASTM D648 - Deflection Temperature of Plastic Under Flexural Load in the Edgewise Position.
 8. ASTM D695 - Compressive Properties of Rigid Plastics.
 9. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- D. Architectural Woodwork Institute (AWI).
- E. Business and Institutional Furniture Manufacturers Association (BIFMA).
- F. Factory Mutual (FM).

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- G. Forest Stewardship Council (FSC).
 - H. Leadership in Energy and Environmental Design (LEED II).
 - I. National Electrical Manufacturers Association (NEMA).
 - 1. NEMA LD3-2000 - High-Pressure Decorative Laminates.
 - J. National Fire Protection Association (NFPA).
 - 1. NFPA 30 - Flammable and Combustible Liquids Code.
 - 2. NFPA 45 – Standards on Fire Protection for Laboratories Using Chemicals
 - K. Office of Safety and Health Administration (OSHA).
 - L. Scientific Equipment and Furniture Association (SEFA).
 - 1. SEFA 8 - Laboratory Furniture Casework, Shelving and Tables Recommended Practices Testing.
 - M. Underwriters Laboratories (UL).
 - N. Woodwork Institute (WI).
- 1.5 SUBMITTALS
- A. Product Data: Submit manufacturer's data for each item of laboratory furnishings and equipment. Include component dimensions, configurations, construction details, joint details, and attachments. Indicate location, size, and service requirement for each utility connection.
 - B. Shop Drawings:
 - 1. Provide 3/8 inch = 1 foot 0 inches(1:33) scale minimum elevations of individual and battery of casework units showing cross sections, rough-in and anchor placements, tolerances, and clearances. Indicate relation of units to fume hoods, other laboratory equipment, surrounding walls, windows, doors, and other building components.
 - 2. Provide 1/8 inch = 1 foot 0 inches(1:100) scale minimum rough-in plan drawings for coordination with trades. Rough-in shall show free area.
 - C. Qualification Data: For manufacturer and installer.
 - D. Qualification Data: For installer.
 - 1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
 - E. Samples for Initial Selection: For factory-applied finishes and other materials requiring color selection.
 - F. Samples for Verification: : Unless otherwise directed, approved full-size Samples may become part of the completed Work, if in an undisturbed condition at time of Substantial Completion.

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Notify Architect of their exact locations. If not incorporated into the Work, retain acceptable full-size Samples at Project site and remove when directed by Architect.

1. Top Samples: Submit product sample of each type of benchtop.
2. Hardware Samples: Provide samples of door and drawer pulls, locks, casters, and hinges.
3. Finish Samples: Submit 3 inch by 5 inch(75 mm by 125 mm) samples of each color of finish for casework, work surfaces and for other prefinished equipment and accessories for selection by the Owner's Representative.
4. Cabinet Samples: Submit the following full size cabinet samples constructed as specified herein. Ship to the lab consultant for review and approval before fabrication of casework and after approval of cabinet hardware and finish sample submittals.

a. Cabinet Types:

- 1) 24" wide, 4-drawer base cabinet
- 2) 24" wide, full-height cupboard base cabinet

G. Test Reports: Submit test reports verifying conformance to specified performance tests.

H. Maintenance Manual: Provide written instruction manual with proper maintenance procedures.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Provide casework, work surfaces, laboratory furnishings, and accessories, all furnished by a single laboratory furniture company.

1. Modern plant with proper tools, dies, fixtures, and skilled production staff to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:
 - a. 10 years or more experience in manufacture of laboratory casework and equipment of type specified.
 - b. 10 installations of equal or larger size and requirements.

B. Installer Qualifications:

1. Experience: Installer with not less than 10 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installation of products and systems similar to this Project and has a record of successful in-service performance.

D. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 10 years experience in providing

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recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

- E. Mock-ups: Prior to fabrication and installation, provide a laboratory mock-up where indicated on drawings. Components utilized meet the requirements of the Drawings and Specifications. The purpose of the mock-up is to verify designs and confirm or modify the sequence of installation between the various trades. Approved mock-up serves as the standard of quality against which the remaining laboratory work is measured. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Provide laboratory casework and furnishings. Furnishings, such as the fume hood, must be installed, complete with fixtures and accessories, but does not need to be operational.
 - b. Provide plumbing pipe, valves, fittings, and accessories required to make connections to complete the laboratory mock-up. Fixtures and furnishings are not required to be operational, but must be installed to review and ensure proper coordination.
 - c. Provide electrical systems in conjunction with the laboratory mock-up. Power receptacles, raceway, data back boxes and conduit must be installed, but do not need to be operational. Lighting to be fully operational.
 - d. Provide supply and exhaust ductwork required to make connections to complete the laboratory mock-up. Connections to the laboratory furnishings are required, but the systems do not need to be operational.
2. Clean exposed faces of mock-up.
3. Notify Architect and Lab Planner fourteen days in advance of the dates and times when mock-up will be installed and ready for review.
4. Make such changes and alterations to mock-up as may be discussed, agreed upon, and documented in writing resulting from the review. Modifications to the mock-up that are agreed upon in writing will be incorporated into the overall design of the project without change in contract sum. Obtain Architect's and Lab Planner's acceptance of mock-up before starting fabrication.
5. Maintain mock-up during construction in an undisturbed condition as a standard for review of the completed Work.
6. Acceptance of mock-up does not constitute acceptance of deviations from the Contract Documents contained in mock-up unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
7. Once installed and approved the mock-up becomes part of the completed Work
8. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including superintendent.

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- d. Installer, including project manager and supervisor.
 - e. Manufacturer/fabricator's qualified technical representative.
 - f. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Review required inspection, testing, certifying, and material usage accounting procedures.
 - f. Review environmental conditions and procedures for coping with unfavorable conditions.
 - g. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.
3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Schedule delivery of casework and equipment so that spaces are sufficiently complete that material can be installed immediately following delivery.
- B. Handling: Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating. Protect all work surfaces from damage throughout construction period. Do not allow standing on work surfaces during the construction period. Provide signage marked in large lettering that reads: "NO STANDING".

1.9 PROJECT CONDITIONS

- A. Do not deliver or install equipment until the following conditions have been met:
 - 1. Building areas requiring the installation of laboratory casework: Dry and unexposed to adverse weather conditions which may damage finished materials.
 - 2. The air conditioning or heating system: On and functioning in areas of casework installation to maintain the temperature between 60 and 85 degrees Fahrenheit (16 and 30 degrees Celsius) with the relative humidity between 45 percent and 65 percent.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 SEQUENCING AND SCHEDULING

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- A. All overhead mechanical, electrical and plumbing rough-in work: Complete prior to laboratory casework deliveries.
- B. All mechanical, electrical and plumbing rough-in work required along walls and service islands, where lab furnishings are to be installed: Complete prior to delivery of materials.
- C. Walls and partitions must be in place and finished with at least the primer coat of paint. If finish painting is to take place after lab casework and furnishings installation, protect the casework and furnishings by covering and masking prior to commencement.
- D. All necessary wood or metal blocking must be installed within partitions prior to delivery of casework and furnishings.
- E. Overhead soffits and ceiling grid must be in place prior to casework installation.
- F. Overhead lighting must be installed and connected prior to casework installation.
- G. All flooring required to be placed under lab casework and furnishings must be installed prior to material delivery.
- H. Concrete floors must be level within 1/8 inch(3 mm) of level per 10 foot(3 m) run, nonaccumulative, when tested with a straight edge in any one direction.
- I. Wet operations to be performed must be complete prior to material deliveries.

1.11 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Coverage of warranty includes but is not limited to the following:
 - 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

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1. Basis of Design product: Lab Crafters, www.lab-crafters.com

B. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. A.T. Villa Inc., www.atvilla.com
2. Kewaunee Scientific Equipment Corp., www.kewaunee.com
3. Lab Crafters, www.lab-crafters.com

C. Furnish and install casework, furnishings and equipment specified in the following sections by the same supplier.

1. Laboratory Fume Hoods.

2.2 CASEWORK DESIGN: METAL

A. Flush overlay style: Square edged door and drawer fronts overlapping the openings on all four sides. In elevation, hold the reveal between end panel and door or drawer edge to a maximum of 1/8 inch(3 mm) wide. Hold spaces between abutting doors and drawers to a maximum of 1/8 inch(3 mm) wide, both horizontally and vertically, and shall be accurate and uniform, forming a continuous reveal throughout full length of assembled casework. Hold the reveal between top of cabinet and door or drawer edge to a maximum of 1/4 inch(6 mm) wide.

B. Self Supporting Units: Completely welded shell assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit.

C. Interior of Case Units: Easily cleanable, flush interior. Base cabinets, 30 inches(750 mm) and wider, with double swinging doors shall provide full access to complete interior without center vertical post.

D. Drawers: Sized on a modular basis for interchange to meet varying storage needs, and designed to be easily removable in field without the use of special tools.

E. Case Openings: Rabbeted-like joints all 4 sides of case opening for hinged doors and 2 sides for sliding doors in order to provide dust resistant case.

F. Secure intersection of case members with spot and arc welds.

G. Testing of Casework, Tables, and Shelving: Meet or exceed SEFA 8.

2.3 MATERIALS

A. Sheet Steel:

1. ASTM A1008 mild steel, cold-rolled, pickled, double annealed, and free from rust, scales, deep scratches, buckles, ragged edges, and other defects. Provide metallic furniture stock sheets.
2. Finish: Powder coat finish. Color shall be a custom color as selected by the architect.

B. Solid Phenolic Resin Sheets:

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1. Trespa Toplab Plus Laboratory Tops
2. Fundermax Max Resistnace
3. A self-supporting flat panel based on thermosetting resins, homogeneously reinforced with cellulose fibers and manufactured under high pressure. Hardened acrylic decorative surface of pigmented resins.
4. Physical Properties:
 - a. Material: Solid phenolic panel.
 - b. Modulus of Elasticity: 1,500,000 psi(10,335 MPa) minimum.
 - c. Shear Strength: 2000 psi(14 MPa) minimum.
 - d. Compressive Strength: 24,000 psi(165 MPa) minimum.
 - e. SEFA 49 testing.
 - f. Weight: 93 pcf(1,490 kg/m³) maximum.
 - g. Fire Performance: Maximum flame spread of 25 per ASTM E84 (Class I, Class A).
 - h. Nonporous surface and edges.
 - i. Microbial Characteristics: Will not support micro-organic growth.

C. Glass:

1. Laminated safety glass: Two outer plies of glass with a vinyl interlayer, nominal 1/4 inch (6 mm) thick.

2.4 CASEWORK FABRICATION: METAL

A. Floor Mounted Base Cabinets:

1. End Panels and Backs
 - a. 18 gage(1.2 mm) steel.
 - b. End panels and back formed from a single steel sheet with front edges formed to a channel shape and further offset to form a strike for doors and drawers.
 - c. Reinforce at front and rear corners with 18 gage(1.2 mm) full upright posts containing shelf adjustment holes, maximum 1/2 inch(12 mm) on centers.
 - d. Provide removable backs on all base cabinets, except units with security panels and sink cabinets, to allow access to service piping from the front of the unit
 - e. All sink cabinets to have partial height back panels to allow passage of drain line and piping to service chase.
2. Bottoms:
 - a. 18 gage(1.2 mm) steel.
 - b. Bottom and bottom rail formed from a single piece of metal with both sides and back formed up with a radius between flange and bottom for ease of cleaning. Form front rail to provide a strike for doors and drawers.
 - c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
3. Door Fronts: Provide AWI premium grade, wood veneer door fronts with transparent finish. Custom species and grain pattern as selected by architect.
4. Front Top Rails:
 - a. 16 gage(1.2 mm) steel.
 - b. Provide flush at face of cabinet and interlock within the flange at the top of the end panels. Form front of rail to provide a strike for doors and drawers.

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- c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
- 5. All suspended or mobile casework units shall have 18 gage(1.2 mm) tops except for sink cabinets.
- 6. Toespace Rails:
 - a. 18 gage(1.2 mm) steel.
 - b. Install between end panels to provide a minimum toespace of 3 inches(75 mm) deep by 4 inches(100 mm) high.
 - c. Provide 11 gage(3.5 mm) steel corner gussets at front and rear corners with 3/8 inch(10 mm) diameter leveling screws integral with bottom flange.
- 7. Intermediate Rails:
 - a. Provide between drawers and doors, and between drawers at all security panels.
 - b. Recessed behind doors and drawer fronts.
 - c. Removable for later revision in cabinet configuration.
- 8. Adjustable Pullout Shelves:
 - a. 20 gage(1.0 mm) steel.
 - b. Form in one-piece including the bottom, two sides, front, and back.
 - c. Sides, front, and back to be 2 inches(50 mm) high with return bends to eliminate sharp edges.
 - d. Adjustable on 1/2 inch(12 mm) centers.
 - e. Front edge of shelf to be within 1 inch(25 mm) of inside face of door.
 - f. Pullout shelves to fully extend with doors open at minimum of 90 degrees.
- 9. Adjustable Shelves:
 - a. 20 gage(1.0 mm) steel.
 - b. Form front and back edges down 3/4 inch(19 mm) and returned back 3/4 inch(19 mm). Form ends down 3/4 inch(19 mm).
 - c. For shelves over 36 inches(915 mm) long or 16 inches(400 mm) deep, reinforce with a welded hat channel for the full length of the shelf.
 - d. Adjustable on 1/2 inch(12 mm) centers.
 - e. Front edge of shelf to be within 1 inch(25 mm) of inside face of door.
- 10. Hinged Doors:
 - a. 3/4 inch(19 mm) double wall assembly with 18 gage(1.2 mm) exterior panel and 20 gage(1.0 mm) interior panel.
 - b. Reinforce interior of front panel with welded steel hat channels. Prepaint and sound deaden interior. Weld outer corners and grind smooth.
 - c. Secure hinges with screws to internal 14 gage(2.5 mm) reinforcing in case and door. Hinges shall be removable; welding of hinges is not acceptable.
 - d. Doors shall close against rubber bumpers.
- 11. Drawers:
 - a. Drawer front: 3/4 inch(19 mm) double wall assembly, 20 gage(1.0 mm) interior and exterior panels, prepaint prior to assembly and sound deaden, weld top front corners and grind smooth.

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- b. Drawer body: 20 gage(1.0 mm) steel, one-piece construction including bottom, 2 sides, back, and inner front. Fully coved at interior bottom.
- c. Drawers shall close against rubber bumpers.
- d. Provide security panels for drawers with keyed different locks.

B. Mobile Cabinets:

- 1. Provide mobile cabinets as described under Floor Mounted Base Cabinets above, unless modified under this Article.
 - a. Tops: Provide all mobile casework units with a 3/4 inch thick top. Top material noted on the Drawings.
 - b. Anti-Tip Interlock: Provide in all cabinets with drawers and adjustable pullout shelves. Provide with snapper actuator, lockbar, adjustable locking pins, drawer wedges, lockbar retainers, and wedge lock.
 - 1) Basis of Design: CompX Timberline, System 350
- 2. Door Fronts: Provide AWI premium grade, wood veneer door fronts with transparent finish. Custom species and grain pattern as selected by architect.

C. Wall and Upper Cabinets:

- 1. End Panels and Backs
 - a. 18 gage(1.2 mm) steel.
 - b. End panels and back formed from a single steel sheet with front edges formed to a channel shape and further offset to form a strike for doors and drawers.
 - c. Reinforce at front and rear corners with 18 gage(1.2 mm) full upright posts containing shelf adjustment holes, maximum 1/2 inch(12 mm) on centers.
- 2. Bottoms:
 - a. 18 gage(1.2 mm) steel.
 - b. Bottom and bottom rail formed from a single piece of metal with both sides and back formed up with a radius between flange and bottom for ease of cleaning.
 - c. Form front rail to provide a strike for doors and drawers.
 - d. Reinforce at front corners with 14 gage(2.5 mm) gusset.
- 3. Tops
 - a. 18 gage(1.2 mm) steel.
 - b. One piece construction with front edge formed into a channel shape and offset for door recess and to provide a strike for doors. Turn down flanges at back and side edges for welding top to back and end panels.
 - c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
 - d. Sloped surface at the top of cabinet to prevent dust collection.
- 4. Door Fronts: Provide AWI premium grade, wood veneer door fronts with transparent finish. Custom species and grain pattern as selected by architect.
- 5. Adjustable Shelves:

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- a. 20 gage(1.0 mm) steel.
 - b. Form front and back edges down 3/4 inch(19 mm) and returned back 3/4 inch(19 mm). Form ends down 3/4 inch(19 mm).
 - c. For shelves over 36 inches(915 mm) long or 16 inches(400 mm) deep, reinforce with a welded hat channel for the full length of the shelf.
 - d. Adjustable on 1/2 inch(12 mm) centers.
 - e. Front edge of shelf to be within 1 inch(25 mm) of inside face of door.
6. Hinged Framed Glass Doors:
- a. Frame: Outer head of 18 gage(1.2 mm) one piece construction. Inner head consisting of top, bottom and side framing members removable for replacement of glass.
 - b. Glass: tempered safety glass.
 - c. Provide continuous vinyl glazing retainer to receive glass.
- D. Tall Cabinets:
- 1. End Panels and Backs
 - a. 18 gage(1.2 mm) steel.
 - b. End panels and back formed from a single steel sheet with front edges formed to a channel shape and further offset to form a strike for doors and drawers.
 - c. Reinforce at front and rear corners with 18 gage(1.2 mm) full upright posts containing shelf adjustment holes, maximum 1/2 inch(12 mm) on centers.
 - 2. Bottoms:
 - a. 18 gage(1.2 mm) steel.
 - b. Bottom and bottom rail formed from a single piece of metal with both sides and back formed up with a radius between flange and bottom for ease of cleaning. Form front rail to provide a strike for doors and a 4 inch(100 mm) high base.
 - c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
 - 3. Tops
 - a. 18 gage(1.2 mm) steel.
 - b. One piece construction with front edge formed into a channel shape and offset for door recess and to provide a strike for doors. Turn down flanges at back and side edges for welding top to back and end panels.
 - c. Reinforce at front corners with 14 gage(2.5 mm) gusset.
 - 4. Door Fronts: Provide AWI premium grade, wood veneer door fronts with transparent finish. Custom species and grain pattern as selected by architect.
 - 5. Fixed and Adjustable Shelves:
 - a. 20 gage(1.0 mm) steel.
 - b. Form front and back edges down 3/4 inch(19 mm) and returned back 3/4 inch(19 mm). Form ends down 3/4 inch(19 mm).
 - c. For shelves over 36 inches(915 mm) long or 16 inches(400 mm) deep, reinforce with a welded hat channel for the full length of the shelf.
 - d. Center shelf to be fixed by attaching to end panels with screws.
 - e. Adjustable on 1/2 inch(12 mm) centers.

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f. Front edge of shelf to be within 1 inch(25 mm) of inside face of door.

6. Hinged Framed Glass Doors:

- a. Frame: Outer head of 18 gage(1.2 mm) one piece construction. Inner head consisting of top, bottom and side framing members removable for replacement of glass.
- b. Glass: laminated safety glass.
- c. Provide continuous vinyl glazing retainer to receive glass.

2.5 HARDWARE:

A. Drawer and Hinged Door Pulls: 3/8 inch(10 mm) diameter stainless steel wire pull, 4-3/4 to 5-1/16 inches(120 mm to 128 mm) center to center with radiused corners and a projection of 1 inch to 1-1/2 inches(25 mm to 40 mm). Model 115.61.602 as manufactured by Hafele America (800) 423-3831, Lamp Model SST-30L as manufactured by Sugatsune America, Inc. (800) 562-5267, Model 1.381.128 as manufactured by Ironmonger Inc. (800) 621-1937, or Model DP57C as manufactured by Mockett (800) 523-1269.

- 1. Provide with a clear abrasion and acid resistant coated finish.
- 2. Mount door pulls vertically and drawer pulls horizontally.
- 3. Provide drawers 48 inches(1219 mm) wide and smaller with one pull per drawer face at centerline of cabinet.

B. Drawer and Pullout Shelving Slides:

- 1. Description: Full extension, ball bearing, rail mounted, multimembered slides fabricated of minimum 16 gage(1.6 mm) steel with an electro-zinc finish.
- 2. Available Manufacturers:

- a. Accuride International Incorporated, Santa Fe Springs, California
- b. CompX Precision Slides, Waterloo, Ontario Canada
- c. Knappe and Vogt, Grand Rapids, Michigan

3. Drawer Slides: Basis of Design as follows

- a. Drawer Width: 0-24 inches (0-610 mm) 3820 Maximum dynamic load rating 100 pounds (45 kg)
- b. Drawer Width: Over 24 inches (Over 610 mm) 3620 Maximum dynamic load rating 200 pounds (90 kg)

4. Pullout Shelving Slides: Basis of Design as follows:

- a. Shelving Width: 0-24 inches (0-610 mm) 3820 Maximum dynamic load rating 100 pounds (45 kg)
- b. Shelving Width: Over 24 inches (Over 610 mm) 3620 Maximum dynamic load rating 200 pounds (90 kg)

5. .

C. Hinges:

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1. Description: Institutional type, 5-knuckle, wraparound design, projecting barrel, minimum 2-1/2 inches(60 mm) long.
 2. Description: Institutional type, 5 knuckle, projecting barrel, minimum 2-1/2 inches(60 mm) long.
 3. Material: Type 304 stainless steel, minimum 0.095 inches(2.4 mm) thick.
 4. Provide minimum of 2 hinges for doors under 48 inches(1200 mm) high; minimum of 3 hinges for doors 48 inches(1200 mm) to 84 inches(2130 mm) high; and minimum of 4 hinges for doors over 84 inches(2130 mm) in height.
- D. Door Catches: Roller type, adjustable, operating with a built-in tension spring. Provide all parts of cadmium plated steel except roller. Attach to top of base cabinet doors, the bottom of wall cabinet doors, and at the top and bottom of tall cabinet right-hand doors. Provide an elbow catch for the left-hand door of tall cabinets at the fixed center shelf.
- E. Shelf clips: Die formed steel, zinc plated, to engage in shelf adjustment holes on nominal 1/2 inch(12 mm) centers.
1. Finish: Exposed surfaces of locks shall match other casework hardware.
 2. Keying: Capacity for 2000 primary key changes. Master key 1 level with built-in flexibility to accommodate, if required, 3 levels; 1 Grandmaster, 59 Master groups and 70 Submaster groups with 13 primary changes under each.
 3. Keys: Stamped brass available from manufacturer or local locksmith, and supplied in the following quantities unless otherwise specified:
 - a. 2 for each keyed different lock.
 - b. 3 for each group keyed alike locks.
 - c. 2 for master keys for each system.
- F. File Suspension Rails: Provide each file drawer with a pair of 14 gage(2.0 mm), epoxy coated steel, Pendaflex file suspension rails.
- G. Casters: Swivel type, 4 inch(100 mm) overall height, with wheel lock. Provide minimum load rating of 300 pounds(136 kg).
1. Basis of Design: Payson Model 050-3UM WK.
- H. Anti-Tip Interlock: Provide in all mobile cabinets with drawers and adjustable pullout shelves. Provide with snapper actuator, lockbar, adjustable locking pins, drawer wedges, lockbar retainers, and wedge lock.
1. Basis of Design: CompX Timberline, System 350.
- I. Drawer Protection and Identification Plate: Plate, Type 304 stainless steel, 16 gage with a number 4 finish. Attach plate to drawer with flathead stainless steel screws countersunk at each corner. Engrave each plate with 1/2 inch high numbering. Numbering selected by the Owner's Representative. Padlock eyes, Type 304 stainless steel, 12 gage with a number 4 finish. Padlock provided by Owner.
- J. Grommets in Countertops: Manufacturer: Outwater Plastic Industries, Wood Ridge, New Jersey, (800) 631-8375, Model Number 35 DG, Dove Gray, or equal (no known equal). Seal Grommets to bench with silicone sealer.
- 2.6 KNEE OPENING (KO):

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A. Components:

1. Perimeter Rails: 3/4 inch by 4-1/8 inches(19 mm by 105 mm) C-channel with a maximum span of 72 inches(1829 mm)..
2. Reinforcing Cross Rails: 3/4 inch by 4-1/8 inches(19 mm by 105 mm) steel C-channel at intervals not more than 33 inches(840 mm) on centers.
3. Leg: 2 inch by 2 inch(50 mm by 50 mm) steel tube legs with welded leg bracket. Attach legs with 2 bolts to front and back aprons and weld to end rails. Provide legs with leveling glides and a 2 inch(50 mm) high black covered vinyl or rubber shoe around leg base.
4. End Panel: 3/4 inch(19 mm) thick support end panel.
5. Cantilevered Leg Panel: 1-1/2 inch(38 mm) thick cantilevered steel member.
6. Back Panel: Minimum 18 gage(1.2 mm) steel. Provide all panels with bottom 6 inches(152 mm) fixed and the top portion removable
7. Drawers. Provide as noted on the Drawings. Drawer unit, hardware, and suspension same as specified for base unit drawers.

B. Construction:

1. For KO's between two cabinets or cabinet and wall, provide front and back perimeter rails. Provide reinforcing cross rail as required. Attach with steel angles to adjacent cabinets or wall.
2. For KO's at the end of a bench, provide front, back, and side perimeter rails. Provide reinforcing cross rails as required. Attach with steel angles to cabinets and steel corner braces, grooved and screwed into both rails at each corner.
3. For KO benches with no adjacent cabinets or walls, provide front, back, and side perimeter rails. Provide reinforcing cross rails as required. Attach with steel corner braces, grooved and screwed into both rails at each corner.

2.7 FILLER PANELS:

- A. Provide filler panels and service chase enclosure panels at exposed to view areas between back of cabinets and walls, between backs of cabinets at end of island or peninsula benches, and at any other area necessary to enclose gaps. Provide all filler panels with bottom 6 inches(152 mm) fixed and the top portion removable.

B. Materials:

1. Minimum 18 gage(1.2 mm) steel.
2. Grind edges and radius corners to eliminate sharp edges.

- C. Secure to frame and/or cabinet back and wall with metal angle and oval head screws with finishing washers.

2.8 SERVICE CHASE PIPE SUPPORT ASSEMBLY:

- A. Provide in all service chases whether or not piping is required.
- B. Channels: Provide assemblies as detailed on the Drawing. Unistrut part numbers are referenced.
1. Acceptable Manufacturers and Products:
 - a. Unistrut Corporation
 - b. Elcen
 - c. Grinnell Power Strut

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- C. Space and position pipe support assemblies out of all knee opening and undercounter equipment locations.

2.9 VACUUM PUMP CABINETS

- A. Construction: Construct as specified for metal laboratory casework and as detailed on drawings.
- B. Vacuum Pump and Cabinet Exhaust: Provide a 2 inch(50 mm) polypropylene exhaust pipe from inside cabinet to 6 inches(125 mm) above ceiling as details on the Drawings. Secure vent pipe inlets to back of cabinet with polypropylene locking nuts.
- C. Doors: Provide air gap between back of door and toe kick panel.
- D. Interior: Provide rigid, aluminum-faced acoustical insulation on all sides, back, top, and doors.
- E. Pull-out Shelf on Casters: Provide with a removable 18 gage(1.2 mm) minimum galvanized metal pan, full depth and width of cabinet, with a 1 inch(25 mm) lip all around, and four swivel type casters. Mount toe kick panel to front edge of shelf.
- F. Vacuum Line Pass-Through: Provide a 1 inch(25 mm) hole in back of cabinet for the vacuum piping provided by Division 22. Final connection to O.F.O.I. pumps by owner.
- G. Electrical: Factory install switch, receptacle, wiring, and all required electrical fittings in accordance with applicable codes and Division 26 specifications. Final connection to back of cabinet by electrical contractor.
- H. Finish: Color selected by Owner's Representative.

2.10 ADJUSTABLE HEIGHT MOVABLE TABLE:

- A. Upper horizontal rails: 2 inches by 2 inches by 12 gage(50 mm by 50 mm by 2.7 mm) steel channel with a continuous inner reinforcement U-channel. Spot weld inner reinforcement channel approximately 12 inches(300 mm) on center, staggering weld on each side.
- B. Legs: 1-1/2 inch by 1-1/2 inch by 12 gage(38 mm by 38 mm by 2.7 mm) steel tubing. Height adjustment to be accomplished through inner telescoping leg and spring bolts.
- C. Inner leg: 27-1/4 inches long by 12 gage(692 mm by 2.7 mm) inner telescoping leg extension. Provide with six 9/16 inch round holes on inside of table for spring bolts. Provide each leg with a leveling glide unless otherwise noted.
- D. Quick Release Pins: Provide each leg with two 1/2 inch diameter by 2-1/2 inch(13 mm diameter by 64 mm) useable leg stainless steel push-button, quick-release pins, McMaster-Carr model 92384A096, or equal.
- E. Stretcher rails: 2 inches by 1-1/4 inch by 16 gage(51 mm by 32 mm by 1.6 mm) steel tube. Connect by welding between two end legs and between two back legs.
- F. Finish: Finish as specified for Metal Finishes under this section. Color selected by the Owner's Representative.
- G. Tops: As specified for Work Surfaces under this section. Refer to Drawings for type.

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- H. Casework: Suspended type laboratory cabinet. Provide as indicated on the Drawings. Secure cabinet with cadmium plated forged or cast steel 'cabinet hook' mounted in front of cabinets top frame for attachment to upper horizontal rail and designed so that easy removal of cabinets can be accomplished. Provide a minimum of four "cabinet hooks" per cabinet. Support bottom of cabinet with stretchers.

2.11 SINKS

A. Epoxy Resin Sink:

1. Available Manufacturers:
 - a. Durcon Laboratory Tops.
 - b. Epoxyn Products.
2. Description: Integrally molded from modified thermosetting black epoxy resin, and oven cured. Minimum wall thickness of 1/2 inch(12 mm) with all interior corners coved to 1-1/2 inch(36 mm) radius and bottoms pitched to end outlet opening.
3. Sink mounting methods:
 - a. Under Mount: Support sink at bottom using an upper direction compression support system.
4. Seal joint between top and sink with Dow Corning 732 RTV or General Electric SE 1203.
5. Provide sink with the following accessories:
 - a. Outlet: 1-1/2 inch(36 mm) NPS.
 - b. Overflow: Open end overflow standpipe. Overflow to be 2 inches(50 mm) shorter than depth of sink.
 - c. Strainer: Removable disc strainer.
 - d. Tailpiece: Town & Country Plastics Model PP-18, R&G Sloane Part Number 7218; or Scientific Plastics Company, Inc., Part Number W81595-158.

B. General:

1. Installation: Provide and installed at point of use all service fixtures. Connect to the service piping systems specified in Division 22. Provide the product of 1 manufacturer for all laboratory service fixtures, including fixtures supplied with fume hoods. Provide all fixtures designed for laboratory use.
2. Acceptable Manufacturers:
 - a. Water Saver Faucet Company. Water Saver fixture numbers are referenced on the Drawings.
 - b. Chicago Faucet Company.
3. Materials: Provide the bodies of service valves, fixtures and accessories of cast or forged brass with a minimum copper content of 85 percent. Faucets shall have a tapered body design. Fabricate assembly components and operating parts such as valve stems, renewable units, packing nuts, outlet nozzles, and straight serrated hose ends from solid brass bar stock. Fabricate replaceable seats, needle cones, valve disc screws, and other accessories from monel metal or stainless steel alloys especially selected for use intended.
4. Assembled at the factory: Service fixtures, including the mounting of valves and shanks to turrets, flanges, and other mounting accessories.

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5. Furnish and install nipples, locknuts, shanks and other accessories required to properly mount and connect the fixtures.
6. Testing: Individually factory test fixtures. Valves and fixtures, except water fixtures, shall withstand a test pressure of 100 pounds per square inch(690 kPa). Test water fixtures at 80 pounds per square inch(550 kPa). Test fixtures for gases under water.
7. Fixtures located on the same plane shall have their handles project the same distance from the plane of reference to present a uniform, related appearance, regardless of valve type.
8. Fixture types as scheduled on the drawings.

C. Water Valves:

1. Renewable unit containing all working parts which are subject to wear, including stainless steel or monel metal seat, monel metal screw, heavy duty seat disk, Teflon packing, and an integral or external adjustable volume control.
2. Provide unit capable of being readily converted from compression to self closing, and vice versa, without disturbing faucet body proper and shall also be capable of being readily converted from water construction to needle valve or steam valve construction without disturbing faucet body.
3. Provide unit sealed in valve body with special composition gasket. Metal-to-metal or ground-joint type of sealing not acceptable.

D. Needle Valves:

1. Vacuum, gas, and air needle valves shall have a stainless steel replaceable floating cone that is precision ground and self-centering.
2. Action of valve: Slow compression for fine control under pressure up to 150 psi(1050 kPa) and shall have parts subject to wear, easily replaceable.
3. Carbon Dioxide
 - a. Pressure Regulator Fixture, Low Pressure / Carbon Dioxide, Wall Mounted Double
 - b. Basis of Design: As schedule on the drawings.

E. Valves:

1. Forged brass body with all interior components coming in contact with water constructed of polypropylene.
2. Maximum working pressure of 50 psig(350 kPa).
3. Provide with 3/8 inch(10 mm) brass riser and gooseneck with polypropylene lining.
4. Provide with polypropylene serrated tip at the outlet.
5. Fixture types as scheduled on the drawings.

F. Laboratory Ball Valves: Straight pattern body, valve stem with integral chrome plated ball and TFE-coated O-rings stem seals in valve body, molded TFE valve seals, and tested at 125 psi nitrogen under water. Valves shall have chrome plated forged brass lever-type handle with screw-on type index requiring less than 5 pounds pressure to actuate. Provide with removable 10 serrated hose end.

G. Vacuum Breakers: Provide vacuum breakers, integral with the gooseneck where required. Vacuum breakers shall have a forged brass body, renewable seat and a special design valve member for fine flow control. Vacuum breakers shall not spill over at low water volume.

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- H. Aerators: Aerators shall have 3/8 inch(10 mm) NPS male inlet. Provide with integral flow control that adjusts between 0.5(1.29) and 3.0(7.77 LPM) GPM. Flow control to be set as indicated on Drawings.
- I. Serrated Tips: Serrated tip fixtures shall have 3/8 inch(10 mm) IPS thread with hose end being tapered and shall not have less than 10 serrations. Provide 1/8 inch(3 mm) diameter of orifice in serrated tip, except where otherwise specified. For water units provide with integral flow control that adjusts between 0.5(1.29) and 3.0(7.77 LPM) GPM. Flow control to be set as indicated on Drawings.
- J. Turrets: Round type design, brass drop forging, as indicated on Drawings. One-way or two-way as required with 3/8 inch(10 mm) IPS female inlet thread for connections. Furnish units with brass shanks, brass locknuts, and washers.
- K. Quick Disconnect Fitting: For service tube ends. Each keyed disconnect shall include nipple and coupler with color-keyed band marking media.
- L. Fixture Finish:
 - 1. Coat all laboratory service fixtures with acid and solvent resistant epoxy coating equal to ColorTech as manufactured by Water Saver Faucet Company.
 - 2. Coating Material: Free flowing epoxy powder with a particle size of 35 to 70 microns. Color; light white/gray.
 - 3. Application Procedure: Immerse fitting in a phosphoric acid cleaning solution to remove thoroughly all oil, grease and other foreign substances. Sandblast with an extra fine grit to produce a uniform fine-grained surface. Following cleaning and sandblasting, apply coating material evenly to all exposed surfaces, by means of an electrostatic spray, so that coating material is electrostatically bonded to the surface of the metal. After application, fully bake coating at 400 degrees Fahrenheit(200 degrees Celsius) to permit curing. Provide surfaces with a minimum coating thickness of 4 mil.
 - 4. Testing: Assemble faucet and valve components and individually test after coating is applied.
 - 5. Performance Requirements: Suspend coated samples in a container of at least 6 cubic feet(0.168 m3) capacity, approximately 12 inches(300 mm) above open beakers. Beakers shall contain 100 cc of 70 percent nitric acid, 94 percent nitric acid, 94 percent sulfuric acid, and 35 percent hydrochloric acid, respectively. After exposure to these fumes for 150 hours, the finish on the samples shall show no discoloration, disintegration, or other effects. Subject coated samples to the direct action of the following reagents and solvents at a temperature of 25 degrees Celsius dropping from a burette at the rate of 60 drops per minute for 10 minutes. Finish on the samples shall not rupture, though slight discoloration or possible softening is permissible.
 - a. Acetone
 - b. Carbon Tetrachloride
 - c. Ethyl Alcohol
 - d. Glacial Acetic Acid, 95.5 percent
 - e. Hydrochloric Acid, 38 percent
 - f. Mineral Oil
 - g. Nitric Acid, 70 percent
 - h. Sodium Hydroxide, 50 percent
 - i. Sulfuric Acid, 92 percent
 - j. Toluene
 - k. Zinc Chloride-Saturated.

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6. Mar and Abrasion Resistance: Coating material shall have a pencil hardness of 2H-4H with adhesion substantial enough to withstand both direct and reverse impacts. Provide coating capable of withstanding scuffing, marring and other ordinary wear.
 7. Reparability: Provide coating material capable of surface repair in the event that a fixture is scratched or a surface rupture occurs. The service fixture manufacturer shall have available an air drying aerosol coating, formulated to match the existing epoxy coating color, which may be applied in the field to repair coated surfaces.
- M. Faucet and Valve Handles: Chromeplated, 4-arm type or wrist blade type with removable screw-on type colored plastic discs with identification lettering stamped on disc in a contrasting color as scheduled below.

<u>Service</u>	<u>Disc Color</u>	<u>Lettering Color</u>	<u>Lettering</u>
Steam	Black	White	STM
Nitrogen	Grey	Black	N2
Vacuum	Yellow	Black	VAC
Gas	Blue	White	GAS
Cold Water	Green	White	CW
Hot Water	Red	White	HW
Deionized Water	White	Black	DI
Compressed Air	Orange	Black	AIR
Purified Water	White	Black	PW
Chilled Water	Brown	White	CH
Lab Air	Orange	Black	LA
Industrial Hot Water	Red	White	IHW
Industrial Cold Water	Green	White	ICW
Air	Orange	Black	AIR
Special Gas	Lt. Blue	Black	SG

- N. Faucet and Valve Handles: Molded plastic or wrist blade type with a colored screw-on type index disc. Provide color coded handle and index disc to match the fixture's service index color. Provide color code requirements for indexing service fixtures as follows:

<u>Service</u>	<u>Disc Color</u>	<u>Lettering Color</u>	<u>Lettering</u>	<u>Handle Color</u>
Steam	Black	White	STM	Black
Nitrogen	Grey	Black	N2	Black
Vacuum	Yellow	Black	VAC	Black
Gas	Blue	White	GAS	Black
Cold Water	Green	White	CW	Black
Hot Water	Red	White	HW	Black
Deionized Water	White	Black	DI	Black
Compressed Air	Orange	Black	AIR	Black
Purified Water	White	Black	PW	Black
Chilled Water	Brown	White	CH	Black
Lab Air	Orange	Black	LA	Black
Industrial Hot Water	Red	White	IHW	Black
Industrial Cold Water	Green	White	ICW	Black
Air	Orange	Black	AIR	Black
Special Gas	Lt. Blue	Black	SG	Black

2.12 EMERGENCY SHOWER AND EYE WASH UNITS

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- A. General: Provide and install at point of use all emergency shower and eyewash units. Connection to the service piping systems specified in Division 22. Provide units that meet the requirements of ANSI Standard Z358.1.
- B. Acceptable Manufacturers:
1. Water Saver Faucet Company. Water Saver fitting numbers are referenced on the Drawings.
 2. Guardian Equipment.
 3. Chicago Faucet Company.
- C. Safety Station:
1. Deluge type with a pull-on, push-off control valve. Provide 3/8 inch(10 mm) stainless steel control rod. Maximum height of rod with valve in the closed position shall not exceed 69 inches(1.75 m).
 2. Deluge type with a concealed stay-open ball valve. Provide with "Panic Bar" activation as detailed on the Drawings.
 3. Shower head, nipple, and escutcheon: stainless steel. Maximum mounting height of shower head 96 inches(2.4 m).
 4. Design valve so that water flow remains on without requiring use of the operator's hands.
 5. All exposed valves, piping, and associated devices: Stainless steel.
 6. Includes matching fire extinguisher cabinet.
 7. Basis of Design: As scheduled on the drawings.
- D. Deck Mounted Eye, Face and Body Spray Units:
1. Dual purpose eyewash/drench hose unit.
 2. The angled dual head body and valve of forged brass.
 3. The squeeze handle of stainless steel with plastic cover.
 4. The handle and deck flange of molded nylon, with handle locator guides.
 5. Provide self-closing valve with a locking clip to hold the valve open once the unit is activated.
 6. Provide unit with dual, polypropylene, angled, gentle spray heads; polyurethane filter; integral volume control; integral backflow preventer; and integrated nylon flip-top dust cover.
 7. Finish: Match laboratory service fitting finish.
 8. Provide with 8 foot long high pressure, reinforced PVC hose.

2.13 UMBILICALS

- A. Description: Construct of 18 gage(1.2 mm) sheet metal with collar at top. Provide bottom curb in same material as benchtop, properly glued or cemented to benchtop. Provide top collar of 16 gage(1.6 mm) sheet steel. Provide 1 inch by 1 inch(25 mm by 25 mm), 18 gage(1.2 mm) angle at curb.
- B. Umbilicals shall have removable sections for easy access to piping and conduit. Exposed fasteners will not be allowed. Removal of sections shall not disturb ceiling or benchtop. Construct hanger clips of 18 gage(1.2 mm) sheet metal and spot welded to removable section.
- C. On freestanding umbilicals provide a pipe support channel, spot welded to the fixed enclosure section. On wall or corner umbilicals, attach pipe support channel to the wall.
1. Basis of Design: Unistrut

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- D. Finish: Finish as specified for metal finish in this section, with color selected by Owner's Representative.

2.14 SHELVING

- A. Metal Shelves: 16 gage(1.6 mm) steel shelving with hat-section reinforcing. Finish as specified for metal finish in this section, with color selection by the Owner's Representative.
- B. Retainer Rod: Type 304 stainless steel 1/4 inch(6 mm) diameter rod with a number 4 polished finish. Bend 90 degrees at 1-1/2 inches(38 mm) from each end. Insert bent ends into shelf to a depth of 1/2 inch(12 mm) with horizontal portion of rod at 1 inch(25 mm) above shelf.
- C. Adjustable Wall Shelving:
1. Standards: Double-slotted type, 30 inches(760 mm) long unless otherwise noted on Drawings. Satin zinc finish.
 2. Basis of Design: Garco Corporation, Number 3225; E.B. Bradley, Number 44.
 3. Brackets: 16 gage(1.6 mm) metal with 3 blade hooks. Screw shelves to each bracket. Finish as specified for metal finish in this section, with color selected by the Owner's Representative.

2.15 DRYING RACK:

- A. Available Manufacturers: Mod-Rack by Inter-Dyne
- B. Body: One-piece, 20 gage(1.0 mm), Type 304 stainless steel with a Number 4 finish. Provide top with two 90 degree bends and sides with one 90 degree bend. Bottom shall have two 90 degree bends to provide an integral drip trough and catch drain. Provide front with a multiple of T-shaped holes to accommodate pegs.
- C. Pegs: Injection molded white polypropylene, 1/2 inch(12 mm) diameter by 6 inches(150 mm) long. T-shaped protrusion on base of pegs shall allow easy removal and replacement without need for tools. Design T-shaped holes to fit protrusion on support pegs for holding single or multiple utensil drip trays, drain shelves, funnel racks, or pipette holders.
- D. Drip Trough: 4 inch(100 mm) wide, 20 gage(1.0 mm), Type 304 stainless steel with a 3/8 inch(9 mm) OD stainless drain tube and a stainless steel screen insert. Screen; 16 gage(1.6 mm), 14 by 14 mesh, 0.025 wire. Provide with a 3/8 inch(9 mm) ID flexible drain tube minimum of 30 inches(760 mm) long.
- E. Provide with hanger to allow removal and replacement of entire rack for cleaning without need for tools.
- F. Finished Backs: Provide with all units not mounted on walls. Fabricate from 20 gage (1.0 mm), Type 304 stainless steel with a Number 4 finish.

2.16 DRYING RACK:

- A. Available Manufacturers: Mod-Rack by Inter-Dyne
- B. Body: One-piece, 20 gage(1.0 mm), Type 304 stainless steel with a Number 4 finish. Provide top with two 90 degree bends and sides with one 90 degree bend. Bottom shall have two 90 degree

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bends to provide an integral drip trough and catch drain. Provide front with a multiple of T-shaped holes to accommodate pegs.

- C. Pegs: Injection molded white polypropylene, 1/2 inch(12 mm) diameter by 6 inches(150 mm) long. T-shaped protrusion on base of pegs shall allow easy removal and replacement without need for tools. Design T-shaped holes to fit protrusion on support pegs for holding single or multiple utensil drip trays, drain shelves, funnel racks, or pipette holders.
- D. Drip Trough: 4 inch(100 mm) wide, 20 gage(1.0 mm), Type 304 stainless steel with a 3/8 inch(9 mm) OD stainless drain tube and a stainless steel screen insert. Screen; 16 gage(1.6 mm), 14 by 14 mesh, 0.025 wire. Provide with a 3/8 inch(9 mm) ID flexible drain tube minimum of 30 inches(760 mm) long.
- E. Provide with hanger to allow removal and replacement of entire rack for cleaning without need for tools.
- F. Finished Backs: Provide with all units not mounted on walls. Fabricate from 20 gage (1.0 mm), Type 304 stainless steel with a Number 4 finish.

2.17 SPLASH GUARD

- A. Clear polycarbonate resin with a minimum thickness of 1 inch. Finish on front and all four edges. As detail on the drawings.

2.18 GAS CYLINDER RESTRAINTS/STORAGE

- A. Description: Provide metal framing system members, fastened to the wall or laboratory bench, for mounting of cylinder restraint devices.
- B. Metal Framing System Components: Consist of two 12 gage steel P1000 channel members with two male swivel hanger fittings, Number M2350, on each member for each cylinder. Unistrut Part Numbers are referenced. Finish as specified for metal finish in this section, with color selected by Owner's Representative.

1. Acceptable Manufacturers:

- a. Unistrut Corporation
- b. Elcen
- c. Grinnell Power-Strut

- C. Chain Restraints: Consist of **3/16 inch(5 mm)** diameter Type 316 stainless steel chain Number 3618T715, length as required to restrain a standard **9 or 10 inch(230 or 250 mm)** gas cylinder, with a Type 316 stainless steel threaded connector Number 3711T33, on one end of the chain, and a Type 316 stainless steel load rated spring snap with a minimum load rating of **300 pounds(136 kg)**, Number 8907T11, on the other end of the chain;

1. Available Manufacturer/Distributor:

- a. McMaster-Carr.

- D. Gas Cylinder Holder for Storage Area:

1. Acceptable Manufacturers:

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- a. Rotarex: <https://rotarex.com/product/gas-cylinder-holder-for-storage-area>

2.19 SLEEVES IN COUNTERTOPS

- A. Description: 14 gage(2.0 mm), Type 304 stainless steel, with a Number 4 finish.
- B. Extend sleeves 1 inch(25 mm) above the countertop and provide with a flange on the bottom for fastening to the underside of the countertop. Install with clear silicone sealant between the outside of the sleeve and the countertop. Provide top edge of sleeve with a smooth radius to prevent chafing of insulation on hoses.

2.20 SOURCE QUALITY CONTROL TESTING OF METAL FINISH

- A. Metal Finish: Meet or exceed the latest edition of the following Section and Articles of SEFA-8 Recommended Practices;
1. 8.0 Cabinet Surface Finish Test
 2. 8.1 Chemical Spot Test
 3. 8.2 Hot Water Test
 4. 8.3 Impact Test
 5. 8.4 Paint Adhesion on Steel
 6. 8.5 Paint Hardness on Steel
- B. Testing Requirements: Provide a third party tester that is not a representative of the Manufacturer or Installation Contractor
1. Test Results: Submit a certified report providing test results and indicating the finish conforms with or exceeds the above SEFA-8 Recommended Practices.

2.21 SOURCE QUALITY CONTROL TESTING OF EPOXY RESIN WORK SURFACE

- A. Test Procedure: Apply 5 drops of each reagent to surface and cover with 25 mm watchglass, convex side down; test volatiles using 1 ounce(28 ml) bottle stuffed with saturated cotton. After 24 hour exposure flush surface, clean, rinse and wipe dry.
- B. Evaluation Ratings: Describe by the following ratings, changes in surface finish and function:
1. No Effect: No detectable change in surface material.
 2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
 3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
 4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
 5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.
- C. Test Results: Submit a report of the test results. Provide results equal to or better than the following.

<u>Reagent</u>	<u>Rating</u>
1. Hydrochloric Acid, 37 percent	Excellent
2. Sulfuric Acid, 33 percent	No Effect
3. Sulfuric Acid, 77 percent	No Effect
4. Sulfuric Acid, 96 percent	Failure

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5.	Formic Acid, 90 percent	Excellent
6.	Nitric Acid, 20 percent	Excellent
7.	Nitric Acid, 30 percent	Excellent
8.	Nitric Acid, 70 percent	Good
9.	Hydrofluoric Acid, 48 percent	Fair
10.	Phosphoric Acid, 85 percent	No Effect
11.	Chromic Acid, 60 percent	Failure
12.	Acetic Acid, 98 percent	Excellent
13.	3 & 8 Equal Parts	Excellent
14.	Ammonium Hydroxide, 28 percent	No Effect
15.	Sodium Hydroxide, 10 percent	No Effect
16.	Sodium Hydroxide, 20 percent	No Effect
17.	Sodium Hydroxide, 40 percent	No Effect
18.	Sodium Hydroxide Flake	No Effect
19.	Sodium Sulfide	Excellent
20.	Zinc Chloride	No Effect
21.	Tincture of Iodine	Excellent
22.	Silver Nitrate	No Effect
23.	Methyl Alcohol	No Effect
24.	Ethyl Alcohol	No Effect
25.	Butyl Alcohol	No Effect
26.	Benzene	Excellent
27.	Xylene	No Effect
28.	Toluene	Excellent
29.	Gasoline	No Effect
30.	Dichloroacetic Acid	Good
31.	Dimethylformamide	Excellent
32.	Ethyl Acetate	No Effect
33.	Amyl Acetate	Excellent
34.	Acetone	Excellent
35.	Chloroform	Excellent
36.	Carbon Tetrachloride	No Effect
37.	Phenol	Excellent
38.	Cresol	Excellent
39.	Formaldehyde	No Effect
40.	Trichlorethylene	Excellent
41.	Ethyl Ether	Excellent
42.	Furfural	Good
43.	Methylene Chloride	Excellent
44.	Monochlorobenzene	Good
45.	Dioxane	Excellent
46.	Methylethyl Ketone	Excellent
47.	Acid Dichromate	Fair
48.	Hydrogen Peroxide	No Effect
49.	Naphthalene	Excellent

2.22 SOURCE QUALITY CONTROL TESTING OF SOLID PHENOLIC RESIN WORK SURFACE

- A. Test Procedure: Apply 5 drops of each reagent to surface and cover with 1 inch(25 mm) watch glass, convex side down; test volatiles using 1 ounce(28 ml) bottle stuffed with saturated cotton. After 24 hour exposure flush surface, clean, rinse and wipe dry.
- B. Evaluation Ratings: Describe by the following ratings, changes in surface finish and function:

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1. No Effect: No detectable change in surface material.
2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.

C. Test Results: Submit a report of the test results. Provide results equal to or better than the following:

<u>Reagent</u>	<u>Rating</u>
1. Hydrochloric Acid, 10 percent	No Effect
2. Hydrochloric Acid, 37 percent	No Effect
3. Sulfuric Acid, 33 percent	No Effect
4. Sulfuric Acid, 77 percent	Excellent
5. Sulfuric Acid, 96 percent	Excellent
6. Nitric Acid, 20 percent	No Effect
7. Nitric Acid, 30 percent	No Effect
8. Nitric Acid, 70 percent	No Effect
9. Hydrofluoric Acid, 48 percent	Fair
10. Phosphoric Acid, 85 percent	No Effect
11. Chromic Acid, 60 percent	No Effect
12. Acetic Acid, 99 percent	No Effect
13. Ammonium Hydroxide, 28 percent	No Effect
14. Sodium Hydroxide, 10 percent	No Effect
15. Sodium Hydroxide, 20 percent	No Effect
16. Sodium Hydroxide, 40 percent	No Effect
17. Sodium Hydroxide Flake	No Effect
18. Silver Nitrate 1 percent	No Effect
19. Methyl Alcohol	No Effect
20. Ethyl Alcohol	No Effect
21. Xylene	No Effect
22. Toluene	No Effect
23. Dichloroacetic Acid	No Effect
24. Dimethylformamide	No Effect
25. Ethyl Acetate	No Effect
26. Acetone	No Effect
27. Phenol 90 percent	No Effect
28. Formaldehyde 37 percent	No Effect
29. Trichloroethylene	No Effect
30. Ethyl Ether	No Effect
31. Furfural	No Effect
32. Methylene Ketone	No Effect
33. Potassium permanganate 10 percent	No Effect
34. Ferric (III) chloride 10 percent	No Effect
35. Copper sulphate 10 percent	No Effect
36. Sodium hypochlorite 13 percent	No Effect
37. Sodium chloride 10 percent	No Effect
38. Ethylene glycol	No Effect
39. Dichloromethane	No Effect
40. Acetic anhydride	No Effect

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41.	n-Butyl acetate	No Effect
42.	n-Hexane	No Effect
43.	Methylisobutylketone	No Effect
44.	Tetrahydrofurane	No Effect
45.	Acridine orange 1 percent	No Effect
46.	Basic fuchsin 1 percent	No Effect
47.	Carbol fuchsin 1 percent	No Effect
48.	Malachite green oxalate 1 percent	No Effect
49.	Methylene blue 1 percent	No Effect
50.	Methyl violet 2B 1 percent	No Effect
51.	Wright stain 1 percent	No Effect
52.	Gentian Violet (dye) 1 percent	No Effect

2.23 Adjustable Height Microscope Table

- A. Description: motor operated, vibration resistant, adjustable height microscope table.
- B. 1,000 pound capacity with vibration dampening levelors
- C. 30" to 36" range in height
- D. Basis of Design: RDM Industrial Products, Model Number i-107-Micro, www.rdm-ind.com

SOURCE QUALITY CONTROL TESTING EXECUTION

2.24 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

2.25 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

2.26 INSTALLATION

- A. Casework Installation:
 - 1. Install, plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Securely anchor to building structure. Where laboratory furniture abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.

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2. Installation of each individual bench run shall start at the high point of the floor under that bench run with levelers screwed in as much as possible.
3. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch(1.5 mm).
4. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by Manufacturer.
5. Securely fasten tall cabinets, fume hood superstructures and tall flammable storage cabinets to solid support material near top of cabinet.
6. Reinforcement of stud walls to support cabinets, shelving, and other wall mounted laboratory furnishing items: Done during wall erection by trade involved. Laboratory furniture company/supplier is responsibility for indicating on Shop Drawings the accurate location and sizing of reinforcement.

B. Wall Cabinet Installation:

1. Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets.
2. Reinforcement of stud walls to support wall mounted cabinets: Done during wall erection by trade involved. Laboratory furniture company/supplier is responsibility for indicating on Shop Drawings the accurate location and sizing of reinforcement.

C. Work Surface Installation:

1. Field jointing where practicable: Made in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by Manufacturer. Locate field joints as shown on accepted Shop Drawings, factory prepared so that there is no job site processing of top and edge surfaces.
2. Abut top and edge surfaces in 1 true plane, with internal supports placed to prevent any deflection.
3. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Prior to making openings, verify size of opening with actual size of equipment to be used. Form inside corners to a radius of not less than 1/8 inch(3 mm). After sawing, rout and file cutouts to ensure smooth, crack free edges. Seal exposed edges after cutting with a waterproofing material recommended by manufacturer.
4. Secure tops to support with concealed Z-Type, angle type fastening or equivalent devices spaced no more than 3 feet(0.9 m) on center.
5. Plastic laminate worktop joints: 1/4 inch(6 mm) diameter bolt type "dog-bone" or "tite-joint" fasteners routed into bottom surface of worktops. Provide flush hairline joints in top units.
6. Epoxy Resin Work Surface Joints: 3/32 inch(2.38 mm) flush and smooth.
7. Stainless Steel Work Surface joints: Electrically weld all shop and field joints; grind smooth and polish.
8. Caulk joints between curb and walls, fume hoods, and cabinets with acid-resistant silicone caulk.

D. Sink Installation: Set in chemical resistant sealing compound sinks which were not factory installed and secured and supported per manufacturer's recommendations.

E. Accessory Installation: Install accessories and fixtures in accordance with manufacturer's recommendations.

2.27 ADJUSTING

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- A. Repair or remove and replace defective work, as directed by Owner's Representative upon completion of installation.
- B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

2.28 CLEANING AND PROTECTION

- A. Clean shop finished casework, touch up as required, and remove and refinish damaged or soiled areas.
- B. Cover casework for protection against soiling and deterioration during remainder of construction period.
- C. Clean countertops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.
- D. If steel wool is used in cleaning stainless steel, use only stainless wool.
- E. Protect casework before, during, and after installation. Materials damaged due to improper protection are cause for rejection.

2.29 FIELD QUALITY CONTROL

- A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
- B. Owner's Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

END OF SECTION

SECTION 123653

LABORATORY CASEWORK TOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Laboratory casework tops.

1. Phenolic resin tops.

1.2 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- B. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components.
- C. NEMA LD 3 - High-Pressure Decorative Laminates.
- D. SEFA 2 - Installations.
- E. SEFA 3 - Laboratory Work Surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of laboratory casework top specified.

1. Include product test reports from and based on tests performed by a qualified independent testing laboratory evidencing compliance of laboratory casework top finishes with requirements specified for chemical and physical resistance.

B. Shop Drawings: For laboratory casework tops showing plan layout, location and type of service fittings.

1. Submit shop drawings as one complete submittal that includes all items specified in this section. Submittals that include only part of the specified items of this section are not acceptable and will be rejected.
1. Include details and location of anchorages and fitting walls and base, including required blocking or back blocking.
2. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
3. Coordinate shop drawings with other work involved.
4. Include manufacturer's recommendations for blocking and securing of laboratory casework tops.

5. Sample units will be used to demonstrate aesthetic effects as well as other qualities of materials and execution. Sample units may not be incorporated in work.

1.4 CONCURRENT SUBMITTALS

- A. Concurrent Submittals: Submittals for the following Sections shall be coordinated and submitted simultaneously.
 1. Section 12 3553.13 – Movable Laboratory Casework.
 2. Section 12 3553.33 – Laboratory Casework and Furnishings.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide laboratory casework tops manufactured or furnished by same company as laboratory furniture manufacturer for single responsibility. Provide casework tops by company with minimum of 10 years experience in the manufacture of laboratory casework of the type specified for this project.
- B. Installer: Installer of laboratory casework tops shall be trained and certified by the manufacturer of the casework.
- C. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E699, that it has the experience and capability to conduct satisfactorily the testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver laboratory casework tops only after building is enclosed, weathertight, and wet operations in building are completed.
- B. Protect finished surfaces from soiling and damage during handling and installation. Cover with polyethylene film or other protective covering.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install casework tops until HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Coordinate installation of casework tops with Construction Manager to determine whether adjacent construction, especially floor, wall, and ceiling finishes, is at a stage of completion permitting the installation of casework.

1.8 WARRANTY

- A. Special Project Warranty: Executed by the manufacturer, agreeing to repair or replace laboratory casework tops that fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Construction Manager under the Contract Documents.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Laboratory casework tops shall withstand the effects of earthquake motions determined according to ASCE 7.

2.02 PHENOLIC RESIN COMPOSITE TOPS

- A. Solid, high-pressure decorative laminate, laboratory grade, complying with NEMA LD 3, Grade CGS and SEFA 3.
- B. Manufacturers: Provide products by the following:
 - 1. Basis of Design: Trespa North America; TopLab: www.trespa.com/us.
 - 2. Fundermax: www.fundermaxnorthamerica.com.
 - 3. Durcon Inc.: www.durcon.com.
- C. Chemical Resistance: Composite countertop material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5 and SEFA 3:
 - 1. No Effect: Acetic acid (98 percent), acetone, benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, formaldehyde (37 percent), hydrochloric acid (37 percent), hydrofluoric acid (48 percent), phosphoric acid (85 percent), sodium hydroxide (40 percent), sulfuric acid (33 percent), toluene, and zinc chloride.
 - 2. Excellent: ammonium hydroxide (28 percent), furfural, nitric acid (30 percent).
- D. Color: As selected by Architect from manufacturer's full range. Finish color or top shall match the core for a consistent color throughout.
- E. Countertop Fabrication:
 - 1. Fabricate in one piece with square edge at overhang and drip groove on underside. Fabricate backsplash and endsplashes separately. Adhere splashes to top with epoxy adhesive.
 - 2. Fabricate with cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.
 - 3. Thickness: One inch.
 - 4. Countertop Configuration: As indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Determine related work in place is not detrimental to the timely completion of the work of this section. Start of this work shall indicate acceptance of related work.

3.02 INSTALLATION

- B. Comply with installation requirements in SEFA 2. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where indicated on Shop Drawings.

C. Work surface installation:

1. Where required due to field conditions, scribe or caulk to abutting surfaces.
2. Secure joints in the field, where practicable, in same manner as in factory, with dowels, adhesive or fasteners recommended by manufacturer.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
4. Provide cutouts for related work, coordinate with other trades.

D. Field Jointing of Solid Phenolic Tops: Locate field joints as shown on approved shop drawings; factory prepare mating surfaces so there is no jobsite processing of top and edge surfaces. Join using adhesives recommended by manufacturer and that match color of top.

E. Fastening Tops to Base Cabinets:

1. Solid Phenolic Tops: Secure tops to cabinets with silicone adhesive, applied at each corner and continuously along perimeter edges.
2. Maximum penetration of screws into underside of countertops shall not be installed closer than 1/4 inch below the top surface, unless instructed otherwise by countertop manufacturer.

F. Fastening Tops to Metal Wall-Hung Brackets:

1. Solid Phenolic Tops: Secure tops to brackets with screws, applied at each corner by screwing through top bracket arm into underside of countertop. Provide pre-drilled holes for field installed stainless steel flathead torx or square head screws.
2. Maximum penetration of screws into underside of countertops shall not be installed closer than 1/4 inch below the top surface, unless instructed otherwise by countertop manufacturer.

G. Tolerance: Install countertops with no more than 1/8 inch in 96 inches sag, bow, or other variation from a straight line.

H. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

1. Join tops using clamping devices to create flush hairline joints. At joints in phenolic tops, use manufacturer's recommended adhesives and clamping devices to create joint widths of not more than 1/16 inch, completely filled and flush with abutting surfaces.
2. Where necessary to penetrate epoxy and phenolic tops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal in chemical resistance, color, hardness, and texture to top surface.

I. Provide holes and cutouts as required for mechanical and electrical service fittings.

J. Carefully dress joints smooth, remove surface scratches, and clean and polish entire surface.

K. Provide and scribe moldings for closures at junctures of top, curb, and splash with walls as recommended by manufacturer for materials involved.

L. Caulk space between wall and countertops with mildew-resistant silicone sealant specified in Section 07 9200 - Joint Sealants.

3.03 CLEANING

M. Repair or remove and replace defective work as directed upon completion of installation.

- N. Clean factory and shop-finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as acceptable to the Architect.

3.04 PROTECTION

- A. Protection: Provide a suitable covering over countertop surfaces to prevent marring of surface due to impact, or staining due to corrosive materials; tape to underside of countertop. Protect installed laboratory casework from damage by work of other trades until date of Substantial

Completion.

END OF SECTION

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SECTION 123661

SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: The following simulated stone countertops along with supplementary items necessary for installation:
 - 1. Solid surfacing countertops.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
 - 1. Show materials, finishes, edge profiles, methods of joining, locations, and details of joints.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in fabrications.
 - 3. Show direction of directional pattern, if any.
- C. Samples for Verification Purposes:
 - 1. Panel Material: 6 in ()square, showing color and pattern selected. Trim piece samples to be 6 in ()long.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For simulated stone fabrications to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of sources for products.

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1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.

B. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

- a. Architect.
- b. Contractor, including superintendent.
- c. Installer, including project manager and supervisor.
- d. If requested, Manufacturer's qualified technical representative.
- e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.

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- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 - 1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. Solid Surfacing:
 - a. Avonite Surfaces
 - b. E. I. du Pont de Nemours and Company
 - c. Formica Corporation
 - d. LG Chemical, Ltd.
 - e. Meganite Inc.

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- f. Samsung Chemical USA, Inc.
- g. Swan Corporation (The)
- h. Transolid, Inc.
- i. Wilsonart International

- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 SOLID SURFACE MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
- 1. Colors and Patterns: As scheduled or indicated in Design Selections.
- B. Panel Thickness: Minimum 1/2 in or as indicated on drawings.

2.4 ACCESSORIES

- A. Subtop Materials:
- 1. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
 - 2. Softwood Plywood: DOC PS 1, Exposure 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness. Panel Grade B-C.
- B. Lavatory Bowls: Provide one or both types below, as indicated on drawings:
- 1. Integral Lavatory Bowl (Rectangular): Made of solid surfacing material; nominal 15 in front-to-back by 20 in side-to-side inside plan dimension by 5 in deep; drain 4 in from rear side, provide unit with overflow; seam-mount installation.
 - a. Manufacturer and Product: Wilsonart; Model D354SL.
- C. Backsplash: Preformed 4 in high coved backsplash, to match countertop.
- D. Front Edge Trim: Preformed 1-1/2 in, to match countertops.

2.5 FABRICATION

- A. Comply with simulated stone manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
- 1. Fabricate items without joints unless otherwise indicated.

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2. Fabricate countertops with shop-applied backsplashes and edges, unless otherwise indicated
- B. Cutouts and Holes: Accurately cut holes and drill panels in shop for penetrations, fittings and other accessories indicated on Drawings. Obtain field measurements prior to fabrication and maintain minimum clearance at walls.
 1. Make cutouts using template or pattern. Form cutouts to smooth, even curves.
 2. Drill fabrications for fittings and similar items.

2.6 INSTALLATION MATERIALS

- A. Adhesives: Product recommended by simulated stone manufacturer.
- B. Accessories: Provide joint seam adhesives and other items required for a complete installation as recommended in writing by simulated stone manufacturer.
- C. Sealant: Mildew resistant silicone sealant as specified in Division 07 Section Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 1. Respective manufacturer's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 in per 48 in.
- B. Variation from Level: Do not exceed 1/8 in per 96 in, 1/4 in maximum.

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- C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.
- D. Variation in Plane at Joints (Lipping): Do not exceed 1/64 in difference between planes of adjacent units.
- E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64 in difference between edges of adjacent units, where edge line continues across joint.

3.5 INSTALLATION

- A. Secure countertops to subtops with adhesive according to material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- B. Bond joints with adhesive and draw tight as fabrications are set. Mask surfaces of fabrications adjacent to joints to prevent adhesive smears.
 - 1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- C. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- D. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- E. Complete cutouts not finished in shop. Mask areas of fabrications adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in subtops by saturating with varnish.
- F. Apply sealant and compress to form bond with simulated stone material and adjacent surfaces and tool sealant surface to clean, straight lines.
 - 1. Comply with Division 07 Section Joint Sealants.

3.6 CLEANING

- A. Promptly clean simulated stone as work progresses to minimize final cleaning. Do not leave adhesive or sealant to dry on simulated stone faces.
- B. Final clean and protect installed countertops in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 124816

ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this section includes rigid sections of closely spaced rail treads set in recessed frames in the floor designed to remove debris carried in by foot and wheeled traffic; along with supplementary items necessary to complete their installation
- B. Related Section(s):
 - 1. Division 12 Section "Entrance Floor Mats" for roll-up (removable) rail mats for recessed applications; with or without frames.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, joint locations, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, sections, details of components, details of patterns or designs, and attachments to other work. Distinguish between shop and field-assembled work
 - 1. Recess: Coordinate Shop Drawings showing oversize recess for deferred installation of frames with concrete work.
 - 2. Floor Drain: Coordinate Shop Drawings with plumbing Coordination Drawings showing floor drain and piping for pan and frames.
- C. Samples for Verification: 12 inch square assembled sections of floor grille, frame members, tread surface, metal finish and accessories required.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For cleaning and maintaining entrance floor grilles. Include in maintenance manuals.

1.4 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

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1.6 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Defer frame installations until building enclosure is completed and related interior finish work is in progress.
- C. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. ARDEN Architectural Specialties, Inc.
 - 2. Balco, Inc.
 - 3. Construction Specialties, Inc. (C/S Group)
 - 4. J.L. Industries, Inc.
 - 5. Kadee Industries, Inc.
 - 6. Pawling Corporation; Architectural Products Division
 - 7. Reese Enterprises, Inc.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 ENTRANCE FLOOR GRILLES, GENERAL

- A. Structural Performance: Provide floor grilles and frames capable of withstanding the following loads and stresses:
 - 1. Uniform floor load of 300 lbf/sq. ft..
 - 2. Wheel load of 350 lb per wheel.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 FRAMES

- A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

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2.4 ENTRANCE FLOOR GRILLES

- A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.
- B. Aluminum Floor Grilles: Provide manufacturer's standard floor grilles with extruded members, top-surfaced tread rails, and as follows:
 - 1. Tread Rails: Extruded-aluminum tread rails.
 - a. Aluminum Color: Mill finish.
 - 2. Tread Rail Spacing: 1-1/2 inches o.c. with 1/8- to 3/16-inch-wide openings between treads.
 - 3. Top Surface:
 - a. Fusion-bonded, level-cut-pile nylon carpet insert; 1/4 inch high, 28 oz./sq. yd.. As selected by Architect from manufacturer's full range of industry colors.
 - 4. Grille Size: As indicated.
 - 5. Product Standard: C/S Group; Pedigree series.
- C. Stainless-Steel Floor Grille: Type 304.
 - 1. Surface Treads: 0.071-by-0.177-inch wire with 0.125-inch-wide openings between wires.
 - 2. Support Rods: Spaced 1 inch o.c., welded to each wire.
 - 3. Pit Grating: 1-1/8 inches deep.
 - 4. Stainless-Steel Finish: Mill.
 - 5. Grille Size: As indicated.
 - 6. Product Standard: C/S Group; Gridline series.
- D. Lockdown: Hidden.

2.5 SUPPORT SYSTEM FOR ALUMINUM FLOOR GRILLES

- A. Drainage Pit Applications: Provide manufacturer's special deep-pit frame and support extrusion system with intermediate support beams, sized and spaced as recommended by manufacturer for indicated spans and equipped with vinyl support cushions.

2.6 DRAIN PANS

- A. Provide manufacturer's standard 0.060-inch- thick, aluminum or stainless-steel sheet drain pan with NPS 2 drain outlet for each floor grille unit. Coat bottom of pan with protective coating recommended by manufacturer.

2.7 MATERIALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15.

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- B. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52 as standard with manufacturer. Coat surface of frame in contact with cementitious materials with manufacturer's standard protective coating.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- D. Stainless-Steel Angles: ASTM A 276 or ASTM A 479/A 479M, corrosion resistant, Type 304.

2.8 FABRICATION

- A. Shop-fabricate entrance floor grilles to greatest extent possible in sizes as indicated. If not otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.
- B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION, ENTRANCE FLOOR GRILLES

- A. Install recessed entrance floor grilles and frames and drain pans to comply with manufacturer's written instructions at locations indicated and with top of entrance floor grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer.

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1. Set floor grille tops at height for most effective cleaning action but not to exceed 1/4 inch above adjacent floor finish.
2. Coordinate top of floor grille surfaces with doors that swing across grilles to provide clearance under door.
3. Arrange with horizontal members perpendicular to dominant direction of traffic.

3.5 PROTECTION

- A. After completing frame installations, provide temporary filler of plywood or fiberboard in floor grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

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SECTION 12 5250

UPHOLSTERED SEAT CUSHIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes seat cushions.

1.2 RELATED SECTIONS

- A. Section 06 4023 Interior Architectural Woodwork.
- B. Finish Schedule on Sheet A3.40.

1.3 SUBMITTALS

- A. Samples:
 - 1. Fabric: Submit a minimum of 12-inch-long length of each type of fabric, from same bolt/dye lot as fabric proposed for the work.
 - 2. Cushions: One half scale seat cushion fully assembled.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. High Density Foam: Industrial Grade High Density Foam that is solid and primarily for furniture and mattresses, with a good balance between softness and support.
 - 1. Thickness: 1/2-inch.
 - 2. Firmness: Medium to Medium Firm
- B. Upholstery Wrap: High-quality polyester fiber batting designed to be wrapped around upholstery foam inserts for seats and cushions that is hypoallergenic and resists stains.
 - 1. Product: Dacron
 - 2. Thickness: 1/2-inch.
- C. Water Barrier: 1.9 Ounce Polyurethane Coated Ripstop Fire Retardant
 - 1. Color: White

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- D. Fabric: As Scheduled within Drawings, see Interior Finish Schedule on Sheet A3.40
- E. Hook and loop strips: Velcro; 1-inch width.

2.2 FABRICATION

- A. Fabricate cushions to the shapes indicated:
 - 1. Seat Cushions: 1-layer of high-density foam for a thickness of 1/2-inch.
- B. Wrap foam cushions fully in 1/2-inch-thick Dacron meeting fire regulations.
- C. Wrap foam and Dacron with Ripstop.
- D. Fabricate for tight fit between cushions and adjacent construction.
- E. Sew cushion fabric covers with self-welt; non-reversable design unless otherwise indicated on the Drawings. Provide heat resistant zipper along length of cushion at back side.
- F. Sew loop portions of woven nylon hook and loop ("Velcro") fastener section to align with hook sections mounted to substrate.
- G. Install covers to cushions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

- A. Adhere hook portion of hook and loop fastener sections to substrates.
- B. Tightly and evenly fit cushions in position, secure hook, and loop fasteners.

END OF SECTION

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SECTION 129300

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: the Contractor shall furnish all labor, materials, equipment, transportation, services and necessary appurtenant work required to complete the work shown on the Plans and/or specified herein.

B. Extent of work shall include but not be limited to the procurement and installation of:

1. Community Table- ADA; 112" length
2. Community Table- 82" length
3. Flat Benches for Community Tables
4. Curved Wood Slat Bench
5. Wall-Mounted Wood Slat Bench
6. Backed Bench
7. Single Lounge Chair
8. Double Lounge Chair
9. Side Table
10. Table
11. ADA Table
12. Bike Racks
13. Leaning Rail
14. Moveable Stool
15. Waste Bin
16. Recycling Bin
17. Charging Station
18. Tree Grate

1.2 RELATED DOCUMENTS

A. Attention is directed to Bidding and Contracting requirements, drawings and general provisions of the Contract, including General Conditions and Division 1 Specification sections, which are hereby made part of this section.

B. Related Sections:
321313 Cement Concrete Pavements, Curbs and Gutters
033000 Cast-In-Place Concrete

1.3 REFERENCE SPECIFICATION

A. Materials and Work covered under this Section shall be in accordance Wayne State University Standard Specifications unless otherwise indicated. All work under this Contract which is not included in the Wayne State University Standard Specifications, or which is performed using modifications to those Standard Specifications, shall be performed in accordance with the Detailed Specifications included in these contract documents. If a conflict exists between specifications, the more rigorous shall govern.

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1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 – PRODUCTS

2.1 COMMUNITY TABLE -ADA 112" length

- A. Product Name: Monoline Community Table
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: ML-CMTADA-112
- D. Mount: Freestanding
- E. Finish: Thermory Ash/ Alpine Green
- F. Install per manufacturer's instructions.

2.2 COMMUNITY TABLE -82" length

- A. Product Name: Monoline Community Table
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: ML-CMT-82
- D. Mount: Freestanding
- E. Finish: Thermory Ash/ Alpine Green
- F. Install per manufacturer's instructions.

2.3 FLAT BENCHES FOR COMMUNITY TABLES

- A. Product Name: Monoline Flat Bench
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: ML-FLAT-72
- D. Mount: Freestanding
- E. Finish: Thermory Ash/ Alpine Green
- F. Install per manufacturer's instructions.

2.4 CURVED WOOD SLAT BENCH

- A. Product Name: Curved Pedestal-Mount Bench with Back
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: Custom
- D. Mount: Embedded/Footing
- E. Finish: Thermory Ash/ Alpine Green
- F. Install per manufacturer's instructions.

2.5 WALL-MOUNTED WOOD SLAT BENCH

- A. Product Name: Custom Wall-Mounted Bench
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: Custom
- D. Mount: Wall-Mounted
- E. Finish: Thermory Ash
- F. Install per manufacturer's instructions.

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2.6 BACKED BENCH

- A. Product Name: Monoline Backed Bench
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: ML-BENCH-96
- D. Mount: Embedded/Footing
- E. Finish: Thermory Ash/ Alpine Green
- F. Install per manufacturer's instructions.

2.7 SINGLE LOUNGE CHAIR

- A. Product Name: Americana Single Lounge Chair
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Harvest 40" Side Table
- D. Mount: Freestanding
- E. Finish: Charcoal HDPE; Dusk POWDER COATED METAL
- F. Install per manufacturer's instructions.

2.8 DOUBLE LOUNGE CHAIR

- A. Product Name: Americana Double Lounge Chair
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Harvest 40" Side Table
- D. Mount: Freestanding
- E. Finish: Charcoal Gray HDPE; Dusk POWDER COATED METAL
- F. Install per manufacturer's instructions.

2.9 SIDE TABLE

- A. Product Name: Harvest Round Table
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Harvest 40" Side Table
- D. Mount: Freestanding
- E. Finish: Charcoal Gray HDPE; Dusk POWDER COATED METAL
- F. Install per manufacturer's instructions.

3.0 TABLE

- A. Product Name: Takeout Table
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Double Takeout Table
- D. Mount: Freestanding
- E. Finish: Lemon
- F. Install per manufacturer's instructions.

3.1 ADA TABLE

- A. Product Name: Takeout Table
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Left Triple Takeout Table
- D. Mount: Freestanding
- E. Finish: Lemon

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F. Install per manufacturer's instructions.

3.2 BIKE RACK

- A. Product Name: Monoline Duo Bike Rack
- B. Manufactured by Site Pieces (800) 484 0797; sitepieces.com
- C. Model: ML-DUO-18
- D. Mount: Surface
- E. Finish: Alpine Green
- F. Install per manufacturer's instructions.

3.3 LEANING RAIL

- A. Product Name: Jessie Rail
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Backrest infill; with BAR top; + 4 expansion units
- D. Mount: Embedded/Footing
- E. Finish LEGS: Dusk; BAR TOP: Dusk
- F. Install per manufacturer's instructions.

3.4 MOVEABLE STOOL

- A. Product Name: Chipman Stool
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: N/A
- D. Mount: Freestanding
- E. Finish: Lemon
- F. Install per manufacturer's instructions.

3.5 WASTE BIN

- A. Product Name: Chase Park Litter
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Side Opening; Unlocked, 36 gallon with liner
- D. Mount: Freestanding
- E. Finish: Matte Black
- F. Install per manufacturer's instructions.

3.6 RECYCLING BIN

- A. Product Name: Chase Park Recycling
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Product Description: Side Opening Single Use; Unlocked; No sand pan; 12 Recyclable Material Only Sign.
- D. Mount: Freestanding
- E. Finish: Matte Black
- F. Install per manufacturer's instructions.

3.7 CHARGING STATION

- A. Product Name: Charging Station with Accent Light
- B. Manufactured by Landscape Forms (800) 521-2546; landscapeforms.com
- C. Model: BM-CSA-1G1U-LBLK

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- D. Mount: Embedded/Footing
- E. Finish: Black with WSU logo; coordinate logo with owner
- F. Install per manufacturer's instructions.

3.8 TREE GRATE

- A. Product Name: 8953 Plaza; 60" Round with 30" diameter Tree opening
- B. Manufactured by EJ; www.ejco.com
- C. Model: 00897551C04
- D. Mount: Per Manufacturer's Instructions
- E. Finish: Gray Iron, Undipped
- F. Install per manufacturer's instructions.

3.9 REMOVABLE INNER TREE GRATE

- A. Product Name: 8953 Plaza Removable Inner Tree Grate to Change Tree opening from 16" diameter to 30" diameter
- B. Manufactured by EJ; www.ejco.com
- C. Model: 00895363B01
- D. Mount: Per Manufacturer's Instructions
- E. Finish: Gray Iron, Undipped
- F. Install per manufacturer's instructions.

PART 3 – EXECUTION

3.1 ASSEMBLY

- A. Assemble as necessary according to the manufacturer's instructions.

3.2 MOUNT: FREESTANDING

- A. No mounting required; furniture to be freestanding and moveable.

3.3 MOUNT: EMBEDDED/ FOOTING

- A. Install per manufacturer's standards and specifications.
- B. Footing depth 42".
- C. Top of footing to be 4" minimum below finish grade to allow for concrete walks and hardscape surface treatment. Footings to be field-located per manufacturer's designs and cut sheets.

3.4 MOUNT: SURFACE

- A. Install per manufacturer's standards and specifications.
- B. All surface mounting hardware to be hot-dipped galvanized, supplied by contractor if not supplied by manufacturer.

END OF SECTION

Monoline ADA Community Table

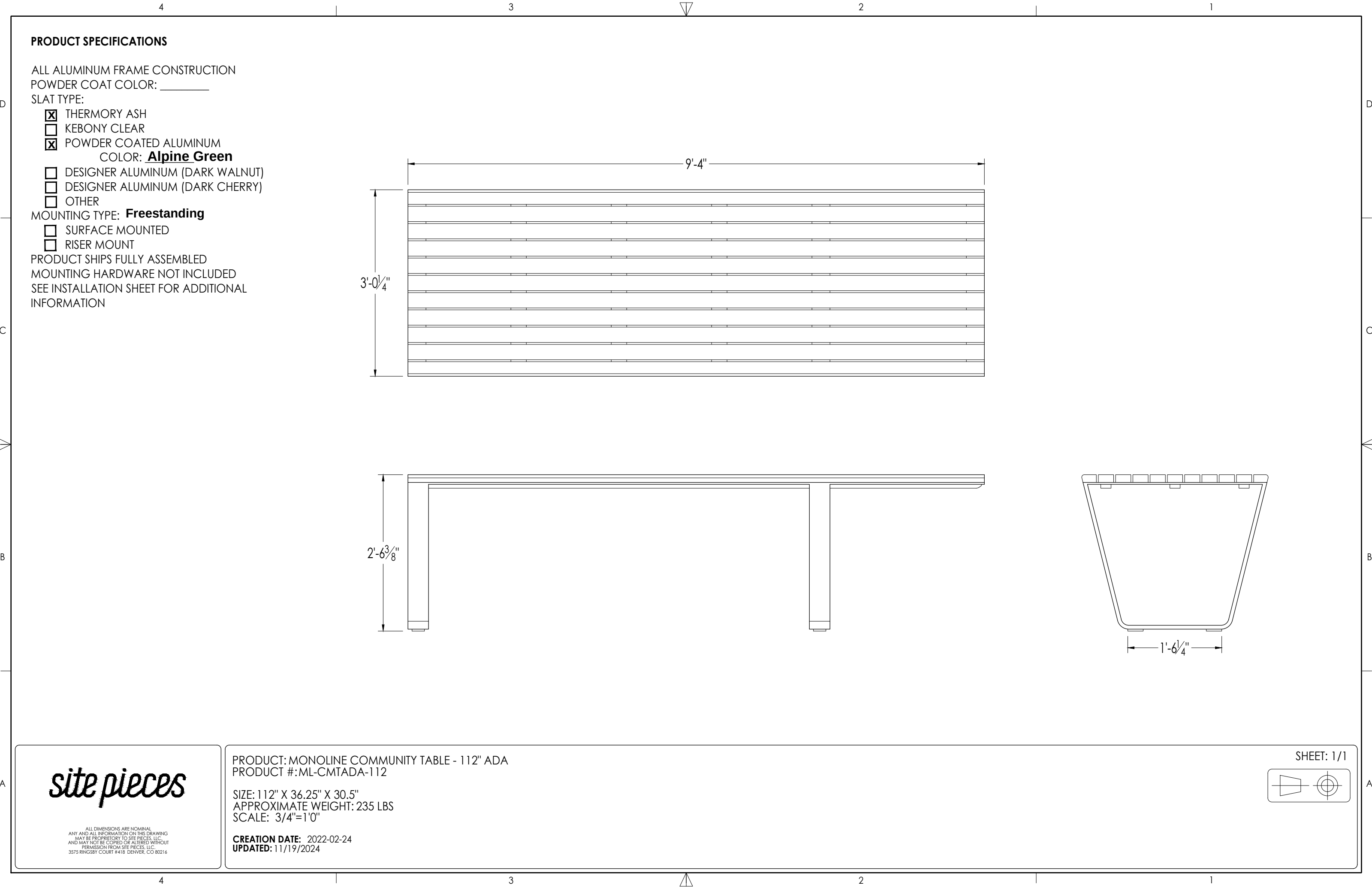


The Monoline Community Table is all about bringing everyone together and sharing some space, time, maybe some food, and making memories together. Pair this table with the Flat Bench for a perfect match.

- wood slats: thermally modified ash or kebony clear
- aluminum slats: powder coated or designer aluminum
- all aluminum frame construction
- powder coated finish
- optional hole for use with an umbrella
- table requires surface mounting
- available as a set or standalone piece
- available in custom sizes
- ships fully assembled

PRODUCT:	LENGTH:	WIDTH:	HEIGHT:
ML-CMTADA-112	112"	36.3"	30.8"





Monoline Community Table

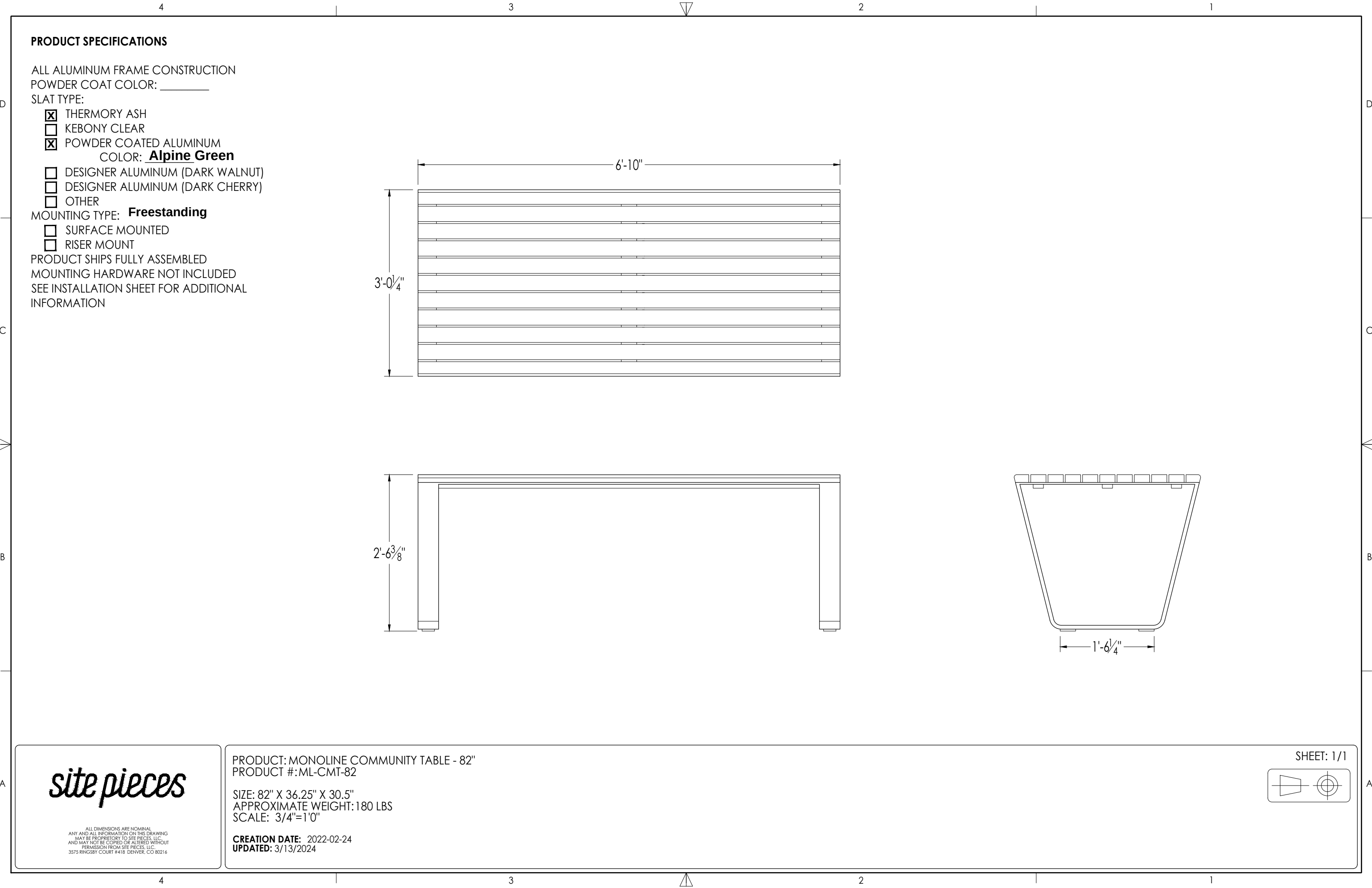


The Monoline Community Table is all about bringing everyone together and sharing some space, time, maybe some food, and making memories together. Pair this table with the Flat Bench for a perfect match.

- wood slats: thermally modified ash or kebony clear
- aluminum slats: powder coated or designer aluminum
- all aluminum frame construction
- powder coated finish
- optional hole for use with an umbrella
- table requires surface mounting
- ADA accessible bench available
- available as a set or standalone piece
- available in custom sizes
- ships fully assembled

PRODUCT:	LENGTH:	WIDTH:	HEIGHT:
ML-CMT-82	82"	36.3"	30.8"





site pieces

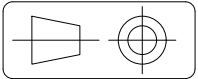
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PERMISSION FROM SITE PIECES, LLC
3575 RINGSBY COURT #418 DENVER, CO 80216

PRODUCT: MONOLINE COMMUNITY TABLE - 82"
PRODUCT #:ML-CMT-82

SIZE: 82" X 36.25" X 30.5"
APPROXIMATE WEIGHT:180 LBS
SCALE: 3/4"=1'0"

CREATION DATE: 2022-02-24
UPDATED: 3/13/2024

SHEET: 1/1



Monoline Standard Flat Bench

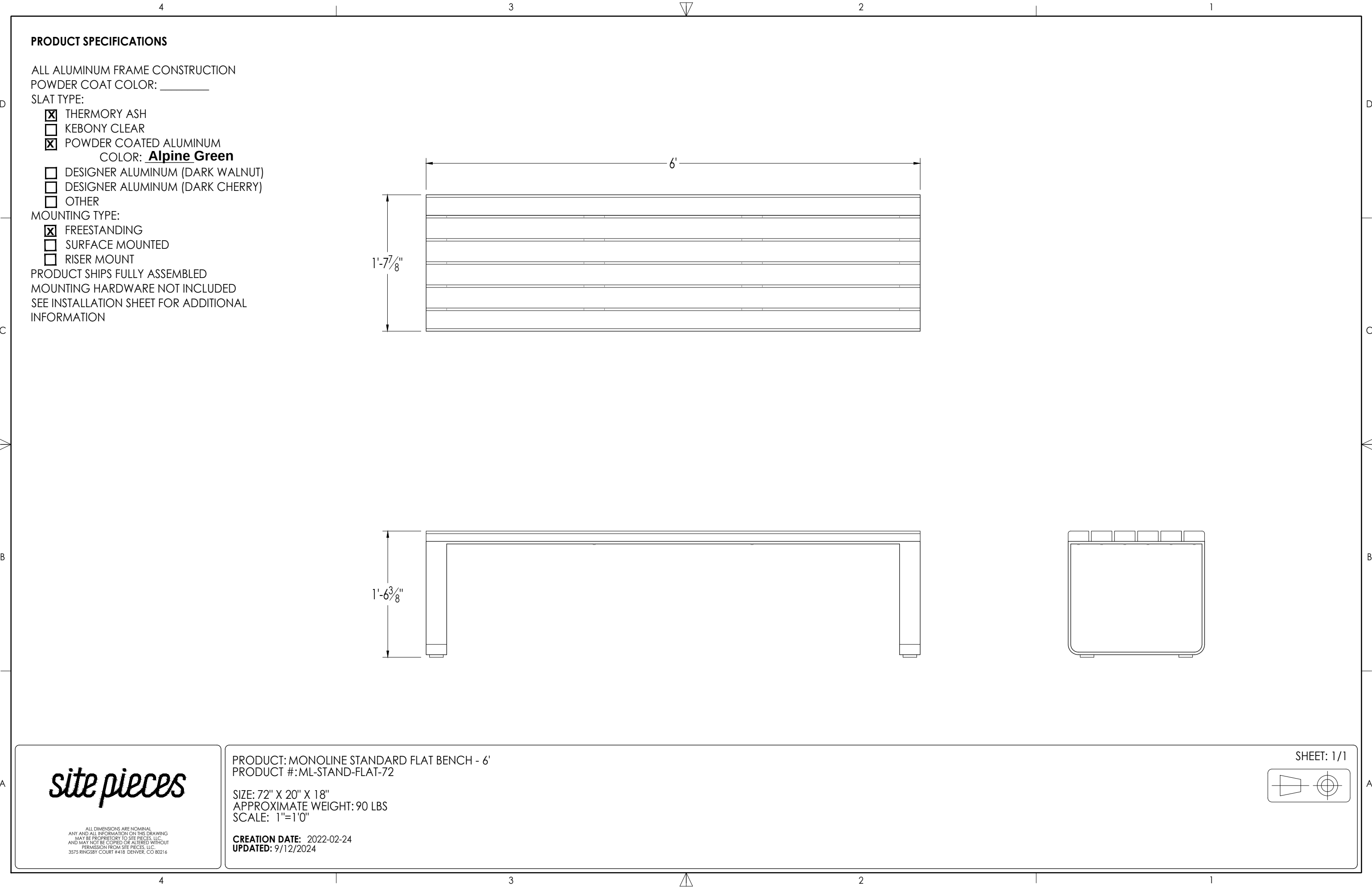


The Monoline Flat Bench is a straight-legged version of our Flat Bench. It shares the same generously dimensioned wood top and optional armrests that allows it to stand on its own while also pairing perfectly with our Standard Community Table or Backed Bench.

- wood slats: thermally modified ash or kebony clear
- aluminum slats: powder coated or designer aluminum
- all aluminum frame construction
- powder coated finish
- countersunk holes for surface mounting
- low friction glides for freestanding option
- available in custom sizes
- ships fully assembled

PRODUCT:	LENGTH:	WIDTH:	HEIGHT:
~~ML-STAND-FLAT-48~~	~~48"~~	~~20"~~	~~18"~~
ML-STAND-FLAT-72	72"	20"	18"
~~ML-STAND-FLAT-96~~	~~96"~~	~~20"~~	~~18"~~





PRODUCT SPECIFICATIONS

ALL ALUMINUM FRAME CONSTRUCTION

POWDER COAT COLOR: _____

SLAT TYPE:

☒ THERMORY ASH

☐ KEBONY CLEAR

☒ POWDER COATED ALUMINUM

COLOR: **Alpine Green**

☐ DESIGNER ALUMINUM (DARK WALNUT)

☐ DESIGNER ALUMINUM (DARK CHERRY)

☐ OTHER

MOUNTING TYPE:

☒ FREESTANDING

☐ SURFACE MOUNTED

☐ RISER MOUNT

PRODUCT SHIPS FULLY ASSEMBLED

MOUNTING HARDWARE NOT INCLUDED

SEE INSTALLATION SHEET FOR ADDITIONAL

INFORMATION

site pieces

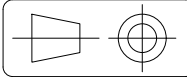
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3575 RINGSBY COURT #418 DENVER, CO 80216

PRODUCT: MONOLINE STANDARD FLAT BENCH - 6'
PRODUCT #: ML-STAND-FLAT-72

SIZE: 72" X 20" X 18"
APPROXIMATE WEIGHT: 90 LBS
SCALE: 1"=1'0"

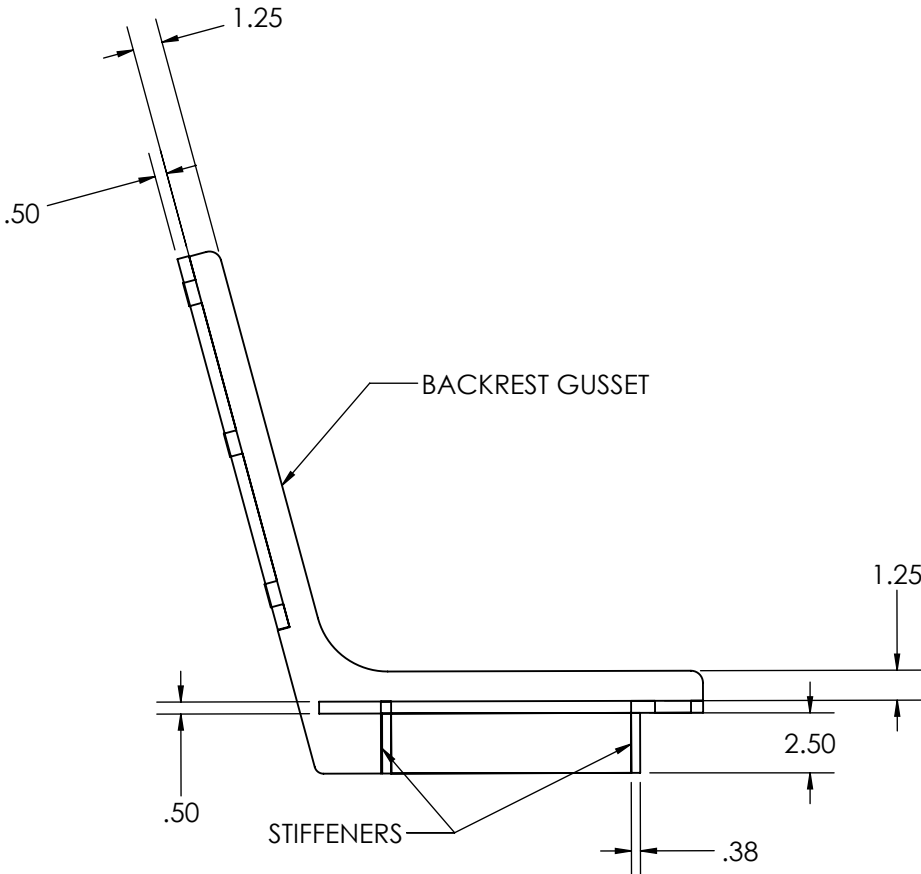
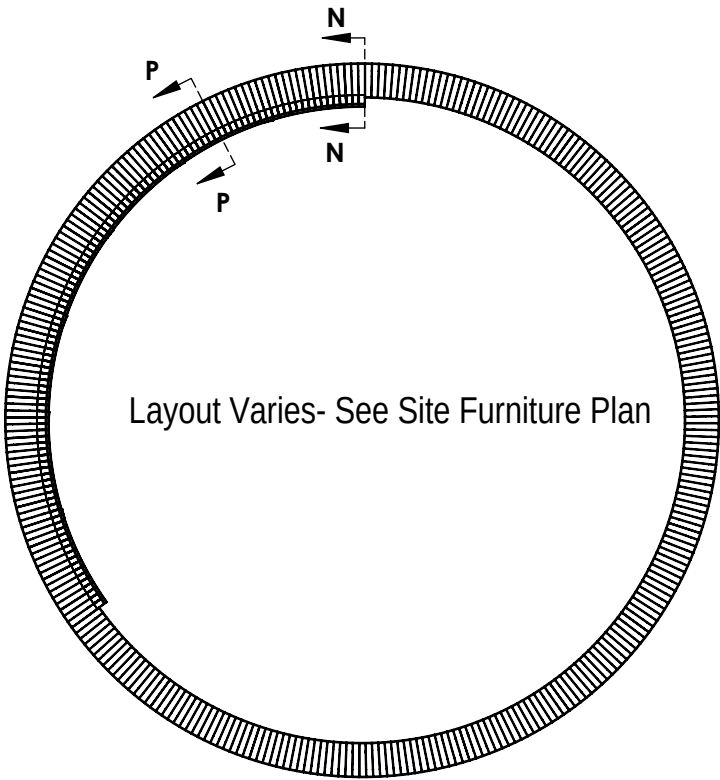
CREATION DATE: 2022-02-24
UPDATED: 9/12/2024

SHEET: 1/1

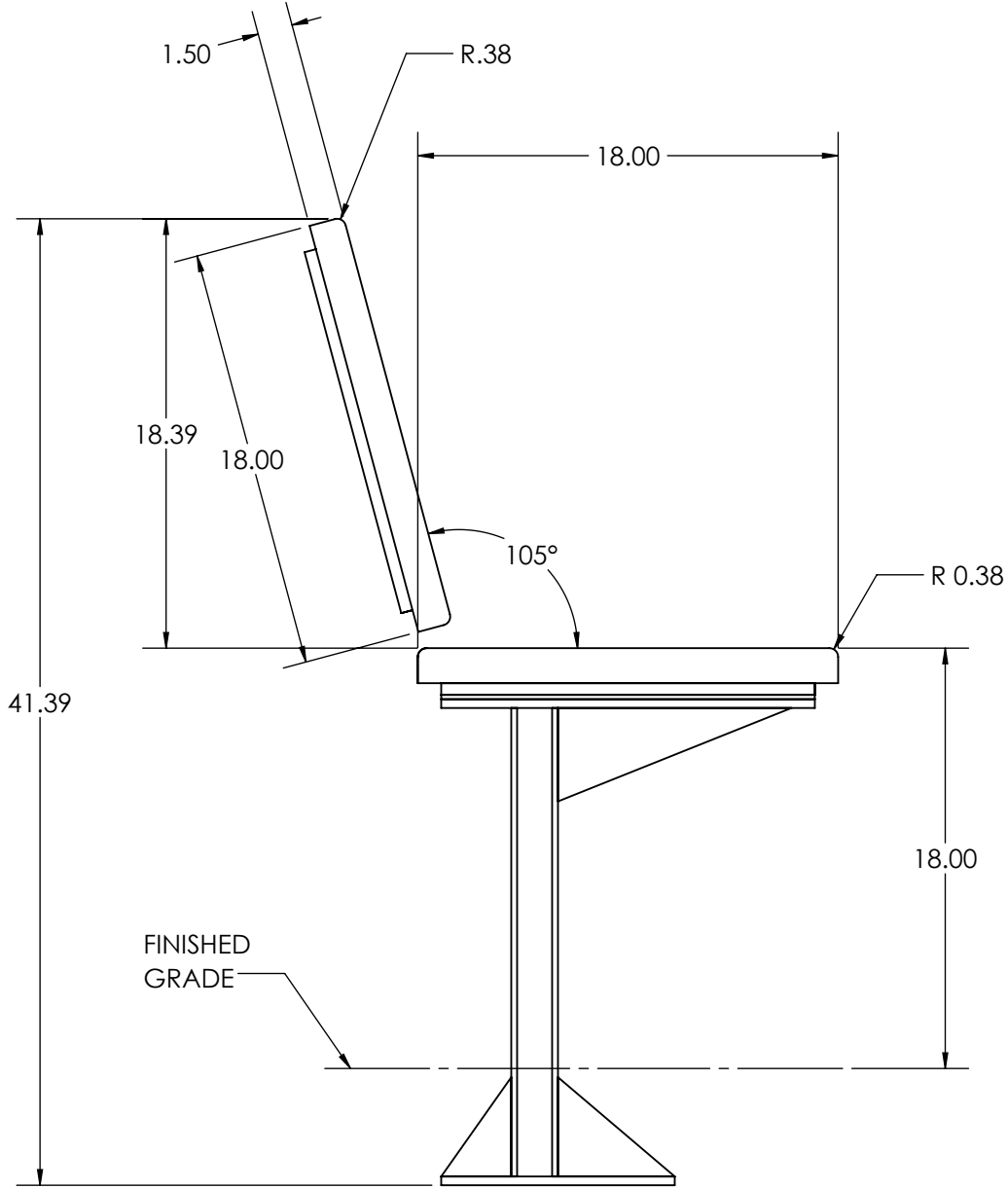


NOTES:

ALUMINUM FRAME CONSTRUCTION SEAT AND BACK
GALVANIZED STEEL LEG ASSEMBLY
POWDER COAT COLOR: Alpine Green
SLAT TYPE: Thermory Ash
SLAT FINISH: Cutek extreme- Walnut colortone
FABRICATED IN MODULAR SECTIONS
MOUNTING TYPE: Embedded/ Footing
ALL STAINLESS STEEL HARDWARE, NO VISIBLE WOOD SCREWS

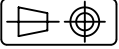


SECTION P-P
SCALE 1 : 8



SECTION N-N
SCALE 1 : 8

REV.	DESCRIPTION	REV BY	APPROVED	DATE
REVISIONS				

MATERIAL: Thermory Ash				
FINISH	Alpine Green		DESCRIPTION: Curved pedestal-mount bench with back	
DRAWN BY	CAD	2022-06-24		
 DO NOT SCALE DRAWING			PART #	
ALL DIMINTIONS IN INCHES TOLERANCES: FRACTIONAL: ±1/16 ANGULAR: ±1° DECIMAL: ± .06			REV	
SIZE			B	EST. WEIGHT: LBS
			SHEET 2 OF 8	

site pieces

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Monoline Backed Bench

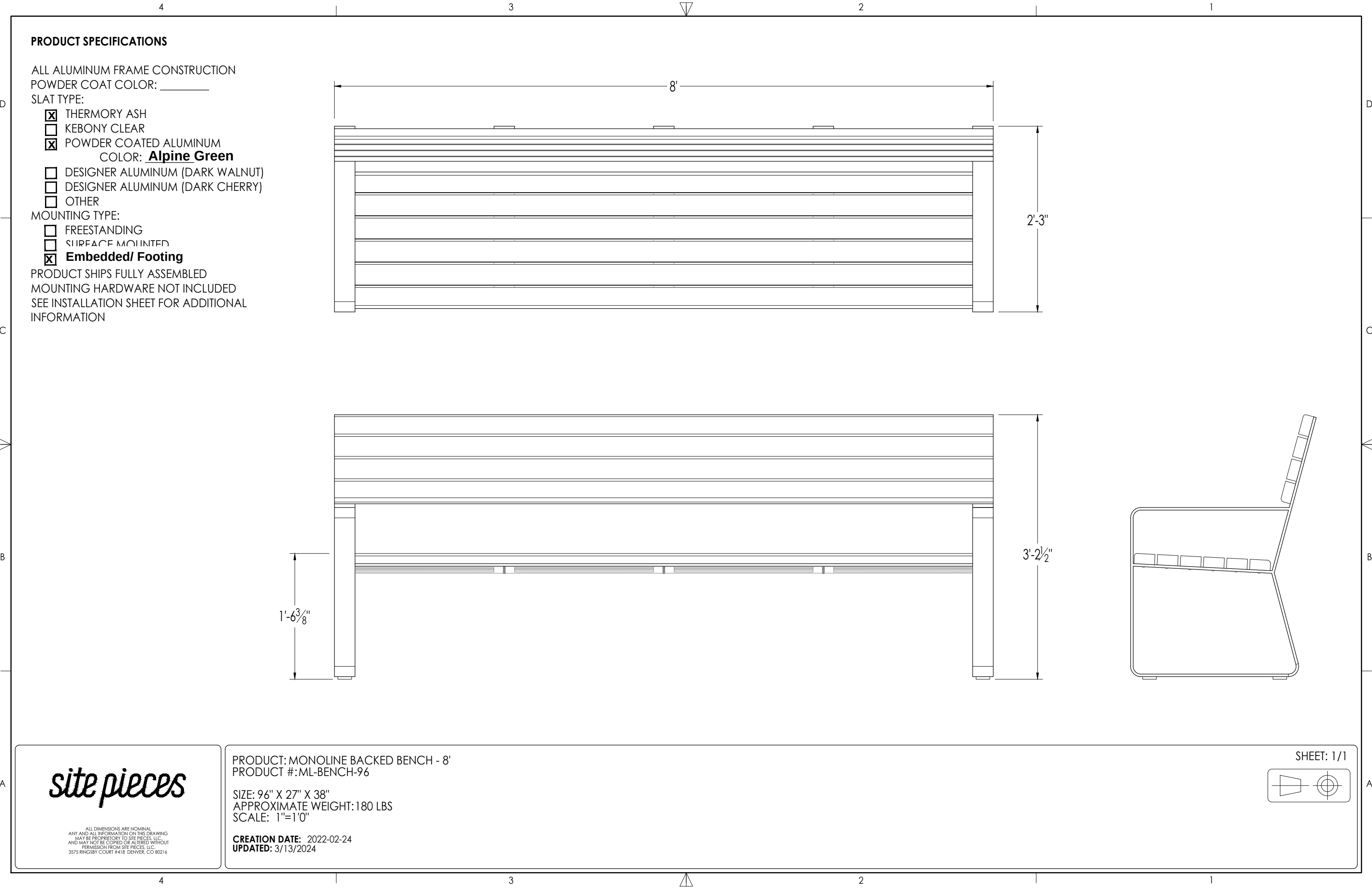


The Monoline Backed Bench is simple, the way things should be. Its lightness, comfort, and restrained lines allow the materials to shine - a perfect match for any space.

- wood slats: thermally modified ash or kebony clear
- aluminum slats: powder coated or designer aluminum
- all aluminum frame construction
- powder coated finish
- surface mounting required
- available in custom sizes
- ships fully assembled

PRODUCT:	LENGTH:	WIDTH:	HEIGHT:
~~ML-BENCH-48~~	~~48"~~	~~27"~~	~~38.5"~~
~~ML-BENCH-72~~	~~72"~~	~~27"~~	~~38.5"~~
ML-BENCH-96	96"	27"	38.5"





site pieces

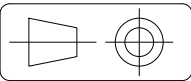
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 3575 RINGSBY COURT #418 DENVER, CO 80216

PRODUCT: MONOLINE BACKED BENCH - 8'
 PRODUCT #:ML-BENCH-96

SIZE: 96" X 27" X 38"
 APPROXIMATE WEIGHT:180 LBS
 SCALE: 1"=1'0"

CREATION DATE: 2022-02-24
 UPDATED: 3/13/2024

SHEET: 1/1



Americana

landscapeforms

Product Data Sheet

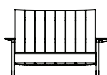


Americana is the reimagination of the classic Adirondack chair—a timeless icon of outdoor enjoyment. Offered in both single and double lounges, Americana modernizes the classic design language, and uses high-performance materials to make a bold visual statement while ensuring the chairs stand the test of time in public spaces. Americana utilizes UV-resistant post-consumer recycled plastic (HDPE) polymer for the seat and back, providing a long, vibrant and low-maintenance life. The rust-proof, commercial grade cast and extruded aluminum supports and understructure are finished with Landscape Forms’ proprietary Pangard II® powdercoating to resist fading and chipping. Accessories for Americana include a hanger underneath the arm for secure bag or purse storage and an optional tablet arm, providing a wider surface for food and beverages or to serve as a functional work surface.

Lounge Chair

- Americana is available in both a single and double lounge chair option.
- Americana is an adirondack lounge chair constructed of cast and extruded aluminum and high density polyethylene (HDPE).
- Americana is available with accessories – a tablet arm and bag hanger. The Single Lounge Chair has a single bag hanger, and the Double Lounge Chair will always have two bag hangers.
- The tablet arm (right or left) provides additional workspace or a wider surface to place food or beverages. For the Single Lounge Chair, the bag hanger is on the right side of the lounge, unless there is a tablet arm, in that case the bag hanger is attached underneath the non tablet arm. For the Double Lounge Chair, there is one bag hanger on each side regardless of tablet arm placement.
- The bag hangers are attached underneath the arm and available for stowing bags and purses.
- The chair glides are made of tough nylon to resist damage from dragging on rough surfaces.
- Americana is available freestanding or surface mount.

Americana	Style	Depth	Width	Height	Weight
	Single Lounge Chair	37.5"	33.5"	39.25"	70 lbs
	Double Lounge Chair	37.5"	56"	39.25"	108 lbs

Accessories	Style	Depth	Width	Height	Weight
	Single Lounge Chair – tablet arm, right	37.5"	37"	39.25"	72 lbs
	Single Lounge Chair – tablet arm, left	37.5"	37"	39.25"	72 lbs
	Double Lounge Chair – tablet arm, right	37.5"	59.5"	39.25"	111 lbs
	Double Lounge Chair – tablet arm, left	37.5"	59.5"	39.25"	111 lbs
	Double Lounge Chair – both tablet arms	37.5"	63"	39.25"	114 lbs

Americana

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Product Data Sheet



Finishes

- All metal components are finished with Landscape Forms' proprietary Pangard II® polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling and fading.
- The lounge seat, back and arms material is made of Loll Designs' recycled high-density polyethylene (HDPE) sourced primarily from milk jugs. Please note that when the Americana product is placed in FULL direct sun, testing has demonstrated that the following Loll HDPE colors have exhibited NO significant change of color over time: Black, Charcoal Grey, and Navy Blue. Testing has also indicated that the following HDPE colors have shown INCREASED change of color over time: Apple Red, Sunset Orange, and Leaf Green. Please note that the changing of color of the HDPE can occur at a different rate than the changing of color of the powdercoated aluminum.
- Available in six standard colors: black, charcoal grey, apple red, leaf green, sunset orange, and navy blue.
- Call for standard color chart.

To Specify

- Specify Americana, single or double lounge, freestanding or surface mount, powdercoat and HDPE colors, and select accessories: tablet arm - left or right for Single Lounge Chair, and tablet arm - left, right, or both for Double Lounge Chair. Americana ships fully assembled.

Designed by Loll Designs

U.S. Patent No. Pending

Visit landscapeforms.com for more information. Specifications are subject to change without notice. Landscape Forms supports the Landscape Architecture Foundation at the Second Century level.
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Kalamazoo, Michigan 49048
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specify@landscapeforms.com

Americana Lounge Chair Product Guide Specification

SECTION 12 93 43 SITE SEATING AND TABLES SECTION 12 93 43.13 BENCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Lounge chair.

1.2 REFERENCES

- A. ASTM Testing Standards:
 - 1. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - 3. ASTM D 523 – Standard Test Method for Specular Gloss.
 - 4. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - 5. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 6. ASTM D 3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
 - 7. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
 - 8. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
- B. ISO Testing Standards:
 - 1. ISO 1520 – Paints and Varnishes – Cupping Test.
 - 2. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.
- B. Product Support: Products are supported with complete engineering drawings and design patents.
- C. Base Worth: An installed base of products worth in excess of one hundred million dollars.

- D. Assets: Excess of twenty million dollars in assets.
- E. Production: Orders are filled within a 40-day schedule.
- F. Facility Operator: Welders and machine operators are certified.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

1.6 **WARRANTY**

- A. Warranty Information:
 - Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
 - The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.
 - Landscape Forms, Inc. shall, at its option, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized Landscape Forms service representative.
 - Purchasers should be aware that normal use of these high quality products can result in superficial damage affecting the finish. Scratches, nicks, and dents are to be considered normal wear and tear, and are not the responsibility of the manufacturer.

PART 2 PRODUCTS

2.1 **MANUFACTURER**

- A. Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048.
Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

2.2 **CHAIR**

- A. Americana:
- B. Style: Lounge chair
 - 1. Size:
 - a. Single
 - b. Double
 - 2. Tablet arm
 - a. no tablet arm
 - 3. Mounting:
 - a. Freestanding

2.4 **MATERIALS**

- A. Seat and back boards, arm: 100% recycled high-density polyethylene (HDPE) with UV stabilizer and embedded pigmentation. Brass inserts in panels accept Magni-coated carbon steel bolts for attaching to frame.
- B. Bench seat and tabletop support frame:
 - 1. Single: arm supports on frame are 1.5" x 1.5" x .125" wall aluminum extrusions. Back legs and front legs are 1.5" x 5" x .125" wall aluminum extrusions. Leg corner joint is an aluminum casting. Arm tab is an aluminum casting. Glide mounting block is an aluminum casting. All components are welded together and welds ground smooth.

2. Double: arm support is an aluminum casting. Back legs and front legs are 1.5" x 5" x .125" wall aluminum extrusions, welded together. Glide mounting block is an aluminum casting, welded to leg extrusions. All components are bolted together.
- C. Back bracing: cast aluminum cross braces bolt to seat back with Magni-coated button head screws.
- D. Bag hangers and inside brackets: Formed 1/8" thick A1008 CR type B or A1011 HRP&O type B carbon steel sheet, bolted to seat with Magni-coated screws.
- E. Glides: Supertough nylon 6/6, attached to legs with Magni-coated screws.
- F. Surface mount tabs: 3/16" thick 6061 aluminum plate.

2.5 **RECYCLED CONTENT** Units are 100% recyclable.

	Post-Consumer Content	Pre-Consumer Content
Americana Single lounge, no tablet arm	6%	18%
Americana Single lounge, with tablet arm	6%	18%
Americana Double lounge, no tablet arm	7%	21%
Americana Double lounge, with tablet arm	6%	21%

2.6 **FINISHES**

Specifier Notes: Delete all that do not apply.

- A. Finish on metal: Landscape Forms, Inc. "Pangard II".
 1. Primer: Rust inhibitor.
 2. Topcoat: Thermosetting polyester powdercoat. UV, chip, and flake resistant.
 3. Test Results: "Pangard II".
 - a. Gloss, Garner 60 Degrees, ASTM D 523: Plus or minus 5.
 - b. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - c. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - d. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.
 - e. Erichsen Cupping, ISO 1520: 8 mm.
 - f. Impression Hardness, Buchholz, ISO 2815: 95.
 - g. Impact Test, ASTM D 2794: 60 inches/pound at 2.5 mils.
 - h. Pencil Hardness, ASTM D 3363: 2H minimum.
 - i. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max undercutting 1 mm.
 - j. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max blisters 1 mm.
 4. Support Frame Color: DUSK

- B. Seat color: CHARCOAL GRAY

PART 3 EXECUTION

3.1 **EXAMINATION**

- A. Examine areas to receive units.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 **INSTALLATION**

- A. Install unit in accordance with manufacturer's instructions at locations indicated on the Drawings.

- B. Install unit plumb and level.

3.3 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Clean unit promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed unit to ensure that, except for normal weathering, products will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

Harvest

landscapeforms

Product Data Sheet



Including rectangular tables in standing and dining heights, round tables in standing and dining heights, a round casual height table, and a round side table, the Harvest line welcomes the full range of postures and use cases. For the rectangular tables, an optional LED light spanning the center sets the mood with warm, gentle illumination. For the round casual height table, an optional fire pit insert creates a signature outdoor experience. Benches and stools in standing and dining height round out the Harvest line. Harvest's durable, post-consumer recycled HDPE plastic surface requires low-to-no maintenance. The line's vibrant colors are blended into the plastic, not surface applied, and a UV-resistant compound is added to the pigment to ensure longevity. The metal structure and legs are finished in Pangard II® HAPS, VOC, and lead-free polyester powdercoat that resists fading and chipping.

Harvest Rectangular, Round and Side Tables

- Harvest table options include a round side table, round casual height table, round dining and standing height table, and rectangular dining and standing height table.
- Harvest rectangular tables are constructed of extruded aluminum legs bolted to steel table top supports, with a high-density polyethylene (HDPE) table top.
- Harvest round casual, round dining, and round standing height tables are constructed of extruded aluminum legs bolted to aluminum table top supports, with a high-density polyethylene (HDPE) table top.
- The rectangular dining height table is ADA compliant.
- Table leg glides are made of tough nylon to resist damage from dragging on rough surfaces.
- Harvest tables are available freestanding or surface mounted (must be surface mounted when used with an umbrella).
- Round dining height table will have six bag hangers, and the round standing height table will have three bag hangers for stowing bags and purses.
- Optional umbrella hole available on the rectangular dining height table, rectangular standing height table, round casual height table, round dining height table, and round standing height table.

Harvest Fire Pit Table

- Harvest fire pit table is constructed of extruded aluminum legs bolted to aluminum table top supports and high-density polyethylene (HDPE) with a burner constructed of brass and mounted to an aluminum pan and surrounded with an aluminum wind deflector.
- Fire pit table is a round casual height table, available with a match-lit or electronic ignition.
- Electronic ignition allows for use of an on/off switch, emergency stop and dial timer.
- The table is available in propane or natural gas. It is not intended for use with portable propane tanks.
- Burner output is 120K BTU (electronic ignition), 65K BTU (match lit ignition).
- A key valve and cover is included.
- Rolled lava rock is included.
- Fire pit table must be anchored.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier

Rectangular Table	Style	Depth	Length	Height	Weight
	Dining Height	47.5"	94.75"	30.25"	260 lbs
	Standing Height	36.75"	94.75"	40"	230 lbs

Round Table	Style	Diameter	Height	Weight
	Casual Height	62"	21.5"	147 lbs
	Dining Height	62"	30"	153 lbs
	Standing Height	47.25"	40"	104 lbs

Side Table	Style	Diameter	Height	Weight
	Side Table	40"	15"	49 lbs

Fire Pit Table	Style	Diameter	Height	Weight
	Fire Table	62"	21.5"	157 lbs

Harvest

landscapeforms

Product Data Sheet



Finishes

- All metal components are finished with Landscape Forms' proprietary Pangard II® polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling and fading.
- Table tops and seating surface material are made of Loll Designs' recycled high-density polyethylene (HDPE) sourced primarily from milk jugs. Please note that when the Harvest product is placed in FULL direct sun, testing has demonstrated that the following Loll HDPE colors have exhibited NO significant change of color over time: Black, Charcoal Grey, and Navy Blue. Testing has also indicated that the following HDPE colors have shown INCREASED change of color over time: Apple Red, Sunset Orange, and Leaf Green. Please note that the changing of color of the HDPE can occur at a different rate than the changing of color of the powdercoated aluminum.
- Available in six standard colors: black, charcoal grey, apple red, leaf green, sunset orange, and navy blue.
- Call for standard color chart.

To Specify

- Specify Harvest rectangular table and table style (dining height or standing height). Choose powdercoat color, HDPE color, and mounting (freestanding or surface mount). Select optional umbrella hole (if selected, tables must be surface mounted). Choose optional luminaire (6" or 14.25"). Rectangular tables ship knocked-down.
- Specify Harvest round table and table style (casual height, dining height, or standing height). Choose powdercoat color, HDPE color, and mounting (freestanding or surface mount). Select optional umbrella hole (if selected, tables must be surface mounted). Round tables ship fully assembled.
- Specify Harvest side table and choose powdercoat and HDPE color. Select mounting (freestanding or surface mount). Side table ships fully assembled.
- Specify Harvest fire pit table. Select powdercoat color and HDPE color. Table comes standard surface mounted. Table ships assembled but the fire pit insert ships separately and requires installation.
- Specify Harvest bench, length (46" or 94") and style (dining height or standing height). Select powdercoat color, HDPE color, and choose mounting freestanding or surface mounted. Benches do not ship fully assembled.
- Specify Harvest stool and style (dining or standing height). Select powdercoat color, HDPE color and choose mounting (freestanding or surface mounted). Stools ship fully assembled.

Designed by Loll Designs

[Click here](#) for patent information related to this product.

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Harvest Side Table Product Guide Specification

SECTION 12 93 43 SITE SEATING AND TABLES SECTION 12 93 43.13 BENCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bench, Stool and Table.

1.2 REFERENCES

Specifier Notes: List standards referenced in this section, complete with designations and titles. Delete standards not included in the edited section. This article does not require compliance with standards, but is merely a listing of those used.

A. ASTM Testing Standards:

1. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
3. ASTM D 523 – Standard Test Method for Specular Gloss.
4. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
5. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
6. ASTM D 3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
7. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
8. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

B. ISO Testing Standards:

1. ISO 1520 – Paints and Varnishes – Cupping Test.
2. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.
- B. Product Support: Products are supported with complete engineering drawings and design patents.
- C. Base Worth: An installed base of products worth in excess of one hundred million dollars.
- D. Assets: Excess of twenty million dollars in assets.
- E. Production: Orders are filled within a 40-day schedule.
- F. Facility Operator: Welders and machine operators are certified.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

1.6 **WARRANTY**

- A. Warranty Information:
 - Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
 - The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.
 - Landscape Forms, Inc. shall, at its option, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized Landscape Forms service representative.
 - Purchasers should be aware that normal use of these high quality products can result in superficial damage affecting the finish. Scratches, nicks, and dents are to be considered normal wear and tear, and are not the responsibility of the manufacturer.

PART 2 PRODUCTS

2.1 **MANUFACTURER**

- A. Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048.
Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

2.2 **BENCH and TABLES**

- A. Harvest:
- B. Style:
 - 1. Side Table
 - a. 40in round side table, 15in height
 - 2. Mounting:
 - a. Freestanding

2.4 **MATERIALS**

- A. Bench seat, stool seat and tabletop: high-density polyethylene (HDPE) with UV stabilizer and embedded pigmentation. Aluminum inserts in panels accept Magni-coated carbon steel bolts for attaching to frame.
- B. Stool frame: legs are 1-3/4" x 3-1/2" aluminum extrusions, bolted to 10ga carbon steel plate. Cast aluminum cross brace bolts to legs.
- C. Bench seat and rectangular tabletop support: Formed 14 gauge A1008 CR type B or A1011 HRP&O type B carbon steel sheet, bolted to seat panels with Magni-coated screws.
- D. Bench and rectangular table frame: Legs and cross braces are formed from 6063-T52 aluminum tube. Cross braces bolt to legs with Magni-coated socket head cap screws.
- E. Side table frame: legs are 2" x 4" aluminum extrusions, bolted to 10ga carbon steel plate. Cross brace is 1-1/2" x 2" aluminum extrusion, bolted to legs.

- F. Round casual and dining table frame: legs are 2" x 6" aluminum extrusions, bolted to top frame. Cross brace is 1-1/2" x 4" aluminum extrusion, bolted to legs. Top frame is 1-1/2" x 2" aluminum extrusion, welded to 1-1/2" x 4" aluminum extrusions, bolted to 1/8" thick aluminum plate.
- G. Round standing table frame: legs are 2" x 6" aluminum extrusions, bolted to top frame. Cross brace is 1-1/2" x 4" aluminum extrusion, bolted to legs. Top frame is 1-1/2" x 2" aluminum extrusions, welded together. Cover for top frame is aluminum sheet.
- H. Glides: Supertough nylon 6/6, attached to legs with Magni-coated screws.
- I. Surface mount tabs: aluminum 6061 plate, 3/8" thick.
- J. Bag hanger: 1/8" thick carbon steel sheet, formed. Bolted to unit.
- Standing ht 46in bench: 2 bag hangers included
 - 62in round dining table, 30in height: 6 bag hangers included
 - 47in round standing table, 40in height: 3 bag hangers included
- K. Umbrella holder: Ø1.75" I.D. aluminum tube, with nylon push-in glide on the bottom. Umbrella secures to post with 1/4-20 screw and hex nut.
- L. Fire pit: Wind deflector is aluminum sheet, bolts to Ø24" aluminum burner pan with 3-3/8" sidewall. Burner pan bolts to aluminum sheet tray. Trim ring is aluminum sheet, with welded tabs for bolting to tray. Cover is HDPE. Brass burner system is preassembled and secured to pan. Includes key valve and rolled lava rock. Cover surround plates are aluminum sheet, includes mounting location for key valve.
- Electronic ignition: Input: 120VAC, 50/60Hz; 24VAC Class II 50-Watt transformer. Unit is provided with a 6' long outdoor-rated corded plug.
- M. Luminaire frame: 6061-T6 aluminum tube frame, bolted to table. Includes 16 gauge carbon steel driver tray and cord cover.
- N. Light Cartridge Assembly: IP68, LED, 3200K, 92 CRI, 417 total lumens, 10.5W power consumption. Light cartridge assembly is bonded to luminaire frame with glazing adhesive.
- O. Driver Circuitry:
- Driver mounting tray: formed carbon steel sheet; Tray is bolted to table frame.
 - Driver: Class 1 output; CE; IP66; Suitable for dry and damp locations; Input: 100-277VAC, 50/60Hz; Output: 18-36 VDC, 350mA max. Max 12.6 watts. Driver attached to plate with glazing adhesive.
 - Wiring: Cartridge is connected to driver via outdoor-rated cord with weatherproof connectors.
 - Supply wiring: Unit is provided with a 12' long outdoor-rated 16/3 corded plug.

2.5 RECYCLED CONTENT Units are 100% recyclable.

	Post-Consumer Content	Pre-Consumer Content
Harvest dining bench, 94in length	18%	22%
Harvest dining bench, 46in length	17%	19%
Harvest standing bench, 46in length	15%	17%
Harvest stool, dining ht	15%	21%
Harvest stool, standing ht	15%	19%
Harvest 40in round side table, 15in ht	16%	24%
Harvest 62in round casual table, 21in ht	4%	22%
Harvest 62in round dining table, 30in ht	4%	21%
Harvest 47in round standing table, 40in ht	6%	21%
Harvest 95in rectangular dining table	13%	21%
Harvest 95in rectangular standing table	16%	20%
Harvest luminaire	10%	5%

2.6 FINISHES

- A. Finish on metal: Landscape Forms, Inc. "Pangard II".
- Primer: Rust inhibitor.
 - Topcoat: Thermosetting polyester powdercoat. UV, chip, and flake resistant.

3. Test Results: "Pangard II".
 - a. Gloss, Garner 60 Degrees, ASTM D 523: Plus or minus 5.
 - b. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - c. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - d. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.
 - e. Erichsen Cupping, ISO 1520: 8 mm.
 - f. Impression Hardness, Buchholz, ISO 2815: 95.
 - g. Impact Test, ASTM D 2794: 60 inches/pound at 2.5 mils.
 - h. Pencil Hardness, ASTM D 3363: 2H minimum.
 - i. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max undercutting 1 mm.
 - j. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max blisters 1 mm.

4. Support Frame Color: DUSK

B. Seat color / top color: CHARCOAL GRAY

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive units.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install unit in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install unit plumb and level.

3.3 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Clean unit promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed unit to ensure that, except for normal weathering, products will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

Take-Out

landscapeforms®

Product Data Sheet



Designed by Rodrigo Torres, Take-Out brings modern refinement, simplified lines and unparalleled versatility to the connected seating category. Light enough to be picked up, arranged and rearranged, Take-Out opens up new ways for people to connect in outdoor spaces—face-to-face or abreast, an intimate chat or a large group gathering. Five different silhouettes can either stand alone or work together in myriad arrangements. Take-Out's design and component materials are simple, concise and intended to make a compelling visual statement with a strong value proposition.

Connected Seating

- Take-Out's minimalist form is designed to maximize its function, comfort and accessibility.
- Take-Out is a table with connected seating, available in five different silhouettes.
- Silhouette styles available include a single, double, triple, left triple, and right triple.
- It was designed with flexibility in mind, light enough to be picked up, arranged and rearranged.
- Square or rectangular table tops, and seats are made of powdercoated sheet steel.
- The support frame is comprised of powdercoated extruded aluminum.
- All styles come standard with two (2) bag hooks, each comprised of gray plastic.
- The Left Triple and Right Triple units are wheelchair accessible.
- Take-Out is available either freestanding or surface mounted.
- Supports are fitted with nylon glides for enhanced mobility and durability in rearranging freestanding units.
- Take-Out ships fully assembled.

Finishes

- All metal is finished with Landscape Forms' proprietary Pangard II® polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling, and fading.
- A wide range of standard, optional and custom colors are available.

To Specify

- Specify Take-Out connected seating and select style (single, double, triple, left triple, or right triple.). Choose powdercoat color and mounting option (freestanding or surface mount). All units come standard with two (2) bag hooks. Take-Out ships fully assembled.

Designed by Rodrigo Torres

U.S. Patent Pending

	Style	Depth	Length	Height	Product Weight
	Single	37.5"	30.25"	30"	72 lbs
	Double	37.5"	52.5"	30"	125 lbs
	Triple	37.5"	71.5"	30"	166 lbs
	Left Triple	37.5"	71.5"	30"	143 lbs
	Right Triple	37.5"	71.5"	30"	143 lbs

*Weights shown represent freestanding units

Visit landscapeforms.com for more information. Specifications are subject to change without notice. Landscape Forms supports the Landscape Architecture Foundation at the Second Century level.
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specify@landscapeforms.com

Take-Out Table Product Guide Specification

SECTION 12 93 43.53 SITE SEATING AND TABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tables.

1.2 REFERENCES

Specifier Notes: List standards referenced in this section, complete with designations and titles. Delete standards not included in the edited section. This article does not require compliance with standards, but is merely a listing of those used.

A. ASTM Testing Standards:

1. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
3. ASTM D 523 – Standard Test Method for Specular Gloss.
4. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
5. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
6. ASTM D 3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
7. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
8. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

B. ISO Testing Standards:

1. ISO 1520 – Paints and Varnishes – Cupping Test.
2. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.
- B. Product Support: Products are supported with complete engineering drawings and design patents.
- C. Base Worth: An installed base of products worth in excess of one hundred million dollars.
- D. Assets: Excess of twenty million dollars in assets.
- E. Production: Orders are filled within a 40-day schedule.
- F. Facility Operator: Welders and machine operators are certified.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

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- A. Warranty Information:
 - Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
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PART 2 PRODUCTS

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Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

2.2 **TABLES**

- A. Take-Out Tables:
- B. Style:
 - 1. Double
 - 2. Left Triple
- C. Mounting option:
 - 1. Freestanding

2.4 **MATERIALS**

Specifier Notes: Delete all that do not apply.

- A. Table:
 - 1. Tabletop/Seat panel: 7 gauge (.18" thick) formed carbon steel sheet with stainless steel standoffs. Attaches to frame with button head cap screws, Magni-coated.
- B. Frame: welded assembly
 - 1. Tabletop/Seat panel brace: Aluminum extrusion, 2" x 6" rectangular tubing.
 - 2. Vertical legs: Aluminum extrusions, 1" x 6" rectangular tubing.
 - 3. Horizontal bracing: Aluminum extrusion, 1" x 3" rectangular tubing
- C. Glides: gray Nylon.

- D. Bag hook: gray Nylon
- E. Optional surface mount tabs: aluminum sheet, 3/16" thick. Anchoring hardware not included.

2.5 **RECYCLED CONTENT** All units are 100% recyclable

	Post Consumer Content	Pre-consumer Content
Single unit	42%	25%
Double unit	45%	26%
Triple unit	47%	27%

2.6 **FINISHES**

- A. Finish on metal: Landscape Forms, Inc. "Pangard II".
 - 1. Primer: Rust inhibitor.
 - 2. Topcoat: Thermosetting polyester powdercoat. UV, chip, and flake resistant.
 - 3. Test Results: "Pangard II".
 - a. Gloss, Garner 60 Degrees, ASTM D 523: Plus or minus 5.
 - b. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - c. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - d. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.
 - e. Erichsen Cupping, ISO 1520: 8 mm.
 - f. Impression Hardness, Buchholz, ISO 2815: 95.
 - g. Impact Test, ASTM D 2794: 60 inches/pound at 2.5 mils.
 - h. Pencil Hardness, ASTM D 3363: 2H minimum.
 - i. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max undercutting 1 mm.
 - j. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max blisters 1 mm.
 - 4. Frame Color: LEMON
 - 5. Seat and Table Top Color: LEMON

PART 3 EXECUTION

3.1 **EXAMINATION**

- A. Examine areas to receive tables.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 **INSTALLATION**

- A. Install tables in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install tables plumb and level.

3.3 **ADJUSTING**

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 **CLEANING**

- A. Clean tables promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed tables to ensure that, except for normal weathering, tables will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

Monoline Duo Bike Rack



The Duo Bike Rack, with its mirrored forms, provides designers the opportunity to mix things up and create their own sequence of bike racks or use them as a pedestrian barrier to busy streets.

- all aluminum frame construction
- powder coated finish
- surface mount + in-ground mount options
- countersunk holes for surface mounting
- two-bike capacity

PRODUCT:	BASE LENGTH:	WIDTH:	HEIGHT:
ML-DUO26	26"	3"	36"
ML-DUO18	18"	3"	36"

NOTE: please add "-IG" at the end of product number to specify the in-ground mount option



PRODUCT SPECIFICATIONS

ALL ALUMINUM FRAME CONSTRUCTION
POWDER COAT COLOR: **Alpine Green**

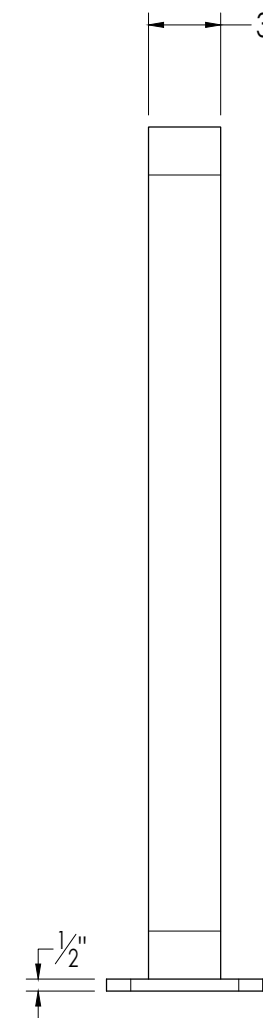
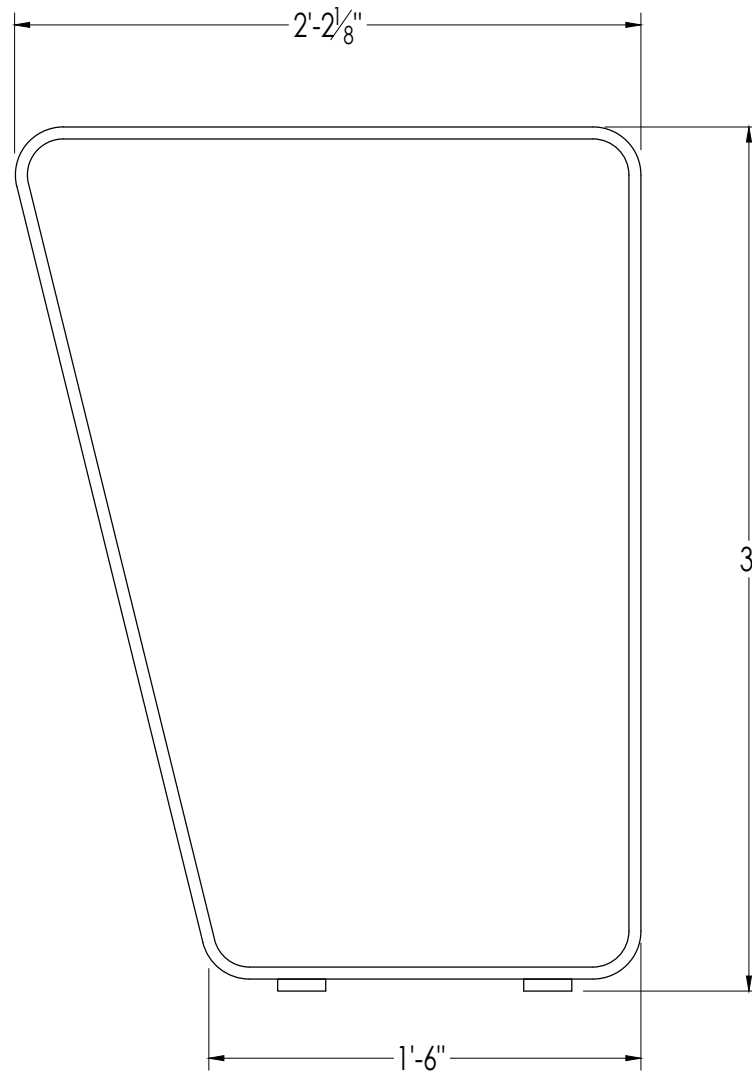
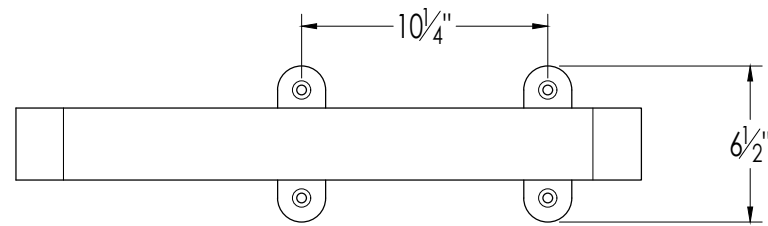
MOUNTING TYPE:

- ☒ SURFACE MOUNTED
☐ RISER MOUNT
☐ EMBEDDED

PRODUCT SHIPS FULLY ASSEMBLED

MOUNTING HARDWARE NOT INCLUDED

SEE INSTALLATION SHEET FOR ADDITIONAL
INFORMATION



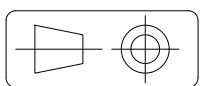
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3575 RINGSBY COURT #418 DENVER, CO 80216

PRODUCT: MONOLINE DUO BIKE RACK - 18" BASE
PRODUCT #: ML-DUO-18

SIZE: 36" X 26" X 3"
APPROXIMATE WEIGHT: 10 LBS
SCALE: 1-1/2"=1'0"

CREATION DATE: 2022-02-24
UPDATED: 3/13/2024

SHEET: 1/1



JESSIE

Product Data Sheet



The Jessie rail is a stand-up performer. With the 3" top it is the perfect leaning rail at transit stops. With the 12" top it becomes a convenient café or bar counter. Standing alone, it stakes out space. With mesh infill, it provides separation and enclosure for restaurants with sidewalk seating.

Railing

- Basic rail configuration is an 8 foot unit as shown in graphic.
- Any number of rail segments can be ordered in 4' units to make an indefinite length of rail.
- Extrusion end pieces with cast aluminum end caps are 5" long.
- Rail is 42" high with 8" of supports embedded or surface mounted.

Railing System Components

- Listed below are the minimum amount of components needed for a basic configuration, see coded illustrations for reference.

A x2 Rail top aluminum extrusion

B x3 Cast aluminum splice lock

C x2 Rail top end aluminum extrusion

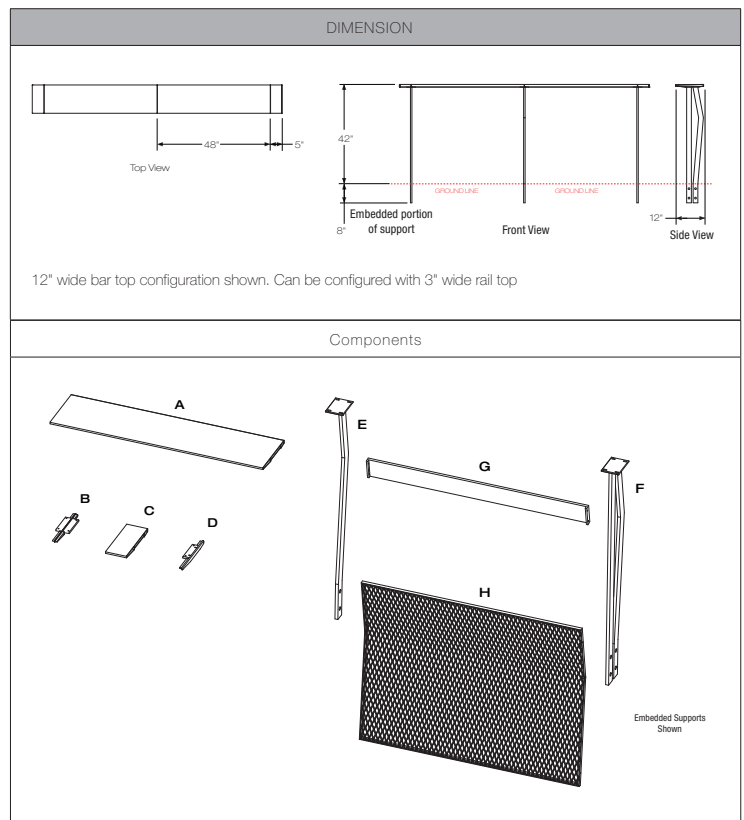
D x1 Cast aluminum right and left hand end caps

E x1 Inside steel support

F x2 Outside steel right and or left hand end support depending on infill specification

G x2 Back rest (optional)

H x2 Mesh infill (optional)



JESSIE

Product Data Sheet



Configuration Options

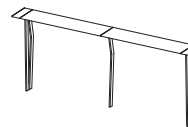
Railing System with 12" wide bar top

- The Jessie railing system with 12" wide top consists of 4-foot long units having a 12" wide aluminum extrusion top supported by double legs at the ends and a single leg in the center.
- The rail can be surface mounted or embedded.
- A minimum length of two units are required, after which single 4-foot expansion units can be added to achieve virtually any length.
- Typical applications include; defining the edges of spaces intended for gathering, socializing or waiting; and, when used with the Bernie bar stool, creating counters for outdoor restaurants or cafés.

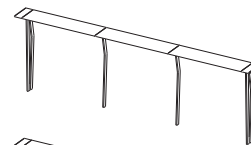
Railing System with 3" wide rail top

- Construction and materials are the same as the railing system with 12" bar top, except the end legs are single rather than double.
- The many applications for the system with 3" rail top include defining safe play areas, creating safety barriers between pedestrian walkways and busy streets, and providing leaning surfaces for passengers waiting at bus stops and train stations.

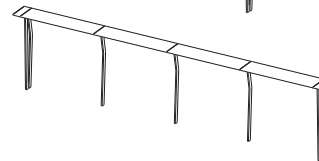
CONFIGURATION OPTIONS



Railing system with no infills can be configured to create a bar height surface of indefinite length. The railing system can be used to create and define spaces as well as delineate boundaries.



Bar top, Open, Center Expansion Unit, embedded

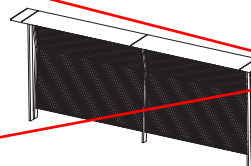


Bar top, Open, 2 Expansion Units, embedded

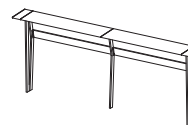
Options

- Mesh infill to create a barrier and privacy surround.
- Back rest to create a leaning surface for the back when used with a planter with a seating insert.
- The graphics on page 2 show some sample configurations.

OPTIONS



Mesh infills can be added to the rail to create screening and further define space and boundaries. Mesh also helps define the rail as a bar height seating area when paired with the bar stool.



Back rest can be added to the rail so that 18" tall planters with seating inserts can be positioned on the outside of the rail to create an additional seating system.

JESSIE

Product Data Sheet



Materials

- Steel supports.
- Aluminum extrusions with cast aluminum splice locks and end caps.

Installation

- Rail can be embedded or surface mounted.

To Specify

- Specify rail or bar top.
- Specify infill selection.
- Specify mounting option.
- Specify number of expansion units.
- Select powdercoat color for rail supports, infill selection, and top color.

Designed by Gustafson Guthrie Nichol, Ltd

Jessie design is protected by U.S. Patent Nos. D685,922; D692,580.

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Jessie Rail Product Guide Specification

SECTION 12 93 00 Site Furnishings RAIL SYSTEM SECTION 05 52 00 Metal Railings RAIL SYSTEM

Specifier Notes: This section covers Landscape Forms, Inc. "Jessie" rail system. Consult Landscape Forms, Inc. for assistance in editing this section for the specific application.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rail System.

1.2 REFERENCES

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 7. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
 8. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
- B. ISO Testing Standards:
1. ISO 1520 – Paints and Varnishes – Cupping Test.
 2. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
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- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.4 **QUALITY ASSURANCE**

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- B. Product Support: Products are supported with complete engineering drawings and design patents.
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E-mail: specify@landscapeforms.com

2.2 **BENCHES**

- A. "Jessie" Rail System
 - 1. Style:
 - a. Basic unit - 106" length: Quantity: 1
 - b. Expansion unit - 48" length: Quantity: 4
 - 2. Top of rail:
 - A. Bar top
 - 3. Infill option:
 - b. Backrest
 - 4. Mounting:
 - b. Embedded

2.3 **MATERIALS**

- A. Support post: Carbon steel plate, 5/8" thick. Top mounting plate is 1/4" thick carbon steel sheet, welded to support post.

- B. Splice lock: Type 319 or 356 ASTM B 26 aluminum casting.
- C. Hardware: Carbon steel Magni-coated screws.
- D. Bar top: Constructed of 6061 aluminum extrusion. Intermediate sections and end caps are 1" x 12".
- E. Cover plate: Type 319 or 356 ASTM B 26 aluminum casting. Cover plate consists of two halves, bolted together with carbon steel Magni-coated screws.
- F. Backrest infill: Aluminum 6061-T6 flat bar, 4-1/2" wide x 1/2" thick

2.4 ACCESSORIES

2.5 RECYCLED CONTENT all units are 100% recyclable

	Post-Consumer Content	Pre-Consumer Content
Bar Top Basic unit Surf Mt Open	43%	38%
Bar Top Basic unit Surf Mt Mesh Infill	47%	36%
Bar Top Basic unit Surf Mt Backrest	45%	37%
Rail Top Basic unit Embed Open	52%	35%
Rail Top Basic unit Embed Mesh Infill	55%	34%
Rail Top Basic unit Embed Backrest	54%	34%

2.6 FABRICATION

- A. Assembly: Shop assembled rails.

2.7 FINISHES

- A. Finish on Metal: Landscape Forms, Inc. "Pangard II".
 - 1. Primer: Rust inhibitor
 - 2. Topcoat: Thermosetting TGIC polyester powder coat. UV, chip, and flake resistant.
 - 3. Test Results: "Pangard II".
 - a. Gloss Consistency, Gardner 60 Degrees, ASTM D 523: Plus or minus 5 percent from standard.
 - b. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - c. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - d. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.
 - e. Erichsen Cupping, ISO 1520: 8 mm.
 - f. Impression Hardness, Buchholz, ISO 2815: 95.
 - g. Impact Test, ASTM D 2794: 60 inch-pounds at 2.5 mils.
 - h. Pencil Hardness, ASTM D 3363: 2H minimum.
 - i. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max. undercutting 1 mm.
 - j. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max. blisters 1 mm.
- 1. Support Color: DUSK
- 2. Top Color: DUSK
- 3. Backrest Color): DUSK

PART 3 EXECUTION

3.1 EXAMINATION

- A. Site Examinations: Examine areas to receive rails.
 - 1. Verify that substrates are stable and capable of supporting the weight of items covered under this section.

2. Verify that substrates have been adequately prepared to securely anchor those items that will be surface mounted.
3. Notify Architect of conditions that would adversely affect installation or subsequent use.
4. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install rails in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install rails level.

3.3 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Clean rails promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed rails to ensure that, except for normal weathering, rails will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

Chipman

landscapeforms®

Product Data Sheet



Chair

- The frame of Chipman is formed of aluminum castings welded together to make the final form.
- Powdercoated seating is offered armless, or with arms, is lightweight and nests.
- Bumper/glides are made of tough nylon to resist damage from dragging on rough surfaces.

Stool

- The frame of Chipman is formed of aluminum castings welded together to make the final form.
- Powdercoated seating is offered armless, is lightweight and nests.
- Bumper/glides are made of tough nylon to resist damage from dragging on rough surfaces.

Finishes

- All metal is finished with Landscape Forms' proprietary Pangard II® polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling and fading.
- Call for standard color chart.

To Specify

Table

- Select table size, shape, height, and powdercoat color. Specify surface mount or freestanding. Select with or without umbrella hole for dining table only. If specified with umbrella, table must be surface mounted.

Chair

- Select chair with arms, or armless, and powdercoat color.

Stool

- Select powdercoat color.

Designed by Robert Chipman

Chipman is protected by U.S. Patent No. D694,543; D69,544; D746,074; D718,558

Chair	Style	Depth	Width	Height	Product Weight
	Armless	22"	20"	33"	17 Lb
	Arms	22"	24"	33"	20 Lb

Stool	Style	Depth	Width	Height	Product Weight
	Stool	19"	22"	35"	18 Lb

Visit landscapeforms.com for more information. Specifications are subject to change without notice. Landscape Forms supports the Landscape Architecture Foundation at the Second Century level.
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Kalamazoo, Michigan 49048
Phone: (800) 521-2546
Fax: (269) 381-3455
www.landscapeforms.com
specify@landscapeforms.com

**Chipman Stool
Product Guide Specification**

SECTION 12 93 43.13 SITE SEATING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Stools.

1.2 REFERENCES

A. ASTM Testing Standards:

1. ASTM B 108 – Standard Specification for Aluminum-Alloy Permanent Mold Castings.
2. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
3. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
4. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
5. ASTM D 523 – Standard Test Method for Specular Gloss.
6. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
7. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
8. ASTM D 3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
9. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
10. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

B. ISO Testing Standards:

1. ISO 1520 – Paints and Varnishes – Cupping Test.
2. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.
- B. Product Support: Products are supported with complete engineering drawings and design patents.
- C. Base Worth: An installed base of products worth in excess of one hundred million dollars.

- D. Assets: Excess of twenty million dollars in assets.
- E. Production: Orders are filled within a 40-day schedule.
- F. Facility Operator: Welders and machine operators are certified.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

1.6 **WARRANTY**

- A. Warranty Information:
 - Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
 - The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.
 - Landscape Forms, Inc. shall, at its option, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized Landscape Forms service representative.
 - Purchasers should be aware that normal use of these high quality products can result in superficial damage affecting the finish. Scratches, nicks, and dents are to be considered normal wear and tear, and are not the responsibility of the manufacturer.

PART 2 PRODUCTS

2.1 **MANUFACTURER**

- A. Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048.
Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

2.2 **SITE SEATING**

- A. "Chipman" Stool
 1. Bar height

2.3 **MATERIAL**

- A. Stool body: A356 or A360 cast aluminum.
- B. Glides and Stacking Bumpers: gray plastic 6/6 nylon

2.4 **RECYCLED CONTENT**

	Post-Consumer Content	Pre-Consumer Content	Recyclable
Stool	0.0%	70%	100%

2.5 **FINISHES**

- A. Finish on Metal: Landscape Forms, Inc. "Pangard II".
 1. Primer: Rust inhibitor.
 2. Topcoat: Thermosetting polyester powdercoat. UV, chip, and flake resistant.
 3. Test Results: "Pangard II".
 - a. Gloss Consistency, Gardner 60 Degrees, ASTM D 523: Plus or minus 5 percent from standard.
 - b. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - c. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - d. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.

- e. Erichsen Cupping, ISO 1520: 8 mm.
- f. Impression Hardness, Buchholz, ISO 2815: 95.
- g. Impact Test, ASTM D 2794: 60 inch-pounds at 2.5 mils.
- h. Pencil Hardness, ASTM D 3363: 2H minimum.
- i. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max undercutting 1 mm.
- j. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max blisters 1 mm.

- 1. Color: LEMON

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive stools.
- B. Notify Architect of conditions that would adversely affect placement or subsequent use.
- C. Do not begin placement until unacceptable conditions are corrected.

3.2 PLACEMENT

- A. Place stools at locations indicated on the Drawings.

3.3 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Clean stools promptly after placement in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect placed stools to ensure that, except for normal weathering, they will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

Chase Park

landscapeforms®

Product Data Sheet



Litter Receptacles

- Receptacle features a hinged side panel door for easy emptying.
- Constructed of cast aluminum sides and door, with spun aluminum top and polyethylene base filled with concrete.
- Door hinge and latch are carbon steel with a Magni-coat.
- Top and side-opening receptacle can be freestanding or surface mounted.
- Logo band available with both top opening and side-opening styles.
- Sand pan optional with side opening unit.
- Capacity of the top-opening receptacle is 40 gallons, for side-opening, 36 gallons.
- An optional keyed lock may be specified.
- Custom fit polyethylene liner in black, standard with all receptacles.
- Chase Park also available in a Dual-use, side opening receptacle and a single-use, top opening receptacle.
- Recycling litter available with 5", or 10" diameter top openings to collect recyclable material.
- Labels with recycle symbol and specified recyclable material printed on high performance, exterior grade UV protected vinyl, mounted securely to each unit.
- For more information on signage options, visit landscapeforms.com

Finishes

- All metal is finished with Landscape Forms' proprietary Pangard II® polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling, and fading.
- Call for standard color chart.

To Specify

- Choose signage and keyed doorlock options.
- Specify powdercoat color.
- A wide array of optional colors may be specified for an upcharge

	Style	Diameter	Height	Product Weight
	Top-Opening	24"	39"	166 lbs
	Side-Opening	24"	39"	162 lbs
	Top-Opening with logo band	24"	39"	175 lbs
	10" Top-Opening with signage	24"	39"	167 lbs
	Side-Opening Dual-use unit	24"	39"	163 lbs
	Side-Opening Dual-use with logo band unit	24"	39"	172 lbs

Designed by Kipp Stewart

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Chase Park Receptacle Product Guide Specification

SECTION 12 93 23 TRASH AND LITTER RECEPTORS

Specifier Notes: This section covers Landscape Forms, Inc. "Chase Park®" litter receptacles. Consult Landscape Forms, Inc. for assistance in editing this section for the specific application.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Litter receptacles.

1.2 REFERENCES

A. ASTM Testing Standards:

1. ASTM A 536 – Standard Specification for Ductile Iron Castings.
2. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
3. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
4. ASTM D 523 – Standard Test Method for Specular Gloss.
5. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
6. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
7. ASTM D 3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
8. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
9. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

B. ISO Testing Standards:

1. ISO 1520 – Paints and Varnishes – Cupping Test.
2. ISO 2815 – Paints and Varnishes – Buchholz Indentation Test.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.
- B. Product Support: Products are supported with complete engineering drawings and design patents.
- C. Base Worth: An installed base of products worth in excess of one hundred million dollars.
- D. Assets: Excess of twenty million dollars in assets.
- E. Production: Orders are filled within a 40-day schedule.
- F. Facility Operator: Welders and machine operators are certified.

1.5 **DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

1.6 **WARRANTY**

- A. Warranty Information:
 - Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
 - The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.
 - Landscape Forms, Inc. shall, at its option, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized Landscape Forms service representative.
 - Purchasers should be aware that normal use of these high quality products can result in superficial damage affecting the finish. Scratches, nicks, and dents are to be considered normal wear and tear, and are not the responsibility of the manufacturer.

PART 2 PRODUCTS

2.1 **MANUFACTURER**

- A. Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048.
Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

2.2 **TRASH AND LITTER RECEPTORS**

- A. "Chase Park" Litter Receptacles
- B. Style:
 - 1. Side-Opening Style
 - 2. Recycling Receptacle:
 - a. Side opening, SINGLE USE
- C. Mounting:
 - 1. Free standing
- D. Signage:
 - 1. For side-opening single use recycling litter:
 - a. 12-Recyclable Material Only

2.3 **MATERIALS**

- A. Base: Rotationally molded linear low density polyethylene. Color is dark gray. Base is filled with concrete for stability.

- B. Sides and Door: Cast 319 aluminum.
- C. Hinges: Two, carbon steel with silver Magni-coat, connects sides and door.
- D. Latch: carbon steel with silver Magni-coat
- F. Lid: 0.100-inch thickness, spun 1100-0 aluminum.
- G. Lid Bracket: 1-inch by 1-inch by 1/4-inch aluminum angle.
- H. Liners: Black, formed polyethylene.
 - 1. Single liner, side opening litter, 36 gallon capacity
- I. Fasteners: Stainless steel.
- J. Logo Band: 3-inch wide by 3/8-inch thick, 6061 aluminum extrusion welded to back panel and door.
- K. Logo Band Decal: 2-1/2-inch tall by 20-inch long, exterior-grade vinyl.
- L. Recycling sign backer plates: Two 8-inch wide by 6-inch tall by 1/8-inch thick, 3003 or 5052 aluminum plates welded to back panel and door.
- M. Recycling sign decals: Two 5-inch tall by 7-inch long, exterior-grade vinyl.
- N. Lid divider: 1/8" thick aluminum sheet, welded to lid. Side opening dual use recycling units only.

2.4 **ACCESSORIES**

2.5 **RECYCLED CONTENT**

- Post-Consumer Material Content: Minimum 10 percent.
- Pre-Consumer Material Content: Minimum 48 percent.
- Recyclable: 100 percent.

2.6 **FABRICATION**

- A. Shop assembled litter receptacles.

2.7 **FINISHES**

- A. Finish on Metal: Landscape Forms, Inc. "Pangard II".
 - 1. Primer: Rust inhibitor.
 - 2. Topcoat: Thermosetting polyester powdercoat. UV, chip, and flake resistant.
 - 3. Test Results: "Pangard II".
 - a. Gloss Consistency, Gardner 60 Degrees, ASTM D 523: Plus or minus 5 percent from standard.
 - b. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - c. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - d. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.
 - e. Erichsen Cupping, ISO 1520: 8 mm.
 - f. Impression Hardness, Buchholz, ISO 2815: 95.
 - g. Impact Test, ASTM D 2794: 60 inch-pounds at 2.5 mils.
 - h. Pencil Hardness, ASTM D 3363: 2H minimum.
 - i. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max undercutting 1 mm.
 - j. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max blisters 1 mm.

Specifier Notes: Specify color of metal finish. Consult Landscape Forms, Inc. for selection of standard colors and availability of custom colors.

- 4. Color: MATTE BLACK

PART 3 EXECUTION

3.1 **EXAMINATION**

- A. Examine areas to receive litter receptacles.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install litter receptacles in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install litter receptacles level and plumb.
- C. Anchor litter receptacles securely in place, if required.

3.3 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Clean litter receptacles promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed litter receptacles to ensure that, except for normal weathering, receptacles will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

OUTDOOR POWER

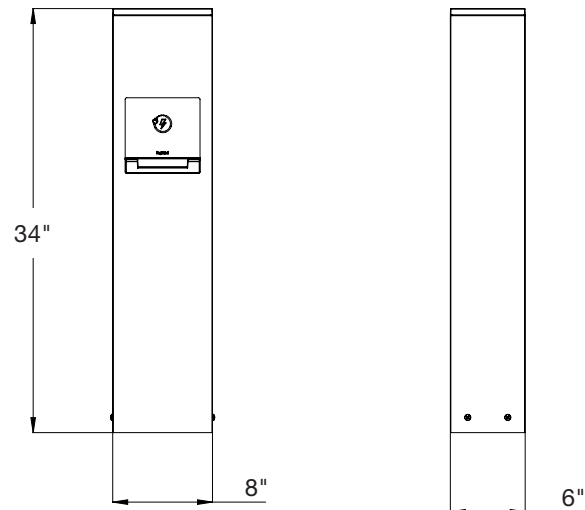
Product Data Sheet



Outdoor Power by Legrand is a family of mobile device charging stations that enable people to plug in and re-charge in the outdoor environments where they live, learn, work, care, play and travel. Outdoor Power supports connectivity with three models: a 49" high Charging Station with LED Area Light; a 46.5" high Charging Station with Accent Light; and a 34" high Power Pedestal. All provide access to power in various configurations of GFCI and/or USB outlets. An unwired option is also available for both 2-gang and 3-gang units, which makes the unit ready for dedicated low voltage applications where power is not required. The unwired 3-gang unit can accommodate the accessory A/V-Communication Kit so customers can install both power and low voltage in one unit. Other available accessories include a transparent door, color-matched doors with locks, and side-mounted shelves for holding phones and other small devices while they are charging. All three models are offered in black, bronze and silver standard finishes and all are NEMA-3R-rated for use in all weather conditions. Outdoor Charging Stations provide access to permanent, reliable, grid-based power. They are well-designed solution that smartly integrate with Landscape Forms site furniture and take power to places it's never been before.

Power Pedestal

- Station features rugged aluminum construction.
- NEMA 3R listed for use in outdoor locations.
- Aluminum body is 0.188" (4.78mm) thick and powder-coated with durable, outdoor-rated paint. Mounts into concrete with four L bolts.
- Available prewired with two or three devices, per chart below. Devices include weather-resistant 20A GFCIs and 4-port USB outlets.
- Also available unwired in two- or three-gang versions. Unwired versions can be populated with any combination of weather-resistant GFCI receptacles and USB outlets.
- Includes color-matched door, which can be easily replaced by a color-matched locking door or a transparent door.
- Interior illuminates when door is open. Door closes automatically to meet while-in-use requirements.
- A/V and communication devices can be added to unwired three-gang versions with addition of A/V-Communication Kit. Kit includes two replacement device plates to accommodate:
 - two decorator-style power devices and one decorator style A/V or communication device.
 - two decorator-style power devices and four Wiremold AVIP device plates.
- Use unwired two- or three-gang pedestal versions for dedicated low voltage applications where power is not required – no A/V-Communication kit needed.
- Product weight: 26.2 lbs



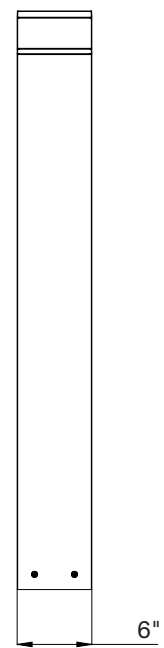
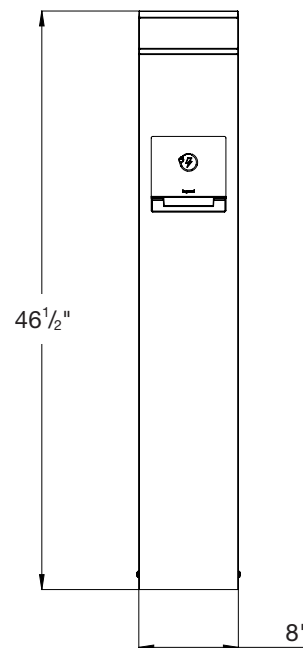
OUTDOOR POWER

Product Data Sheet



Charging Station with Accent Light

- Station features rugged aluminum construction and includes an accent LED light (7W, 4000K) for easy identification at night.
- NEMA 3R listed for use in outdoor locations.
- Aluminum body is 0.188" (4.78mm) thick and powder-coated with durable, outdoor-rated paint. Mounts into concrete with four L bolts.
- Available prewired with two or three devices, per chart below. Devices include weather-resistant 20A GFCIs and 4-port USB outlets.
- Power and lighting are prewired on separate circuits. Lighting circuit can be controlled by a timer at the panel if desired.
- Also available unwired in two- or three-gang versions. Unwired versions can be populated with any combination of weather-resistant GFCI receptacles and USB outlets.
- Includes color-matched door, which can be easily replaced by a color-matched locking door or a transparent door.
- Interior illuminates when door is open. Door closes automatically to meet while-in-use requirements.
- A/V and communication devices can be added to unwired three-gang versions with addition of A/V-Communication Kit. Kit includes two replacement device plates to accommodate:
 - two decorator-style power devices and one decorator style A/V or communication device,
 - two decorator-style power devices and four Wiremold AVIP device plates.
- Use unwired two- or three-gang pedestal versions for dedicated low voltage applications where power is not required – no A/V-Communication Kit needed.
- Product weight: 33.5 lbs



OUTDOOR POWER

Product Data Sheet



To Order

Specify: Product, Model, Power Module and Color.

Product	Model	Power Module		Color
		~~2UW (2-gang, Unwired)~~	~~~~	
		~~2U (2-gang, 2 4-port USB Outlets)~~	~~~~	
	~~PP (Power Pedestal)~~	~~2G (2-gang, 2 Duplex GFCI Receptacles)~~	~~~~	LBLK (L-Black)
BM Outdoor Power	CSA (Charging Station with Accent Light)	1G1U (2-gang, 1 Duplex GFCI Receptacle & 1 4-Port USB Outlet)		~~LBZ (L-Bronze)~~
	~~CSL (Charging Station with Area Light)~~	~~3UW (3-gang, Unwired)~~	~~~~	~~LSIL (L-Silver)~~
		~~1G2U (3-gang, 1 Duplex GFCI Receptacle & 2 4-Port USB Outlets)~~	~~~~	
		~~2G1U (3-gang, 2 Duplex GFCI Receptacles & 1 4-Port USB Outlet)~~	~~~~	

EXAMPLE: BM – CSL – 2G1U – LSIL

Accessories

Product	Model	Color
	~~RDR (Replacement Door)~~	~~LBLK (L-Black)~~
	~~LDR (Locking Door)~~	~~LBZ* (L-Bronze)~~
	~~DSF (Device Shelf Kit)~~	~~LSIL (L-Silver)~~
BM Outdoor Power	TDR (Transparent Door)	No Color Choices
	AVM (A/V-Communication Kit)	

EXAMPLE: BM – RDR – LBLK

*Not available for Device Shelf Kit

OUTDOOR POWER

Product Data Sheet



Finishes

- Aluminum bodies are powder-coated with durable, outdoor-rated paint.
- Available in three standard colors: L-Black, L-Bronze, and L-Silver

Other

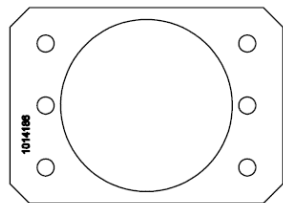
- Outdoor Charging Stations are UL listed to meet NEMA 3R requirements for use in outdoor locations
- Outdoor Charging Stations comply with ADA guidelines.



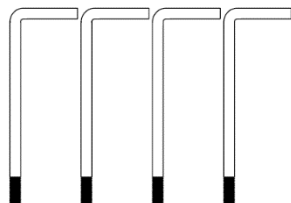
Designed by Legrand

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Included components



Template



4X – 3/8-16 L-bolt



8X – 3/8-16
Hex Nuts



8X – 3/8-16
Flat Washers

ASSEMBLE WITH CARE! To protect this finish during assembly, place unwrapped powdercoated parts on packaging foam or other non-marring surface. Do not place or slide powdercoated parts on concrete or other hard or textured surface – this will damage the finish causing rust to occur. Use touch-up paint on any gouges in the finish caused by assembly tools.

Landscape Forms is not responsible for site preparation and footings.

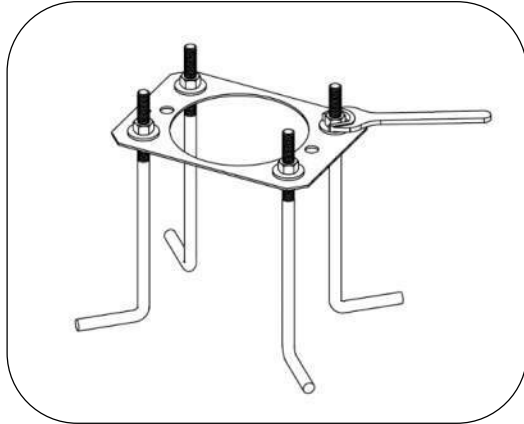
IMPORTANT! Please read all instructions before beginning installation.

Legrand Electrical systems conform to and should be properly grounded in compliance with requirements of the current National Electrical Code or codes administered by local authorities.

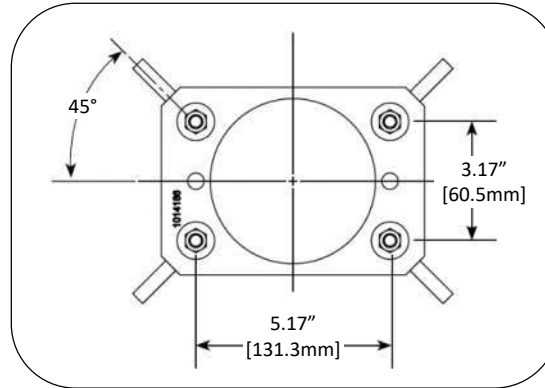
All electrical products may present a possible shock or fire hazard if improperly installed or used. Legrand electrical products may bear the mark of a nationally Recognized Testing Laboratory and should be installed in conformance with current local and/or the National Electrical Code.

Tools Required

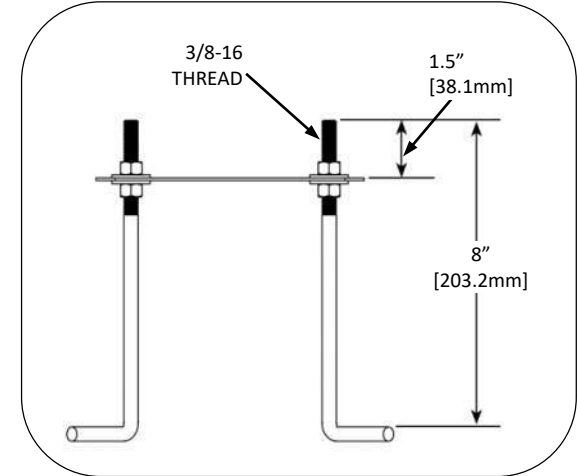
- Safety glasses
- Wrenches, 1/2", 9/16"
- Level



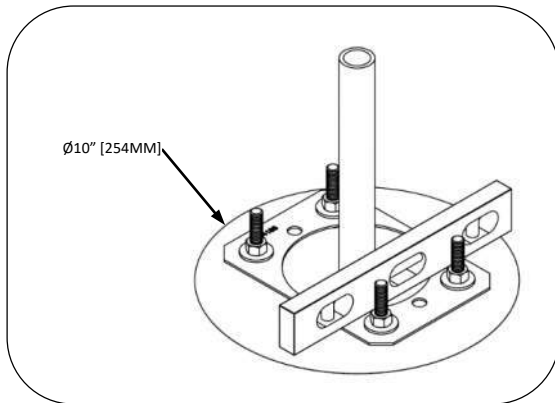
Step 1 – Secure L bolts to template



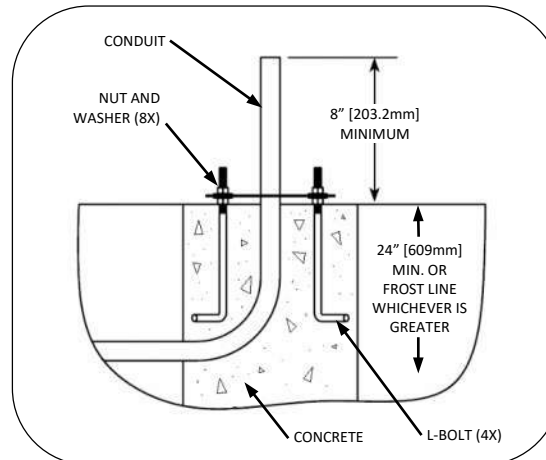
Step 1a – L bolt orientation on template



Step 1b – L bolt placement with nuts and washers



Step 2 – Sink and level template in concrete up to nuts on bottom side of template. Conduit needs to extend out of concrete at least 8" (203mm).



Step 2a – Side elevation of installed template with bolts, nuts and washers.

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Kalamazoo, Michigan 49048
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Fax: (269) 381-3455
www.landscapeforms.com
specify@landscapeforms.com

**Outdoor charging stations
Product Guide Specification**

**SECTION 16492 Outdoor charging stations
SECTION 26 56 33 Walkway Lighting**

PART 1 GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. The General Conditions, Supplementary Conditions, and Division 1 – General Requirements apply.

1.2 SECTION INCLUDES

- A. Outdoor charging stations with accent light

1.3 RELATED SECTIONS

- A. Division 26 - Electrical: Electrical systems and components, Sections 260100 - 262913

1.4 SUBMITTALS

- A. Submit under provisions of Related Sections in Division 26 Electrical
- B. Product Data: Submit for [charging stations] and components.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of charging stations, power pedestals, and components of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years. Provide charging stations, power pedestals, and components produced by a manufacturer listed in this section.
- B. Charging Stations, Power Pedestals, and Components: Comply with requirements of applicable local codes, NEC, UL, and NEMA Standards pertaining to charging stations, power pedestals, and components. UL listed to meet NEMA 3R requirements for use in outdoor locations. cULus listed per File No. E479489 in compliance with UL Standard 1773.
- C. Charging stations and power pedestals comply with ADA requirements

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver charging stations and associated components in factory labeled packages.
- B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- C. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 **WARRANTY**

- A. **Warranty Information:** Legrand Wiremold warrants, to the original purchaser or owner only, that the Products are substantially free of defects in material and workmanship under normal use and service, for a period of one year from the date of original installation or two years from the date of purchase, whichever is sooner. This limited warranty applies only to Products that have been installed properly in accordance with installation instructions supplied by Wiremold and any applicable codes and standards.

This limited warranty is void and Wiremold shall not be liable for any damages or held responsible for the quality, performance or safety of Products that have been repaired, altered or tampered with outside of Wiremold facilities or that have been intermixed (used within a system) with products or materials not approved by Wiremold, or that have been subjected to accident, negligence, misuse or abuse.

Wiremold's sole obligation (and the sole and exclusive remedy of the purchaser or owner of the Product) with respect to any Products that are shown to be defective shall be the repair or replacement of the defective Products, at the sole option of Wiremold. Returned Products will not be accepted unless Wiremold is notified and authorizes the return prior to shipment.

THE WARRANTIES LISTED ABOVE ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY; INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, ALL OF WHICH ARE HEREBY WAIVED BY DISTRIBUTOR AND DISCLAIMED BY WIREMOLD.

PART 2 PRODUCTS

2.1 **MANUFACTURER**

- A. Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048.
Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

2.2 **MATERIALS**

- A. **Top Cap and Pedestal Body:** 0.188-inch thick aluminum extrusion
- B. **Pedestal Base:** Steel base with 4-1/4-inch [108mm] opening and four (4) 3/8-inch [9.5mm] diameter "L" bolts, eight inches [203mm] long, zinc-plated steel.
- C. **Shelves:** 0.25-inch thick aluminum coated with outdoor-rated PlastiKote coating.
- D. **Optional Transparent Door:** Polycarbonate; UL F1 rated to ensure UV resistance.
- E. **Lenses:** Polycarbonate; UL F1 rated to ensure UV resistance.
- F. **Paint:** Outdoor-rated powder coat.

2.3 **OUTDOOR CHARGING STATIONS WITH ACCENT LIGHT**

- A. Outdoor charging stations prewired with [two] [three] devices and a 7W, 4000k LED accent light for easy identification at night. Power and lighting are prewired on separate circuits. Lighting circuit can be controlled by a timer at the panel if desired. Can also be supplied unwired in two- and three-gang versions. Requires two inputs: 120v for receptacles and 120-277v line input for the accent light.

Supplied with color-matched door that can be easily replaced by a color-matched locking door or a transparent door.

Interior illuminates when door is open. Door closes automatically to meet while-in-use requirements.

- B. Two-Gang Outdoor Charging Station with Accent Light: LF Catalog No. BM-CSA-1G1U- LBLK with one (1) 20A weather-resistant GFCI and one (1) 4-port 4.2A USB outlet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions under which charging stations and components are to be installed. Notify the [Construction Manager] in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Examine roughing-in for [charging stations] and conduit to verify actual locations of installation.

3.2 INSTALLATION

- A. Strictly comply with manufacturer's installation instructions and recommendations and approved shop drawings. Coordinate [charging stations] [power pedestals] installation with adjacent work to ensure proper clearances and to prevent electrical hazards. Remove any burrs or sharp edges on material.
- B. Anchor Bolts: Install plumb using manufacturer-supplied template, uniformly spaced.
- C. Stub up conduit to a height of eight (8) inches for standard power installations. If using the A/V kit, run the conduit up to bottom of power module/door.

3.3 CLEANING AND PROTECTION

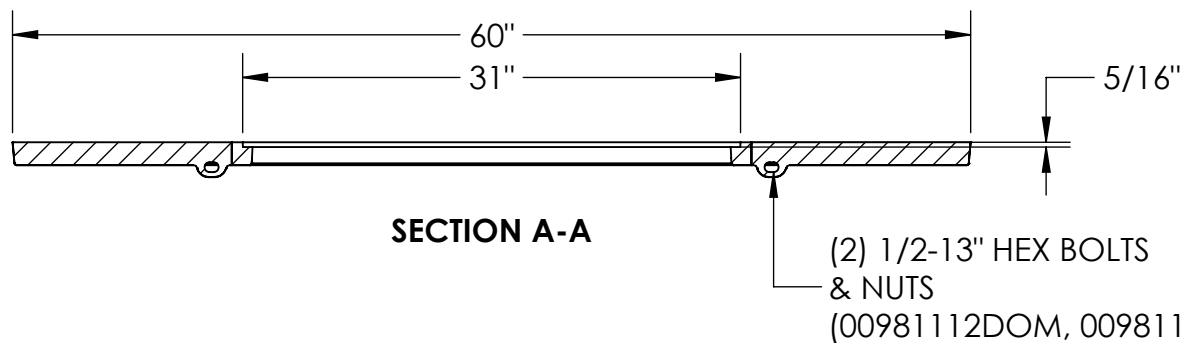
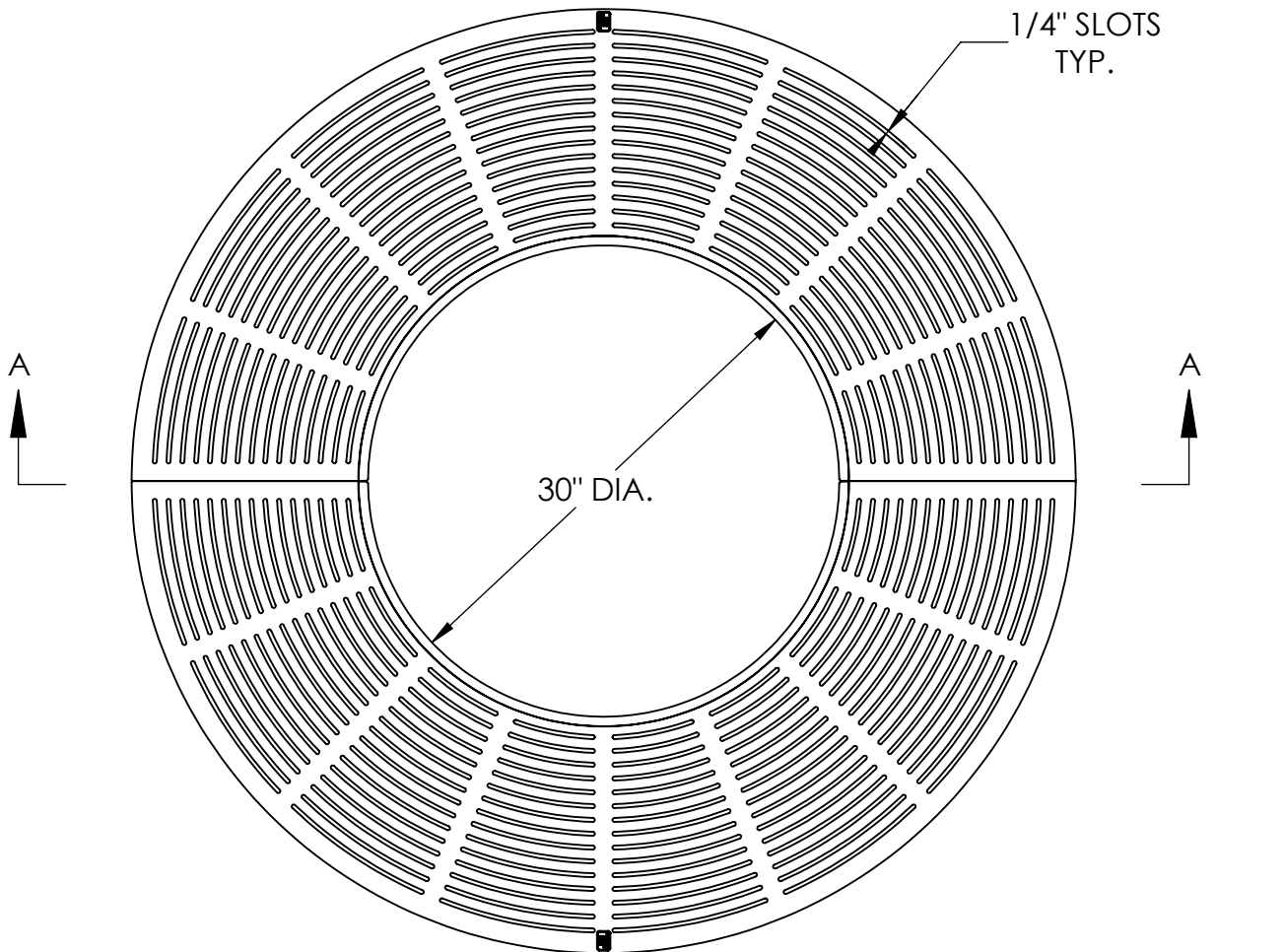
- A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.
- B. Protect [charging stations] [power pedestals] and components from damage until acceptance. Replace [charging stations] [power pedestals] components which are damaged during construction.

END OF SECTION

8975 PLAZA Tree Grate Set



NOTE! COMPONENTS ARE SHIPPED LOOSE. (NOT ASSEMBLED)



Product Number

00897551C04

Design Features

-Materials
Tree Grate
Gray Iron (CL35B)

-Load Rating
Non-Traffic
-Open Area
451 sq. inches
-Coating
Undipped
-√ Designates Machined Surface

Certification

-ASTM A48
-ADA
-Country of Origin: USA

Major Components

(2) 00897551

Drawing Revision

2/16/2022 Designer: MAH
4/10/2022 Revised By: MAH

Disclaimer

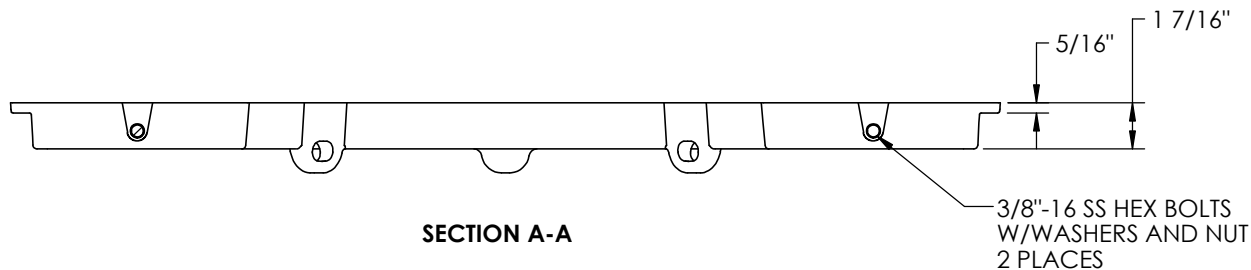
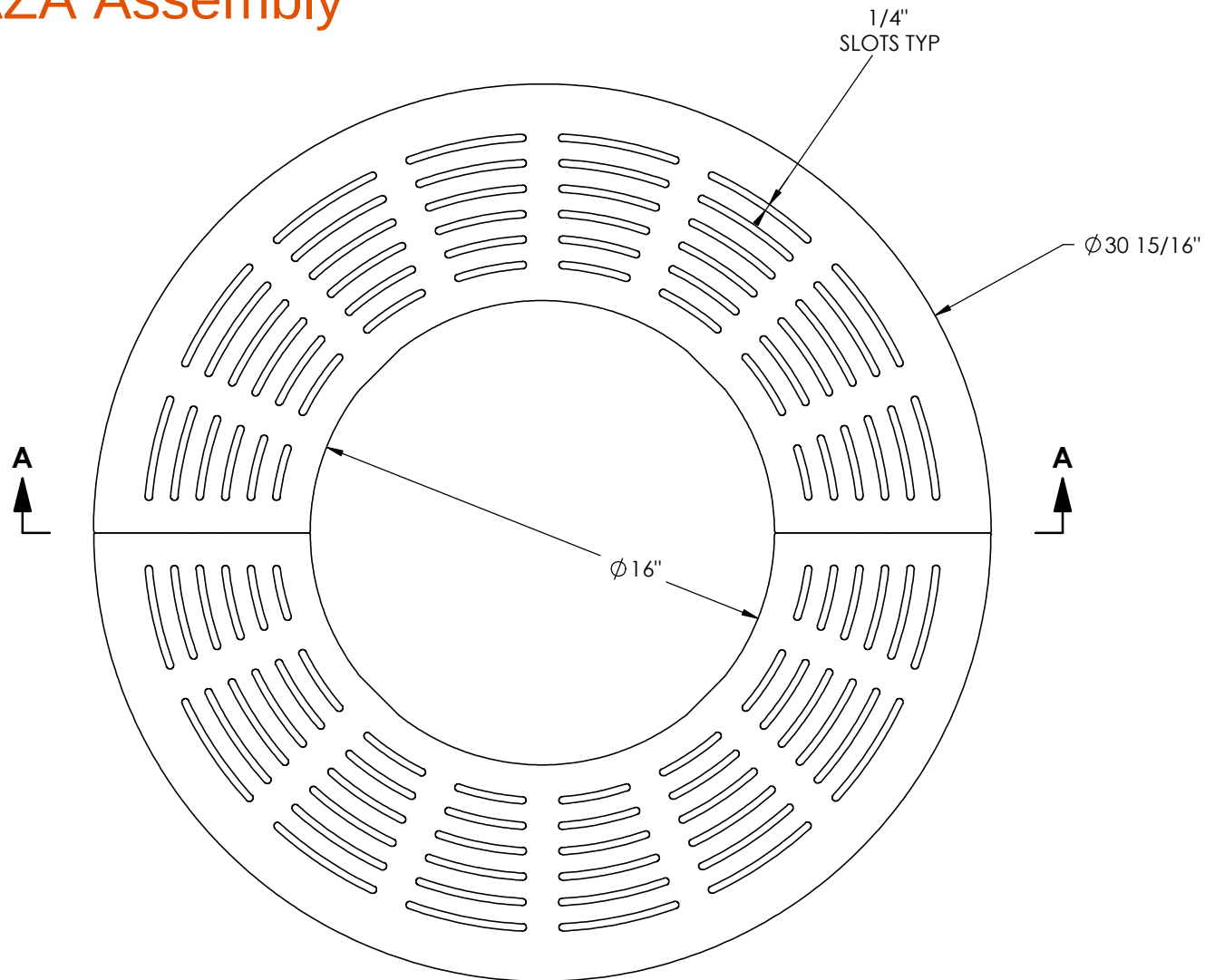
Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

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Contact

800 626 4653
ejco.com

PLAZA Assembly



Product Number

00895363B01

Design Features

- Materials
Tree Grate Removable Center
Gray Iron (CL35B)
- Design Load
Non-Traffic
- Open Area
76 sq. inches
- Coating
Undipped
- √ Designates Machined Surface

Certification

-
- ASTM A48
-
- Country of Origin: USA

Major Components

(2) 00895363

Drawing Revision

06/04/2013 Designer: DEF
Revised By:

Disclaimer

Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

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SECTION 129313

BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes bicycle racks and supplementary items necessary to complete work required for their installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work
- C. Samples: Submit one 12" long tube section for each finish specified.

1.3 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
 - 1. AAA Ribbon Rack Co. - "The Original Ribbon Rack"
 - 2. Bike Security Racks Co. - "Bike Stanchions"
 - 3. Columbia Cascade Co. - "Original CycLoops"
 - 4. Gametime, Inc. - "7700 Series Loop Bike Rack"
 - 5. Madrax, Inc. - "Heavy-Duty Winder"
 - 6. Madrax, Inc. - "Winder-Plus"

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2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIAL

- A. Pipe:
1. Schedule 40 steel pipe. [Schedule 40 stainless steel pipe.] [Schedule 10 steel pipe.]
 2. Gage/Thickness: 0.154 inch [0.109 inch]
 3. Diameter: 2.375 inch (60 mm) OD [1.625 inch (41 mm) OD]

2.4 FABRICATION

- A. Stand: Minimum 35 [42] inch high serpentine type stand.
- B. Finish: Hot-dipped galvanized. [Electrostatically applied powder-coat finish. Color as selected by Architect from manufacturer's standard colors.] [No. 4 satin stainless steel.]
- C. Anchor Type: In-Ground. [Surface Flange Mount.]

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

END OF SECTION

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SECTION 13 2100

CONTROLLED ENVIRONMENT ROOMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Providing all labor, materials, equipment and services necessary for the complete installation of environmental rooms in accordance with the Contract Documents.
2. Factory assembly and testing of major components, including conditioning module, compressor / condensing unit, humidification / dehumidification equipment, and control panels.
3. Delivery of room components to their final location, and assembly of rooms in place by factory trained technicians.
4. Refrigeration piping, electrical power wiring, control wiring and final connections to equipment and devices which are an integral part of the rooms.
5. Interconnection to building mechanical, plumbing and electrical services.
6. Startup and field testing of rooms by factory trained technical personnel.

B. Related Sections:

1. Section: Laboratory Casework and Furnishings.
2. Division 22: Furnishing and installation of plumbing utilities and final connections to service fixtures.
3. Division 23: Furnishing and installation of ventilation ductwork and final connection to environmental rooms.
4. Division 26: Furnishing and installation of electrical utilities and final connections to room control panels and remote compressor/condenser unit control panels.

1.2 REFERENCES

A. Standards:

1. ARI: American Refrigeration Institute, 420-77 and 520-78.
2. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers, Standard 15-1994 - Refrigeration Components, Safety and Use of Refrigerants.
3. ANSI: American National Standards Institute, B9.1.
4. ASHRAE/ANSI Standard 15-70.
5. ASTM: American Society for Testing and Materials, A204 - Aluminum Alloy, Sheet and Plate.
6. ASTM: American Society for Testing and Materials, A240 - Stainless Chromium-Nickel-Steel, Sheet and Strip.
7. ASTM: American Society for Testing and Materials, A-525 - Steel Sheet, Zinc-Coated, Physical Structural Quality.
8. UL: Underwriters Laboratories Inc., 723 - Room Panel Flame Spread Ratings.

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9. A.S.S.C.: American Standard Safety Code for Mechanical Refrigeration, ANS B9.1.
10. FM: Factory Mutual's approval including labeling of insulated panels.
11. NSF floor panels require a radius at the floor/wall and ceiling/wall junctures. Delete references 11 and 12 if not required.
12. NSF: National Sanitary Foundation Seal of Approval - Room Panels.
13. CSA: Canadian Standards Association, C22.2.

B. Codes:

1. NEC: National Electrical Code Article 310 and 410 - Electric Motors.
2. NFPA: National Fire Code, 79 - Electrical Standard for Industrial Machinery.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. Environmental rooms shall be designed, manufactured, and installed by one supplier for single source responsibility.
2. Rooms shall be self-contained units with all essential systems and equipment necessary for a complete and functional room.
3. Design systems with sufficient capacity to simultaneously and continuously meet all loads; including heat transmission from external sources, ventilation load, and internal heat gain from equipment, lighting and people; as scheduled on the drawings. Scheduled power supply represents the amount of power allocated by the building electrical system design for each environmental room. Provide any additional power, in excess of the amount scheduled, that is required to maintain specified environmental conditions.
4. The environmental room design and installation shall conform to applicable codes, ordinances and regulations.

B. Performance Requirements:

1. Achieve the environmental room temperature and humidity conditions scheduled on the Drawings and maintain the conditions within the specified tolerances.\

1.4 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.

B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordination of Contract Documents and Work:

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1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.5 SUBMITTALS

- A. Manufacturer's Data: Submit, for approval, manufacturer's data for all environmental room components including room structural panels, conditioning modules, compressor / condensing units, humidification / dehumidification equipment, control panels, lighting fixtures and flooring.
- B. Shop Drawings: Submit shop drawings, minimum scale 1/4 inch = 1'-0" (1:50), which include dimensioned plans, elevations, and sections. Provide utility data, details, and other information required for proper evaluation of work and for coordination with other related work.
- C. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.
- D. Submittal shall include calculations for cooling, heating, and dehumidification loads and required equipment capacities. Provide refrigeration piping schematic showing all components and their respective size or capacity, airflow schematic, and written sequence of operation for the refrigeration system.
- E. Electrical plan shall show all power connections to lighting and equipment; the voltage, amperage, and kW load for each circuit; and control and power wiring schematics.
- F. Provide roughing in requirements for mechanical and electrical services.
- G. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- H. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- I. Qualification Data: For manufacturer/fabricator, installer and professional engineer.
 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

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2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

J. Documentation for LEED Enhanced Refrigerant Management: Submit documentation for each room the following: type of refrigerant used, number of refrigerant circuits, and the total amount of refrigerant in each circuit.

K. Warranty: Sample of warranty.

L. Test Reports: Submit reports of all specified factory and field performance tests.

M. Operating and Maintenance Manuals: Before request for final payment, provide Operating and Maintenance Manuals that reflect installed conditions and provide detailed operating and maintenance procedures.

N. Qualification Data: For installer and professional engineer.

1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Environmental rooms and associated equipment shall be provided by a single laboratory environmental room manufacturer.

B. Manufacturer's Qualifications:

1. 10 years or more experience in the manufacture and installation of laboratory environmental rooms and equipment of type specified.
2. 10 installations of equal or larger size and with similar requirements.

C. Installer's Qualifications: Technicians factory trained and experienced in the architectural, mechanical and electrical skills necessary to assemble and put the environmental rooms into operation.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

- a. Owner.
- b. Architect.
- c. Contractor, including superintendent.
- d. Installer, including project manager and supervisor.
- e. Manufacturer/fabricator's qualified technical representative.
- f. Installers of other construction interfaced with Work.

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2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Work requirements (Drawings, Specifications, and other Contract Documents).
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Review required inspection, testing, certifying, and material usage accounting procedures.
 - f. Review environmental conditions and procedures for coping with unfavorable conditions.
 - g. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.
3. Contractor shall record discussions of conference, including decisions and agreements reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Do not deliver or install equipment until windows and doors are installed and the building is secure and weathertight.
- C. Examine project conditions at the site with regard to access, dimensions and the general areas of work. Installation work shall be performed in close coordination with other trades.
- D. Provide for any mechanical or electrical service different than that shown on the construction Drawings or indicated in these Specifications, but necessary to accommodate the manufacturer's product requirements.

1.9 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material [and labor] warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by

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manufacture or design and installation] of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a periods listed below from date of Substantial Completion
 - a. 10 year insulated panel warranty.
 - b. 5 year compressor warranty.
 - c. 1 year parts warranty.
 - d. 1 year labor warranty.
- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 1 year from date of Substantial Completion.
- C. If exploratory work is required to determine the cause of the defects, the cost of such work shall be borne by the Contractor if the work is found to be defective as judged by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Harris Environmental Systems): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.
- B. Acceptable Manufacturers/Fabricators and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers/fabricators listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 1. Environmental Growth Chambers
 2. Environmental Specialties, Inc.
 3. Harris Environmental Systems

C. MATERIALS, GENERAL

- D. Single Source Responsibility: Furnish each type of controlled environment room product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 ROOM CONSTRUCTION

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- A. Rooms shall be of modular construction incorporating wall, roof and floor panels consisting of foamed-in-place polyurethane insulation sandwiched between interior and exterior metal surfaces. Provide panels in standard size increments, fully interchangeable, and in a configuration that meets the specified dimensions. Structural metal, wood, or fiberglass material shall not be used between interior and exterior surfaces.
- B. Insulation: Foamed-in-place non-CFC polyurethane with a minimum R-30 for 4 inch(100 mm) thick wall/ceiling panels; min R-15 for 2 inch(50 mm) thick floor panels. Foam shall be 97 percent closed cell, impervious to moisture. Insulation shall bond the panel and have a minimum compressive strength of 28 pounds per square inch(193 kPa). Insulated panels shall comply with current EPA Regulations for CFC emission.
- C. Assembly: Panel sections shall lock together from inside the room with non-corrosive cam type fasteners, providing accurate, tight joining. Provide a minimum of 3 locking devices on each vertical joint. Distance between locking devices shall not exceed 48 inches(1220 mm). Edge of panels shall be tongue and groove construction with every tongue including an interior and exterior flexible vinyl gasket to ensure a tight fit. Batten strips or pressure clips as a means of covering seams or joining panel sections shall not be utilized. Close wrench holes with flush mounted plastic or stainless steel caps.
- D. Panels shall have a flame spread of not more than 25 and a smoke generation of 450 or less when tested in accordance with ASTM E84 and as certified by Underwriters Laboratories.
- E. Wall Panels:
 - 1. Thickness: 4 inches(100 mm).
 - 2. Interior Surfaces:
 - a. 26 ga stucco embossed galvanized steel with white polyester enamel finish. (note: panels must have steel finish to comply with FM 4880)
 - 3. Exterior Surfaces:
 - a. 26 ga stucco embossed galvanized steel with white polyester enamel finish.
 - 4. Reinforce wall panels to support wall mounted shelving shown on the Drawings.
- F. Roof Panels:
 - 1. Thickness: 4 inches(100 mm).
 - 2. Interior Surfaces.
 - a. 26 ga stucco embossed galvanized steel with white polyester enamel finish.
 - 3. Exterior Surfaces:
 - a. 0 26 ga stucco embossed galvanized steel (note: this surface is not visible)

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4. Reinforce roof panels to support equipment loads without violating the insulation value of the panels.

G. Floor Panels:

1. Thickness:
 - a. 2 inches(100 mm)
2. Interior and exterior surfaces:
 - a. 14 gage(1.994 mm) galvanized sheet steel capable of handling floor loads up to 600 pounds per square foot(2940 kg per square meter).

H. Doors:

1. Infitting, semiflush, with a minimum clear opening of 36 inches wide by 78 inches(915 mm by 1980 mm) high. Doors shall have a thermal resistance within 10 percent of that for wall panels.
2. Observation Window: Minimum of 14 inches by 14 inches(355 mm by 355 mm), 3 pane hermitically sealed window. Window shall be removable for replacement.
3. Gaskets: Extruded vinyl, resistant to oils and sunlight, and easily replaceable. Provide antisweat heaters to control condensation as a standard item on all door jambs at rooms designed for operation below 5 degrees Celsius.
4. Hardware: Polished aluminum, cam action type, self-closing, self-lubricating, and edge or strap mounted with stainless steel. A minimum of 2 hinges per door, adjustable for proper gasket seal.
5. Lock: Provide with keyed cylinder lock capable of release from the room interior whether or not the door is locked.

I. Closure Panels:

1. Furnish and install vertical and horizontal closure panels, strips and shrouds to close opening between environmental rooms and adjacent building partitions and ceiling.
2. Finish to match adjoining environmental room wall panels.
3. Include access panel only if it is required.
4. Provide with an access panel as noted on the drawings.

2.3 ROOM INTERIORS

- A. Lay in Ceiling, not required in refrigerators and freezers: Provide a 24 inch by 48 inch(610 mm by 1220 mm) eggcrate type lay in ceiling panels supported by anodized aluminum grid members and covering the total ceiling area. Panels shall be acrylic with 1/2 square perforations.

B. Ceiling Plenum:

1. Plenum to contain conditioning modules, heating elements, control valves and other equipment necessary to condition the room air to maintain specified conditions.
2. Conditioned air shall be directed into a positive pressure plenum extending across the room ceiling. Plenum to provide the correct percentage of total opening to ensure uniform air distribution throughout the room.

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C. Flooring:

1. Basis of Design: Altro Walkway 20 Safety Flooring
2. Available Manufacturers:
 - a. Altro,
 - b. Armstrong
 - c. Mannington
3. Crevice free, non-absorbent, slip resistant, abrasive, vinyl flooring.
4. Depending on room size, floors shall be seamless or have welded seams, coved 4 inch(100 mm) up sides and capped with vinyl trim piece and continuously silicone sealed between vinyl cap and walls.
5. Color: Selected by the Owner's Representative from one of the manufacturer's standard colors.
6. Flooring shall have temperature stability, dimensional stability and flexibility from -20 degrees Celsius to 60 degrees Celsius.
7. Flooring shall meet the current slip resistance Static Coefficient of Friction Guidelines of the Americans with Disabilities Act and OSHA, and be unaffected by surface water.
8. Provide flooring with an underlayment as recommended by the flooring manufacturer.

D. Conditioning Module:

1. Room air shall be temperature conditioned by a conditioning module consisting of an evaporator coil with drain pan, air circulating fans/blowers and controls.
2. Locate conditioning module in ceiling plenum above lay in ceiling. Conditioning module shall be low profile type to maximize the clear height inside the room and arranged so that cooled air is discharged parallel to the ceiling.
3. Electrical power feed to conditioning module shall be through the environmental room control panel.

E. Lighting:

1. Design: Lighting shall be sufficient to provide 70 footcandles(753 lx) of uniform illumination when measured at 36 inches(910 mm) above the floor.
2. Mount fixtures above the false ceiling panels.
3. Fixtures: Vaporproof LED type suitable for the temperature listed in the Environmental Room Schedule. Underwriters Laboratories approved, 120/60/1.
4. Lamps: Provide type specified under Division 26. For rooms at 0 degrees Celsius and below, provide low temperature lamps.
5. Switch: Provide with pilot light and locate outside of the room next to the door.

F. Freestanding Shelving Units: (Note: frequently furnished by Laboratory furniture contractor)

1. Open wire shelves, adjustable on 1 inch(25 mm) centers, constructed of 9 gage wire ribs, perpendicular support ribs, and side reinforcing members all around. Provide four 1 inch(25 mm) diameter vertical support posts with ringed grooves 1 inch(25 mm) apart for each unit.
2. Materials: Shelves and posts of epoxy coated nickel-chrome steel. (Note: what finish is preferred; both are suitable for Environmental room application)
3. Materials: Shelves and posts of Type 304 stainless steel.

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4. Size: 74 inches(1800 mm) high, 48 inches(1220 mm) maximum width, and depth as indicated on the Drawings. Provide with 5 tiers of shelves unless otherwise indicated on the Drawings.

2.4 REFRIGERATION SYSTEM

A. Design:

1. Complete integrated system consisting of a conditioning module, compressor / condenser unit, interconnecting piping, interconnecting wiring, and controls designed for continuous system operation. The refrigeration system shall be a fully modulating type which continuously proportions the mixture of liquid and hot gas phases of the refrigerant entering the evaporator, utilizing a modulating control valve. On/off solenoid valve type of control will not be acceptable. The system shall also include high/low pressure controls, receiver, expansion valve, and all necessary components for a complete system to achieve the specified performance.
2. System capacity shall be sufficient to simultaneously and continuously meet all loads, from 0 to 100 percent, including heat transmission from external sources, ventilation load and internal heat gain from equipment, lighting and people.
3. Refrigerant: (phased out) R-404A for rooms 4 degrees Celsius and above, R-404A for freezers. (Note: R-448A has the lowest GWP)
4. Ventilation will be continuously provided from the building supply air system, for all rooms 4 degrees Celsius and above. Rooms must maintain temperature control and uniformity with ventilation load continuously present.

B. Conditioning Module:

1. Evaporator Coil: Copper tube, copper fin with aluminum housing. Maximum 8 fins per inch(25 mm), minimum 4 rows deep. Air velocity shall be less than 500 fpm(2.5 m/s).
2. Coil Blower Motor: Permanently lubricated, ballbearing design, rubber mounted, and thermally protected.
3. Drain Pans: Provide an insulated, stainless steel or heavy gage aluminum, condensate drain pan large enough to collect all condensate during normal operating and defrost cycles.

C. Compressor/Condenser Unit:

1. Water cooled, semi-hermetic or scroll, serviceable unit sized to maintain temperature / humidity conditions scheduled for each room on the drawings.
2. All components of the unit shall be designed for 125 psig working pressure or 150 percent of maximum operating pressure, whichever is greater.
3. Unit shall have a minimum of a high/low pressure safety control, receiver with fusible plug, liquid line drier with sight glass, crankcase pressure regulator, accumulator, vibration absorbers and thermal protection.
4. Unit shall be designed for continuous operation for maximum compressor life and to eliminate on-and-off cycling.
5. The compressor / condenser unit shall be linked to an evaporator of matching capacity.
6. Water cooled units shall be provided with modulating water regulating valves to maintain head pressure.
7. Provide a fully accessible sheet metal sound enclosure internally lined with 2 inch, 6 pound(48 mm, 2.7 kg) density glass fiberboard tightly fitted to the cold room. The enclosure shall be provided with acoustically lined air transfer ducts as required to dissipate heat buildup within the enclosure.

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D. Automatic Defrost System:

1. For rooms with setpoint temperature 6 degrees Celsius or below, provide hot gas defrost with timer and fan delay switch. Set defrost initiation time and duration so that room temperature increase is minimized while achieving complete removal of accumulated frost. Electric heat trace and insulate drain pipe.
2. For rooms with setpoint temperature 0 degrees Celsius and below, provide electric defrost with timer and fan delay switch. Set defrost initiation time and duration so that room temperature increase is minimized while achieving complete removal of accumulated frost. Electric heat trace and insulate drain pipe for Freezers.

E. Piping: ACR type, hard drawn, cleaned and capped Type L copper tubing soldered with silver solder. Hot gas piping shall be silver brazed. All piping shall be installed to allow for linear expansion of copper after startup.

1. Suction Piping: Size for velocity of 500-700 fpm(2.5-3.5 m/s) on horizontal runs with a slight pitch toward condensing unit. When condensing unit is located below evaporator and there is no possibility of trapping oil; size vertical runs same as horizontal runs. When condensing unit is located above evaporator; size vertical runs for velocity of 1,000-1,500 fpm(5-7.5 m/s) and install proper traps spaced not more than 10 feet(3 m) apart on all tubing risers.
2. Hot Gas Piping: When hot gas piping is field installed remote from compressor, size at same velocities and with same trap requirements as specified above for suction lines.
3. Liquid Piping: Size all liquid piping for maximum 2 psig(13.8 kPa) pressure drop.
4. Hangers: Provide with appropriate tubing clamps to support liquid, suction, and discharge lines individually. Space hangers or clamps 8 feet(2.4 m) on center maximum.
5. Condensate Drain Piping: Provide 7/8 inch(20 mm) or greater, Type L copper tubing from evaporator drain pan to the building waste system. In rooms with sinks, drain piping shall be connected to the sink drain on the house side of the trap. In rooms without sinks, drain piping shall terminate 2 inches(48 mm) above the floor sink or floor drain outside the room. Horizontal piping between drain pan and environmental room wall shall be located above the lay in ceiling and pitched in the direction of flow. Rigidly support piping at walls, 3 feet(1 m) on center with a 1 inch(24 mm) clear space between the wall and the drain line. Provide cleanout tee near drain pan. Where piping passes through wall of room, provide chrome plated escutcheons on both faces of the wall and a trap seal at the outside surface of the wall. Insulate and electric heat trace drain piping.
6. Refrigerant Testing: Pressurize and leak test entire system at not less than 100 psig(690 kPa). Clean and dehydrate by maintaining a vacuum of 500 microns, or lower, for a 5 hour period. Add required charge of refrigerant, and oil if necessary, and test entire system for performance. The type of refrigerant used shall be in accordance with State and Local Codes. Mark each system clearly as to refrigerant type used.
7. Service line penetrations shall be properly sealed with silicone caulking.

F. Insulation: Suction and hot gas refrigeration lines shall be insulated with a closed cell foam plastic insulation. The material shall be tubular in form and sized according to the pipe size. Joints shall be thoroughly bonded by the adhesive recommended by the manufacturer of the insulation. Insulation shall meet local and state fire and smoke requirements. Penetrations of the insulation must be thoroughly sealed to form a complete vapor barrier. Wherever the insulation terminates the edges shall be sealed to the pipe with sealant.

2.5 VENTILATION SYSTEM

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- A. Environmental rooms 72 degrees Fahrenheit and above, must maintain specified design conditions, as scheduled, with ventilation supply and exhaust provided on a continuous basis from the building HVAC system.
- B. Provide a 4 inch diameter exhaust duct collar through the roof of the environmental room for connection to the building laboratory exhaust systems. Insulate entire run of exhaust duct, from the duct collar on the environmental room roof, to the location in the run where the air is properly mixed to prevent condensation. (Note: only required for rooms with ventilation air supply in excess of 50 CFM)
- C. Provide a 4 inch diameter supply duct collar through the roof of the environmental room for connection to the building laboratory supply air system. Termination of the supply air duct in the ceiling plenum shall be at warm side of the evaporator.
- D. Do not provide ventilation air to freezer rooms.

2.6 HEATING COILS

- A. Heaters: fin heater assembly with over-temperature thermostat and a maximum watt density of 23 watts per square inch (23 watts per 645 mm²). Mount heaters on downstream side of evaporator to achieve proper reheat. Heated surfaces shall not contact evaporator fins or tubes, and must have guard to prevent any human contact with the heated surfaces. Ends of heater elements shall be electrically insulated to disallow contact with current carrying parts and sealed to prevent entrance of moisture into the element. Provide electronic control interlock to prevent heaters being energized anytime airflow is inadequate.
- B. Provide separate, independent solid state high limit control which is UL listed (UL 991) as a temperature limit device. This limit control shall monitor air temperature in the conditioning plenum, opening the heater power contactor and enabling audio and visual indicators if temperature exceeds a preset limit. The preset, nonadjustable limit setpoint shall not exceed 65 degrees Celsius, but shall be high enough to prevent false alarming under normal system operation. The tripped limit control shall require manual resetting by operation of a panel mounted push button.
- C. Provide all required power and control wiring from the room main control panel to the heating coil.

2.7 CONTROLS

- A. Locate all instruments and controls in a control panel on the outside of the room, mounted at eye level. Provide panel with a clear acrylic cover and a lock with two keys.
- B. Control Panel Service Enclosure: Provide a removable service enclosure panel from control panel to 6 inches above ceiling. Exposed fasteners will not be allowed. Finish to match control panel.
- C. Main Temperature Control: Microprocessor based PID controller designed for environmental room applications with the following features:
 - 1. Resistance Temperature Detector (RTD) 100 ohm platinum sensor for rapid response to temperature fluctuation, open tip for environmental rooms. Sensitivity shall be greater than or equal to plus or minus 0.1 degree Celsius.

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2. The microprocessor PID controller shall continuously monitor room condition versus setpoint, providing an output which will modify the conditioning system capacity in response to any deviation.
 3. Controller range shall be established to cover the required range of the room as scheduled.
 4. Accuracy: Plus or minus 0.25 percent of reading plus 1 digit over advertised span at 25 degrees Celsius.
 5. Ambient Temperature Error: 0.01 percent of span per degree Celsius deviation from 25 degrees Celsius.
 6. Resolution: 1 degree/unit.
 7. Calibration Drift: Self compensating for ambient temperature. All calibration values shall be stored in memory. No field calibration shall be required.
 8. Noise Rejection: Normal mode, 85 dB minimum at 60 Hertz or greater. Common mode, 90 dB minimum.
- D. High Temperature Safety Control: Provide a separate and independent safety control circuit and devices installed in the control panel. This control shall be a sensitive electronic controller with setpoint dial calibrated in degrees Celsius. In the event of a high temperature alarm condition, the safety control will de-energize the heaters and lights in the room and activate an audible and visual alarm. A panel mounted momentary contact push button shall be provided to deactivate only the audible portion of the alarm. When temperature returns to the normal range the heaters, lights, and alarm system shall automatically reset. Provide dry contact for connection to external alarm.
- E. Low Temperature Safety Control: Provide a separate and independent safety control circuit and devices installed in the control panel. Its sole function shall be to deactivate the refrigeration system and activate audible and visual alarms in the event of a low temperature alarm condition. This control shall be a sensitive electronic controller with setpoint dial calibrated in degrees Celsius. A panel mounted momentary contact push button shall be provided to deactivate only the audible portion of the alarm. When temperature returns to the normal range the alarm system shall automatically reset. Provide dry contact for connection to external alarm.
- F. Data logging: System shall include capacity for logging of all closed-loop control channels with ability to transfer or download to portable media. System shall be capable of storing a minimum of two hundred seventy-five (275) days, logged at five-minute intervals, of data locally (at the chamber). All data is stored in unencrypted format for transfer and analysis by user.
- 2.8 PERSONNEL EMERGENCY ALARM
- A. Provide room with a reset type, electrically powered personnel emergency alarm system. Power shall be from the room electrical input. The system shall consist of an actuator within the room and audible and visual alarms affixed to the front exterior of the room. Provide an additional alarm for the building automation system utilizing two dry contacts.
- B. The alarm system actuator shall be a heavy duty, oil tight switch, equipped with a red button marked, "EMERGENCY ALARM - PULL TO RESET." The actuator shall be mounted on the interior wall of the room adjacent to the door jamb and 12 inches(300 mm) above the finish floor.
- C. The audible alarm shall be of a type that provides a high decibel level of sound output at a frequency distinct from room parameter alarms. The visual alarm shall be mounted in an area providing no vision interference and shall be prominently labeled "PERSONNEL EMERGENCY."

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.

3.3 PREPARATION

General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

Deliver to job site, uncrate, and assemble all equipment specified herein. All debris and crating materials shall be removed. Components shall not be exposed to weather.

Sections shall match without distortion. Door shall close and seal without binding.

A. Electrical:

1. Furnishing, installation and connection of control panel, complete with disconnects for incoming service and branch circuits.
2. Incoming service to control panel mounted disconnects from junction box located above the environmental room.
3. Interlocking control wiring between control panel and compressor/condenser units, conditioning module, and heaters.
4. Provide a dry contact, for use by building automation system, that will close when any of the operating controls fail or when any of the safety devices prevent operation of conditioning equipment.
5. Provide seal-off fitting to seal conduit and prevent condensation at all penetrations of environmental room wall or roof panels.
6. Provide packaged compressor units complete with disconnects and motor starters.

B. Mechanical:

1. Service line penetrations into rooms shall be properly sealed with silicone caulking.
2. Insulate the supply and exhaust ducts for a minimum of 6 feet(1.8 m) beyond the collar.

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- C. Provide carpentry supervisor and mechanical supervisor on job site whenever cold room installation in that area of work on rooms is taking place.
- D. Manufacturer's Representative shall instruct Owner's staff in the operation of room including controls, after completion of room startup. The operating and maintenance manual shall indicate sequential operation, startup and shutdown, with all pertinent control data and schematics.

3.4 TESTING

- A. Installation of casework, shelving, and furnishings to be completed prior to testing of room.
- B. Provide all equipment and instrumentation for testing and perform the specified tests.
- C. Control Setpoint: Verify temperature control of plus or minus 0.5 degrees Celsius at the room sensor.
- D. Temperature Uniformity: Measure temperature using a minimum of sixteen sensing points located at widely separated locations within the chamber to within 4 inches(100 mm) of chamber walls, 12 inches(305 mm) of the floor and 6 inches(150 mm) of the ceiling grid. The maximum allowable variation in temperature shall be 0.5 degrees Celsius and shall be measured by a multipoint strip chart recorder utilizing NIST traceable temperature sensors during a continuous 24 hour test period. (Note: temperature uniformity in Freezers and Cold Rooms without suspended ceiling plenum is $\pm 1^{\circ}\text{C}$)
- E. Temperature Gradient: Verify that maximum temperature gradient from floor to ceiling does not exceed 1.0 degrees Celsius. (Note: temperature gradient in Freezers and Cold Rooms without suspended ceiling plenum is 2°C)
- F. Recovery Test: All rooms, except freezers, shall recover preset operating temperature within 5 minutes after door has been fully opened to 75 degrees Fahrenheit(24 degrees Celsius) ambient for a period of 1 full minute.
- G. Internal Load Test: Each room shall maintain plus or minus 1.0 degree Celsius control when operating with the number of people, amount of ventilation, and internal heat gain of lighting and equipment as shown on the Environmental Room Schedule.
- H. Provide written reports, in duplicate, of all tests. Reports shall indicate procedures followed, instruments used, and tabulation of results.
- I. Witnessing of Tests: Owner's Representative shall be given the option of witnessing and confirming test results. Notify Owner's Representative, in writing, 10 days prior to tests.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

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- B. Owner's Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

END OF SECTION

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SECTION 13 4275

INTEGRATED INTERIOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Delegated design of integrated interior assemblies.
 - 2. Structure.
 - 3. Finish panels.
 - 4. Doors and frames.
 - 5. Door hardware.
 - 6. Factory integrated components.
 - 7. Site integrated components.
- B. Related Requirements:
 - 1. 0871 00 - Door Hardware for site integrated components.
 - 2. 095113 - Acoustical Panel Ceilings for site integrated components.
 - 3. 096500 - Resilient Flooring for site installed integral cove base at interior assemblies.
 - 4. 102223 – Accordion Folding Partitions for site integrated components.
 - 5. 123553 - Laboratory Casework: For modular casework and countertops.
 - 6. Division 26 - Electrical for site integrated components and commissioning.
 - 7. Division 27 - Communications for site integrated horizontal cabling.
 - 8. Division 28 - Electronic Safety and Security for site integrated components.

1.2 DEFINITIONS

- A. Finish Panel: Site installed panels with factory applied final finish and cutouts for accommodation of mechanical, electrical and plumbing components.
- B. Conventional back box: Standard NEC device metallic back box.
- C. Specialty back box: Proprietary back box required for devices other than those specified in this section.
- D. Factory Integrated Components: Materials or components specified in other sections for factory assembly within integrated interior assemblies.
- E. Site Integrated Components: Materials or components specified in other sections for site assembly within integrated interior assemblies.

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1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting:

1. Attendees: Owner's representative, Architect, Contractor, and all Subcontractors interfacing with integrated interior assemblies.
2. Review preparation, sequencing and installation procedures of the integrated interior assemblies to coordinate the work of this section with other impacted sections.

1.4 SUBMITTALS

A. Submit the following in accordance with section 013300 submittal procedures section.

B. Submittals must be reviewed and approved by the Contractor before sending to the Architect for review.

C. Sample: Submit two samples for verification of selected finish as scheduled upon request unless noted otherwise. All wood veneer and non-standard custom finishes must be reviewed and approved by the Architect.

1. Anodized: 3 x 6 inch (76mm x 153mm) on metal.
2. Glass: 4 x 4 inch (102mm x 102mm).

D. Product Data: Provide manufacturers standard tech sheets as applicable to the project for the following: Structure, Finish Panels, Doors and Frames, Door Hardware, Electrical, Communications, Mechanical/Plumbing Accommodation and Accessories.

E. Pre-Manufacture Submittals: Provide the following information to the manufacturer prior to development of shop drawings.

1. Field measurements of existing construction, future construction, finished width and height of walls and associated components, as well as design team provided plans and elevations.
 - a) Where field measurements are not possible, hold-to and control dimensions must be coordinated and agreed upon by all parties who interface with the integrated interior assemblies through the Shop Drawing process before manufacturing begins.
2. Wall hung items: Include make, model, size, configuration and any additional pertinent product data for wall hung items such as furniture, fixtures, equipment and casework.
3. Structure: Include selected wall types.
4. Finish Panels: Include finishes and configurations.
5. Doors and Frames: Include cores, finishes, frames, and operations.
6. Door Hardware: Include manufacturers standard hardware and site integrated component hardware.
 - a) One sample of each type of Site Integrated Door Hardware that is to be installed in doors included in this section shall be sent to manufacturer for review and approval.
7. Factory Integrated Components: Provide make, model, size, configuration, materials and any additional pertinent product data for factory assembly.

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8. Site Integrated Components: Provide make, model, size, configuration and any additional pertinent product data for site installation.
- F. Shop Drawings: Submit shop drawings for review prior to commencing any fabrication of the integrated interior assemblies. Coordinate as required until scope is confirmed by all affected stakeholders. Include manufacturer provided plans, elevations, sections, schedules and applicable notes per the following:
1. Prior to shop drawing submittal review the drawings for obvious drafting and detailing errors.
 2. Indicate material descriptions, dimensions and profiles of adjacent components and assemblies interfacing with the integrated interior assemblies.
 3. Indicate field measurements of existing construction, future construction, finished width and height of assemblies and associated components.
 4. Structure: Indicate reveal type, profile type, finishes and attachment to base building.
 5. Finish Panels: Indicate finishes, cores, glazing, accessories and configurations.
 6. Doors, Frames and Hardware: Include elevations indicating glazing and finishes, schedules indicating door tags, styles, dimensions, handing, hardware and finishes.
 7. Factory and Site Integrated Components: Indicate device type and location.
- G. Delegated Design Submittals: Provide structural analysis data and calculations for installed products to demonstrate code compliance with design loads, signed and sealed by licensed professional engineer registered in the jurisdiction of the project.
1. Include engineering calculations for grid connections, bulkhead connections, and seismic conditions.
- H. Manufacturer's Installation Instructions: Indicate any special preparation of base building conditions, installation and attachment methods.
- I. Operation and Maintenance Data: Provide maintenance data for incorporation into operation and maintenance manuals.
- J. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- K. Closeout Submittals: Submit copy of packing slip for shipment of re-usable packaging "cookies" and modular electrical dust caps back to manufacturer.
- L. Installer Performed Testing: Submit documentation of installer performed tests and certification for submission to the Authority Having Jurisdiction.

1.5 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section, of the quality and complexity required for this project for a minimum 10 years. Show production facilities capable of meeting contract requirements for single-source responsibilities and warranty.

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2. Designer Qualifications: Professional structural engineer with 3 years of documented experience in design of this work and licensed in the location of the project.
3. Wall Installer Qualifications: Company trained and certified by manufacturer and specializing in performing the work of this section.

B. Source Limitations: Obtain integrated interior assemblies from a single source.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver or install integrated interior assemblies until spaces are enclosed and weather-tight, wet work is complete and dry, work above ceilings is substantially complete, and HVAC system is operational and able to maintain ambient temperature and humidity conditions between 60 and 90 degrees Fahrenheit (15.5 and 32.2 Celsius) with Relative Humidity maintained between 25 and 60 percent.
- B. Do not allow packaging to get wet or develop condensation.
- C. Comply with the manufacturer's requirements for a warrantable installation of the installed products to meet the Performance and Design Criteria.
- D. Collect and return re-usable packaging "cookies" and modular electrical dust caps to manufacturer.

1.7 WARRANTY

- A. Manufacturer Warranty: Provide 10 year warranty on walls, doors, door frames, electrical, communications and Mechanical/plumbing accommodations for failures in materials or workmanship as indicated by the manufacturer standard warranty.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Specification is based on products listed below by DIRT Environmental Solutions.

2.2 DESCRIPTION

- A. Factory assembled, site installed, integrated interior assemblies, including Structure, Finish Panels, Doors and Frames, Door Hardware, Electrical, Communications, Mechanical/Plumbing Accommodation, and Factory and Site Integrated components.

2.3 PERFORMANCE AND DESIGN CRITERIA

- A. Provide integrated interior assemblies that are factory sub-assembled, and site installed to integrate with the base building structure, shell, mechanical, electrical and plumbing systems.
- B. Integrated Interior Assemblies shall be non-progressive in method of installation so that frame modules within an elevation can be removed, added or changed without affecting adjacent frame modules.

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- C. Walls shall utilize factory finish site installed panels that mechanically fasten to a factory finished and assembled aluminum structural frame module. Finish panels may be monolithic or segmented with the ability to span off-module, or across multiple frames in segments or monoliths, vertically and horizontally.
- D. Assembly shall allow for independent configuration of structure, finishes and functions relative to each side of the wall.
- E. Assembly shall be comprised of components which can be disassembled, relocated and field cut and substantially reused for future reconfigurations allowing for adaptability and retrofitting of the Structure, Finish panels, Doors and Frames, Door Hardware, Electrical, Communications, Mechanical/Plumbing Accommodation, and Factory and Site Integrated components.
- F. Structure shall be capable of supporting wall hung accessories including but not limited to: casework, furniture, systems furniture, shelves, countertops and equipment in channels or reveals that are integrated within the structural frame and enable universal horizontal alignment without damaging finishes.
- G. Integrated interior assembly shall provide accommodation or provision for the embedding (fully encased behind glass) of electronics in the wall cavity. Structural framing shall allow for universal non-standard AV display, sound, and various support equipment to be mounted in the cavity of the wall with all required structural brackets, wire management, access and ventilation equipment to prevent overheating.
- H. Integrated interior assembly shall enable access of the internal cavity from either side without the addition of an access panel or need for repairing of finishes.
- I. Provide integrated interior assembly with a continuous open cavity vertically and horizontally free of structural impediments for the routing of mechanical, electrical and plumbing components.
- J. Provide integrated interior assemblies capable of accommodating up to a 1-inch (25 mm) gap between the top, bottom and side edges of the prefabricated assembly and base building elements.
- K. Provide an integrated interior assembly system capable of accepting pressure fit extrusions and co-extrusions to fill voids between finish panels, at ceiling connections, and other base building connections.
- L. The manufacturer of finish panels specified herein shall be capable of incorporating owner provided factory finished custom graphics on finish panels.
- M. Structural Performance:
 - 1. Capable of withstanding the effects of loads and stresses within limits allowable by the local authority having jurisdiction and under conditions indicated:
 - a) Transverse Load: Lateral deflection of the overall span when tested under a uniformly distributed load of 5 psf (0.24 kN/m²) in accordance with ASTM E72 where (L) equals wall height:
 - 1. Solid Walls: not more than L/120

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2. Glass Walls: not more than $L/175$ or 3/4 inch (19 mm) whichever is more stringent.
 - b) Where glass panels are installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges of glass shall not be greater than the thickness of glass when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.
 - c) Seismic Performance: Provide integrated interior assemblies capable of withstanding effects of seismic motions determined according to the Authority Having Jurisdiction.
- N. Acoustic Attenuation:
1. Sound Transmission Class (STC) rating of integrated interior assemblies shall be calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
 2. Interior Walls Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - a) Four inch (102mm) single glazed wall: [30]-35 STC.
- O. Fire Resistance:
1. Surface-Burning Characteristics:
 - a) Finish materials shall be tested in accordance with ASTM E84 or NFPA 286.
 2. Integrated Interior Assembly shall be approved for use by a qualified independent testing agency in Type I and Type II Construction.
- P. Assembly UL Ratings:
1. UL QQQX; Sections and Units per 2017 NFPA 70 National Electrical code.
 2. UL QQYZ; Wiring Assemblies.
 3. UL 183; Standard for Safety for Manufactured Wiring Systems.
 4. UL 498; Standard for Safety for Attachment Plugs and Receptacles.
 5. UL 507; Component Fans, Electric.
 6. UL 514A; Standard for Safety for Metallic Outlet Boxes.
 7. UL 514 B; Standard for Conduit Cable and Fittings.
 8. UL 514C; Standard for Safety for Non; Metallic Outlet Boxes, Flush; Device Boxes, and Covers.
 9. UL 514D; Standard for Safety for Cover Plates for Flush; Mounted Wiring Devices.
 10. UL 723; Standard for Test for Surface Burning Characteristics of Building Materials
 11. UL 1784; Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives.

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2.4 STRUCTURE

- A. Glazed wall: Fully assembled non-bearing structural frame module with glass infill and Site assembled non-bearing structural frame module with glass infill.
 - 1. Reveal Type and Size: Enzo 0.157 inches (4 mm)
 - 2. Extrusion Profile: Refer to design Selections.
 - 3. Material: Aluminum extrusions, 6063-T6 aluminum alloy classified as noncombustible in accordance with ASTM E136 per 2018 IBC 703.5.1.
 - a) Thickness: As required to meet performance requirements.
 - 4. Wall Thickness: Actual 4 inch (102mm).
 - 5. Top Track: Continuous, with intermittent breaks for structural components.
 - 6. Bracing: as required to meet structural performance requirements
 - 7. Vertical Element Spacing: As required to meet performance requirements within a minimum of 6 inches (152mm) and a maximum of 60 inches (1524mm).
 - a) Vertical Element spacing may exceed 60 inches (1524mm) with manufacturer review and approval.
 - 8. Glazing Finish Panel: Per Finish Schedule below.
 - 9. Glazing Gasket Color: silver.
- B. Structure Exposed Finishes:
 - 1. Clear Anodized Aluminum: AAMA 611, AAM12C22A31, Class I

2.5 FINISH PANEL

- A. Glass Finish Panel:
 - 1. Glazing Material:
 - a) Tempered glass (GLS-#): Architectural flat glass per ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type 1, Class 1 (transparent), Quality q3. Complies with CPSC-16 CFR Part 1201 Category II per IBC 2018.2406.2.
 - 1. Features: Meets ANSI Z97.1 Safety Glazing Material standards.
 - 2. Thickness: 3/8 inch (10mm).
 - 3. Finish: Per Finish Schedule below.
 - 2. Mounting: Center Mounted for glazed walls and doors
 - a) Face Mounted Features:
 - 1. Aluminum mounting rails to maintain alignment with adjacent finishes.
 - 2. Where specified 1/4 inch (6mm) tempered glass has a maximum size of: 60 x 120 inches (1524mm x 3048mm).
 - 3. Magnetic back painted glass where indicated by plans and/or elevations.

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2.6 DOORS AND FRAMES

- A. Coordinate ADA, ANSI, Access Control and Fire Life Safety requirements with drawings and schedules prior to the development of shop drawings per Pre-Manufacture Submittal requirements.
- B. Hardware Preparation and Reinforcement: Factory milled, reinforced, drilled and taped doors and frames by manufacturer to receive Integrated Hardware Components as scheduled.
 - 1. Factory milled doors and frames with hinge locations and sizes as determined by integrated interior assembly manufacturer; including factory installed steel backer plates.
 - 2. Access Control Components: Factory provided rough in for Site Integrated Components and integrated interior assembly manufacturer provided hardware.
- C. Provide manufacturers standard UL 1784 "S" labeling on doors within smoke partitions as indicated by door schedules.
- D. Aluminum Framed Glass (Butt-Hinge) Doors:
 - 1. Operation: Swing.
 - 2. Door Thickness: 1-11/16 inch (43mm) thick.
 - 3. Door Size: As indicated on Door Schedule.
 - 4. Stile Width: 4 inch.
 - 5. Top Rail Height: 4 inch.
 - 6. Bottom Rail Height: 10 inch.
 - 7. Glazing: Tempered 1/4 inch (6mm).
 - 8. Finish:
 - a) Powder Coat
 - Color: Per Schedule
 - 9. Adjustability: Provide door skirt to accommodate varying floor levels.
 - 10. Features: UL 1784 Smoke and draft control door assemblies with 4 inch stiles.
 - 11. PVC Components: Color; Black
- E. Door Frames:
 - 1. Architectural grade structural aluminum factory finished and integrated with wall structure.
 - 2. Door frames capable of reconfiguration without part replacement or damage to wall components.
 - 3. Frames are shipped knocked down and assembled on site.
 - 4. Jambs shipped over length by 2 inches (50 mm) in height, for field cutting to suit opening height for proper alignment with adjacent frames.
 - 5. Extrusion Profile: Refer to Design Selections
 - 6. Configuration: As required by door operation or function.

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7. Size: As required for doors sizes indicated on Door Schedule.

8. Standard Frame Depth: 4 inches (102mm)

9. Finish:

a) Powder Coat

Color: Per Schedule

2.7 DOOR HARDWARE

A. Site Integrated Components: Provide in accordance with Division 08 Openings and Division 28 Electronic Safety and Security.

B. All Hardware indicated in this section to be provided by the manufacturer or the manufacturers distribution partner and installed on site unless indicated otherwise.

C. General Door Hardware:

1. Hinges: Stanley 4-1/2 x 4 inch Butt-Hinge F179. Four hinges per door; no exceptions.

2. Cylindrical Series Hardware:

A) Schlage "S" Series

B) Falcon "B" Series

3. Acoustical Seals: Manufacturers Standard to accommodate door operation.

a) Type: Jamb, Header, Drop Seal.

b) Color: Black

4. Aluminum Framed Glass Door Gasket Color: Black.

5. Floor Stops

D. Sliding Door Hardware: Site installed manufacturer's standard sliding door track, track cover and door roller assembly with alignment pin on floor. Anti-rack and Anti-lift hardware included in track assembly.

1. Floor Track: None; Trackless

2. Operation:

a) Manufacturer's standard soft close mechanism for door weights up to 165 pounds (75 kg) or 8 roller soft close for door weights up to 200 lbs (90 kg).

E. Hardware Finishes: BHMA Standard finishes provided as follows unless indicated otherwise:

1. 630 - Satin Stainless Steel: pulls.

2.8 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

B. Manufacturer's accessories required by the project:

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1. Manufacturer Standard Wall Base: Mechanically fastened recessed and adjustable Santoprene base.
 - a) Color: To Match Wall Base on Finish Schedule
2. Manufacturer Standard Ceiling Trim: Mechanically fastened recessed and adjustable to accommodate up to a 1/2 inch (13 mm) gap between integrated interior assembly and base building elements
 - a) Color: Black
3. Ceiling Perimeter Hanger: Manufacturer provided 1-1/8 inch (29mm) exposed perimeter edge angle extrusion for supporting lay-in panel ceiling systems. Seismic Suspension Edge Clips to meet code required movement without 2 inch (51mm) wall angles and all other acoustical ceiling components per section 09 51 00 Acoustical Ceilings.
4. Opti-filler Pressure Fit Gaskets:
 - a) Wall Panel Seal at Reveal: Provide extrusions and co-extrusions to fill voids between finish panels, at ceiling connections, and at base building connections as required. (both horizontal and vertical gaskets). Coordinate final locations of gaskets with manufacturer through the shop drawing process prior to procurement of fabrication.

3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions meet the manufacturer's requirements before starting work.
 1. Floor Levelness:
 - a) Contiguous wall lengths less than 40 feet: Base building sub-floor shall be level within 3/8 inch over 10 feet.
 - b) Contiguous wall lengths greater Than 40 feet: Base building sub-floor shall not exceed a maximum total floor flatness deviation greater than 1-1/2 inches.
 2. Vertical leading edge of assembly structure to base building: Where partitions attach to adjacent walls, the finish face shall be plum within 1/2 inch over 10 feet.
 3. Top of assembly structure to base building: Where partitions attach to bulkhead or soffit, the finish face shall be level within 1/2 inch over 10 feet.
 4. Lay in Ceilings: Where partitions attach to lay-in ceiling grid, the grid shall be level within 1/4 inch over 10 feet.
- B. Verify field or hold-to control dimensions before fabrication of integrated interior assemblies. Coordinate fabrication schedule with construction schedule and progress to avoid delay in the work.
- C. Examine all adjoining work including work by others.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

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- B. Locations to receive integrated interior assemblies shall be inspected for compliance with manufacturers requirements.
- C. Survey floor to determine the nature of floor level and determine where special conditions exist beyond manufacturer's standard leveling capabilities of 1-1/2 inch (38mm) total variation in floor level. Prepare sub-floor per section 03 54 ## - [cast underlayment section].
- D. Field conditions and pre-existing installations by others which may adversely affect installation or exceed the manufacturers limitations shall be corrected before installing walls.

3.3 INSTALLATION

- A. General: Install all materials in accordance with manufacturer's instructions based on conditions present and pre-installation meeting.
- B. All building services shall be installed and connected to the base building systems by licensed subtrades. All building services shall be inspected by authorized trade representatives and Authority Having Jurisdiction in the presence of a manufacturer representative. Coordinate with all affected parties as required.
- C. Doors and frames
 - 1. Install sliding doors plumb, level, square, and in proper alignment.
 - 2. Install doors to close against walls without gaps
 - 3. Install doors to open and close smoothly.
 - 4. Anchor sliding doors securely to supports.

3.4 ADJUSTING

- A. Adjust and lubricate hardware for proper operation in accordance with manufacturer's instructions.
- B. Doors and Frames
 - 1. Adjust for smooth and balanced door movement in accordance with manufacturer's instructions.
 - 2. Adjust and lubricate hardware for proper operation.

3.5 CLEANING

- A. Dispose of all waste material in accordance with Section 01 ## ## - [construction waste management section] and project's Waste Management Plan.
- B. Upon completion of installation clean finishes in accordance with the manufacturer's instructions. Avoid alkaline or abrasive agents. Avoid scratching or marring finishes.

3.6 PROTECTION

- A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

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3.7 DEMONSTRATION

- A. Manufacturer's representative will be responsible to provide general product training to the Owner or their outsourced operations team at time of installation as well as conduct a comprehensive training session(s) to convey the methodology, and assembly of the walls to sustain general operational maintenance by the Owner's personnel with clearance over the facilities lifetime.

3.8 FINISH SCHEDULE

- A. (PWD-#) Powder Coat:
 - 1. Type: Color Match
 - 2. Color: To Match AMF10.
- B. (GLS-#) Glass:
 - 1. Type: Tempered
 - 2. Color/Finish: Manufacturer Standard Clear
 - 3. Thickness: 6mm and 10mm
 - 4. Color Manufacturer: DIRT
 - 5. Color/Finish Name: Refer to Design Selections.
 - 6. Pattern Direction: [Vertical] [Horizontal]
 - 7. Notes: Glass in Barn Door: Center Mounted Tempered Glass Tile; 6mm Tempered Glass- Clear; No edge polish
 - 8. Notes: Glass Panels: COM Glass Direct to site- COM Stickbuilt glass, 10 mm clear tempered; COM Glass; Flat polish all edges.

3.9 DOOR HARDWARE SCHEDULE

- A. Refer to Door Hardware Section 087100.

END OF SECTION

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SECTION 134900

RADIATION PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Radiation protection systems and supplementary items necessary for installation.
 - 1. Lead sheet, strip, and plate.
 - 2. Borated polyethylene sheets.
 - 3. Lead-lined gypsum board.
 - 4. Lead glass.
 - 5. Lead-lined hollow-metal doors.
 - 6. Lead-lined hollow-metal frames.
 - 7. Lead-lined solid core or split core flush wood doors.
 - 8. Neutron shielding doors and frames.
 - 9. Informational signs.
- B. Related Requirements:
 - 1. Division 03 Section Cast-in-Place Concrete for concrete floor topping over lead shielding in concrete slabs.
 - 2. Division 08 Section Hollow Metal Doors and Frames for additional door and frame requirements.
 - 3. Division 08 Section Solid Core Flush Wood Doors for additional door requirements.
 - 4. Division 08 Section Glazing for additional glazing requirements.

1.2 DEFINITIONS

- A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.
 - 1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Doors and Frames: Include construction details, material descriptions, core descriptions, fire-resistance ratings and finishes.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

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1. Show layout of radiation-protected areas, indicating lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
 2. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.
 3. Show details of joints between radiation protection materials.
 4. Include door details, including elevations, frame dimensions and profile, and clearances and undercuts.
 5. Neutron-Shielding Doors: Show details of neutron-shielding doors and frames, including anchorage to and coordination with other work. Show locations of electrical conduit and boxes for connecting door operators, door operator switches, and door interlock switches.
 - a. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: For assemblies with radiation protection materials, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Miscellaneous metal members that support lead bricks.
 2. Items penetrating radiation protection materials, including the following:
 - a. Electrical services.
 - b. Air outlets and inlets.
 - c. Sprinklers.
 - d. Access panels.
 - e. Other penetrations.
- D. Product Schedule: For observation windows, doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.
- B. Warranty:
 1. Provide manufacturer written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance for Data Neutron-Shielding Doors: For neutron-shielding doors to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.

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2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Electrical Components, Devices, and Accessories for Neutron-Shielding Doors: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
 - g. Sequence and schedule of radiation protection work in relation to other work.
 - h. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
 - i. Methods of attaching other construction and equipment to lead-lined finishes.
 - j. Notification procedures for work that requires modifying radiation protection.
 3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Lead-Lined Gypsum Panels: Store inside under cover, and keep dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.
- B. Lead-Lined, Hollow-Metal Doors or Frames: Comply with requirements in Division 08 Section Hollow Metal Doors and Frames for delivery, storage, and handling.

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- C. Lead-Lined Wood Doors: Comply with requirements in Division 08 Section Solid Core Flush Wood Doors for delivery, storage, and handling.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

- A. Warranty for Lead-Lined Wood Doors: Comply with requirements in Division 08 Section Solid Core Flush Wood Doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.
 - 1. A & L Shielding Inc.
 - 2. NELCO, Inc.
 - 3. Radiation Protection Products, Inc.
 - 4. Ray-Bar Engineering Corp.
- B. Lead Glass Manufacturers Only:
 - 1. Amerope Enterprises, Inc.
 - 2. McGrory Glass, Inc.
 - 3. Schott North America, Inc.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer unless otherwise indicated.

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2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
- C. Materials, thicknesses, and configurations of radiation protection products indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor upon request.
- D. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in lead-lined assemblies of not less than lead thickness indicated for doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other assemblies in which they are installed.
- E. Lead Glazing: Unless otherwise indicated, provide lead equivalence of not less than that indicated for assembly in which glazing is installed.
- F. Fire-Rated and Smoke-Control Door and Frame Assemblies: Comply with Division 08 Section Hollow Metal Doors and Frames and Division 08 Section Solid Core Flush Wood Doors.

2.4 LEAD SHEET, STRIP, AND PLATE

- A. Lead Sheet, Strip, and Plate: ASTM B749, Alloy UNS No. L51121 (chemical-copper lead).

2.5 BORATED POLYETHYLENE SHEETS FOR NEUTRON-SHIELDING DOORS

- A. Borated Polyethylene Sheets: High-density polyethylene containing not less than 5 percent boron.
 - 1. Color: As selected by Architect from manufacturer's standard selection.

2.6 LEAD-LINED GYPSUM BOARD

- A. Lead-Lined Gypsum Board: 5/8-inch- thick gypsum board complying with Division 09 Section Gypsum Board Assemblies, of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.
 - 1. Lead Sheet Lining: Full width and length of board unless Owner's radiation health physicist report indicates coverage to extend from floor to 84 inches above floor
 - a. Provide 2-inch- wide lead strips for backing joints.
 - b. Provide 3-inch- wide lead strips for wrapping metal stud flanges.
 - 2. Furnish finishing materials, accessories, and trim for lead-lined gypsum board complying with Division 09 Section Gypsum Board.
 - a. Provide 5/16 in (8 mm) lead disks for covering screw heads.

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- b. Provide lead-headed nails for fastening gypsum board, accessories, and trim to wood members.

2.7 LEAD GLASS

- A. Lead Glass: Lead-barium, polished glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
 - 1. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.
 - 2. Laminated Safety Glass: ASTM C1172 lead glass with thickness as needed to provide lead equivalence indicated laminated with polyvinyl butyral interlayer to clear float glass on both sides of lead glass.
 - a. Polyvinyl butyral interlayer or cured resin of manufacturer's standard thickness having a proven record with no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lights and installation.

2.8 LEAD-LINED HOLLOW-METAL DOORS

- A. Lead-Lined Hollow-Metal Doors: Steel doors complying with NAAMM-HMMA 861, except as indicated.
 - 1. Provide single continuous sheet of lead of thickness not less than that required for partition in which door is installed extending from top to bottom and edge to edge, supported by hat-channel stiffeners. Do not weld stiffeners through lead lining.
 - 2. Line-inverted channels at top and bottom of doors with lead sheet of same thickness used in door and close with filler channels to provide flush top and bottom edges.
 - 3. Shield cutouts for locksets with lead sheet of same thickness used in door. Overlap lining of cutouts with lining of door by 1 inch.
 - 4. Prepare doors to receive openings; factory cut and trim openings through doors. Furnish removable stops for glazed openings.
 - 5. Furnish lead-lined astragals for pairs of doors.
 - 6. Factory fit doors to suit frame-opening sizes indicated with 1/16-inch clearance at heads and jambs and minimum clearance at bottom.
 - 7. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
- B. Metal Frames for Glazed Lights: Lead-lined frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

2.9 LEAD-LINED HOLLOW-METAL FRAMES

- A. Hollow-Metal Frames: Steel frames complying with NAAMM-HMMA 861, except as indicated.
 - 1. Provide borrowed lite observation window frames with mitered and welded corners, allowing frame to be installed after construction of partition.
 - a. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch and furnish removable stops.

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- b. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.
- 2. Provide door and observation window frames from steel sheet with minimum thickness of 0.0667 inch.
- 3. Furnish with additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
- 4. Line frame with lead sheet of thickness not less than that required for doors and walls where frames are used. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
- 5. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.10 LEAD-LINED FLUSH WOOD DOORS

- A. Lead-Lined Flush Wood Doors: Wood doors complying with AWI "Architectural Woodwork Standards," except as indicated.
 - 1. Performance Grade:
 - a. ANSI/WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- B. Solid Core Door Construction: Manufacturer Option, one of the following:
 - 1. Lead-Lined Flush Wood Doors: Solid-core wood doors with lead sheet laminated to each side of core.
 - a. Construction: Hot pressed, bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before applying lead lining and faces.
 - 2. Lead-Lined Split-Core Wood Doors: Solid-core wood doors with lead lining in center of core.
 - a. Construction: Split core with lead lining in center of core; bonded (vertical and horizontal edging is bonded to core). Assemble lead lining and core with poured-lead fasteners or steel bolts. Space fasteners not more than 1-1/2 inches from door edge and about 8 inches o.c. Countersink bolt heads and cover with lead.
 - 3. Core: Comply with Division 08 Section Solid Core Flush Wood Doors.
 - 4. Lead Lining: Continuous sheets of lead extending from top to bottom and edge to edge; with total lead thickness not less than that required for partition in which door is installed.
- C. Prepare doors to receive glazed lights and louvers; factory cut and trim openings through doors. Provide removable wood stops for glazed lights.
- D. Metal Frames for Glazed Lights: Lead-lined frame formed of 0.048-inch- thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

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- E. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
- F. Furnish lead-lined astragals for pairs of doors.
- G. Factory fit doors to suit frame openings indicated with 1/16-inch clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

2.11 NEUTRON-SHIELDING DOORS AND FRAMES

- A. General: Steel plate doors lined with lead and borated polyethylene and hung from structural-steel door frames.
 - 1. Shielding Requirements: As indicated on drawings or refer to Owner-provided health physicist report.
 - 2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 3. Door Construction: Fabricate from 1/4 in thick steel plate faces, reinforced at hinge locations, and 1/2 in thick, steel flat-bar edges fully welded together. Continuously weld exposed joints and finish smooth, matching adjacent surfaces.
 - a. Apply filler to interior of door faces to provide smooth, even surfaces for applying lead and polyethylene. Bond lead to interior of door face with permanent adhesive.
 - b. Install lead in one piece and polyethylene in single or multiple sheets, all full height and width of door interior.
 - 4. Door Frame Construction: Fabricate from 1/4 in thick steel plate to dimensions indicated, fully welded together. Continuously weld exposed joints and finish smooth, matching adjacent surfaces.
 - a. Fabricate frames with depth equal to thickness of shielding wall in which door is installed. Rabbet frame to receive door and to provide a 4 in overlap between door edges and remaining frame depth. Make frame faces 4 in wide with 3/4 in deep backbends.
 - b. Provide steel strap anchors using 1/8 by 2 in wide straps of length required for a minimum 8 in embedment. Weld anchors to frame members not more than 8 in from both bottom and top of jambs and from ends of head, and space anchors not more than 24 in apart.
 - c. Provide channel-shaped sill fabricated from 1/4 in thick steel plate lined with lead. Make sill 1-1/2 in deep by same width as jambs and weld to door jambs.
 - 5. Shop-Primed Finish: Prepare ferrous-metal surfaces to comply with SSPC-SP 3 (Power Tool Cleaning) and apply an alkyd primer complying with MPI#79.
 - a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 6. Hardware: Provide the following hardware for each door:
 - a. Hinges: BHMA A156.1, Type A8391; weld- or bolt-on type at manufacturer's option; sized for door weight; two or three per door at manufacturer's option.
 - b. Pulls: BHMA A156.6, Type J401, two per door.

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- c. Operator: Power-opening and spring- or power-closing unit; with automatic hold-open; complying with BHMA A156.10; sized for door weight and width; and adjustable for opening, closing, and checking speeds. Unit shall have an emergency release to allow door to be opened manually and a disconnect switch to prevent power operation when door is in emergency-release mode.
 - d. Controls: Provide two wall-mounted, recessed, push-plate switches for opening door and one push-button switch for closing door. Provide motion or presence sensors to detect persons or objects in path of door and, if these are detected, to stop and reverse action of door operator.
7. Door Interlock Switch: Provide electric switch in frame jamb to prevent operation of radiation therapy equipment when door is open and to shut off power to equipment if door is opened while equipment is in use.
- a. Provide rough box for installing switch, fabricated from 1/4 in thick steel plate welded to frame and lined on all sides with 1/4 in thick lead plate.

2.12 INFORMATIONAL SIGNS

- A. High-Pressure-Laminate Signs: High-pressure laminate engraving stock with contrasting face and core, machine engraved from master templates for accurately formed letters, numbers, and symbols.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
 - 3. Indicate lead equivalence in millimeters and heights of radiation protection in inches.
- B. Rooms Where the Level of Protection is Uniform Throughout: Provide one sign for each room indicating lead equivalence of partitions, ceilings, floors, doors, and other portions of radiation protection enclosure. Indicate height of radiation protection above floor, or indicate that partitions are radiation protected to full height.
- C. Rooms Where the Level of Protection is not Uniform Throughout: Provide one sign for each room with different lead equivalences in different locations. Indicate, in tabular form, lead equivalence of each wall, partition, ceiling, floor, door, and window. Indicate height of radiation protection above floor, or indicate that partitions are radiation protected to full height. Indicate where lead equivalence changes or is not continuous.
- D. Rooms Where Some Partitions are without Radiation Protection: Provide one sign for each partition that contains radiation protection, and indicate its lead equivalence. Indicate height of radiation protection above floor, or indicate that partitions are radiation protected to full height.
- E. Rooms Where Only the Door has Radiation Protection: Provide one sign for each door indicating its lead equivalence.
- F. Mounting: Provide manufacturer's standard two-faced tape or adhesive.

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2.13 DOOR AND DOOR FRAME FABRICATION

- A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with door hardware schedule and templates furnished, as specified in Division 08 Section Door Hardware.

2.14 MISCELLANEOUS MATERIALS

- A. Glazing Compounds, Gaskets, and Accessories: Comply with requirements in Division 08 Section Glazing.
- B. Accessories and Fasteners: Manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.
- C. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Asphalt Felt: ASTM D226/D226M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Concrete Surfaces: Proceed with installation only after surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

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3.4 INSTALLATION OF LEAD SHEET, STRIP, AND PLATES

- A. Proceed with installation only after concrete surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.
- B. Coat concrete surfaces with asphalt emulsion before installing lead sheet.
- C. Lead Sheet, 1/8 Inch Thick or Less: Install in a single layer with a 2-inch minimum lap at joints.
- D. Lead Sheet More Than 1/8 Inch Thick: Install in two or more layers with a 2-inch minimum lap at joints, or in a single layer with joints butted and covered with a 4-inch- wide lead strip of same thickness.
- E. Extend lead sheet at least 12 inches beyond radiation shielding in walls of treatment room.
- F. In floor slabs above shielded rooms, where lead sheet is indicated, extend lead sheet at least 12 inches beyond radiation shielding in walls of room below.
- G. At door openings, extend lead sheet at least 12 inches beyond radiation protection in walls and at least 12 inches beyond door opening on both sides, except where lead-lined thresholds are provided.
- H. After installation, apply two coats of asphalt emulsion on top surface of lead sheet and protect from damage until concrete topping is placed.

3.5 INSTALLATION OF LEAD-LINED GYPSUM BOARD

- A. Install and finish lead-lined gypsum board in accordance with Division 09 Section Gypsum Board Assemblies.
- B. Install lead-lined gypsum board panels with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.
- C. Install lead-lined gypsum board panels in sequence, so lead lining that extends beyond edge of gypsum board is covered by next panel installed.
- D. At joints where lead lining does not extend beyond edge of gypsum board panels, install lead strips 2 inches wide and same thickness as lead lining to face of framing and blocking. Secure lead strips with construction adhesive.
- E. Provide shims at face of supports and blocking, where lead lining does not overlap, to provide a uniform plane across panel surfaces.
- F. Fasten lead-lined gypsum board to framing, with steel drill screws spaced as recommended in writing by lead-lined gypsum board manufacturer.
 - 1. Cover fasteners with lead disks recessed flush with surface of board.
- G. Two-Layer System: Apply a facing sheet of gypsum board vertically over base sheet, using laminating adhesive recommended in writing by gypsum board manufacturer. Offset joints in finish layer from joints in base layer and fasten at top and bottom of sheet to support finish panel until adhesive has set.

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1. Locate fasteners above ceiling or behind wall base. Cover fasteners with lead disks recessed flush with surface of board.
- H. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch. Arrange board around openings, so neither horizontal nor vertical joints occur at corners of openings.
- I. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.

3.6 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

- A. Install lead-lined steel doors and door frames in accordance with Division 08 Section Hollow Metal Doors and Frames.
 1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead comes in contact with masonry or concrete.
- B. Install lead-lined wood doors in accordance with Division 08 Section Solid Core Flush Wood Doors.
- C. Lead-Lined Hollow-Metal Door Frames: Comply with ANSI/NAAMM-HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.
- D. Lead-Lined Observation Windows: Install lead-lined hollow-metal frames, with leaded side of frame on radiation side of wall.
- E. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch.
- F. Lead Glazing: Comply with installation requirements in Division 08 Section Glazing and manufacturer's written instructions.
- G. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. Comply with Division 08 Section Door Hardware for additional installation requirements.
 1. Line astragals with lead sheet.

3.7 INSTALLATION OF PENETRATING ITEMS

- A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.
- B. Provide lead linings, sleeves, shields, and other protection in thickness of not less than that required in assembly being penetrated.
- C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.

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- D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch. Wrap conduit with lead sheet for a distance of not less than 10 inches from box.
- E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to 3 times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch.
- F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches from point of penetration.

3.8 INSTALLATION OF NEUTRON-SHIELDING DOORS AND FRAMES

- A. Installation of Door in Newly Placed Concrete Wall: Install frames in concrete forms before concrete is placed. Adjust frames as needed so they are square and within 1/16 in of plumb. Secure frames to forms and brace to resist forces resulting from concrete placement.
- B. Installation of Door in Existing Concrete Wall: Install frames in concrete openings and adjust as needed so they are square and within 1/16 in of plumb. Secure frames to concrete and brace to resist forces resulting from weight and movement of shielding door. Grout frames, consolidating grout to solidly fill spaces between frame and opening.
- C. Install doors in frames and install door operators, door controls, interlock switches, and other components according to manufacturer's written instructions and Shop Drawings.
- D. Touch up damaged primer with compatible coating after sanding smooth.
- E. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operators and controls for opening, closing, latching, and back-checking speeds and for open- and closed-door positions.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.
- B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.

3.10 PROTECTION

- A. Lock radiation-protected rooms once doors and locks are installed, and limit access to only those persons performing work in the rooms.

3.11 APPENDIX

- A. Owner's Radiation Health Physicist Report: Available to Contractor on request.

END OF SECTION

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SECTION 142100

ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Pre-engineered electric traction elevators and supplementary items necessary to complete their installation.
 - 1. Electric traction passenger elevators.
 - 2. Electric traction service elevators.
 - 3. Designated stretcher elevator complying with code requirements for stretcher.
- B. Related Requirements: Including but not limited to the following:
 - 1. Division 05 Section "Structural Steel Framing" for the following:
 - a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - b. Divider beams.
 - c. Hoist beams.
 - d. Structural-steel shapes for subsills.
 - 2. Division 05 Section "Metal Fabrications" for the following:
 - a. Pit ladders.

1.2 PRODUCT VARIATIONS AND ADJUSTMENTS

- A. Product Variations: In the event of differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts prior to awarding Contract. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
- B. Adjustments: Proposed deviations shall include a detailed analysis of impact to adjacent substrates, structural, mechanical, electrical or other building systems, including related design or construction cost impacts. Deviations causing changes in materials, constructability, substrates, systems or conditions shall be included in the Work at no additional cost to Owner.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

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- C. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
 - 2. Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work
 - 1. Include large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
 - a. Include machine room layout, required clearances and equipment isolation details.
 - b. Include large-scale layout of car-control station.
 - c. Include standby power operation control panel.
 - 2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
 - 3. Indicate variations from specified requirements.
- C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3 inch square Samples of sheet materials; and 4 inch lengths of running trim members.
 - 1. Signal Equipment and Fixtures: Architect shall select and approve all fixture selections from Manufacturer's premium fixtures.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room or control closet layout and dimensions, as shown on Drawings, and electrical service including standby power generator if applicable, as shown and specified, are adequate for elevator system being provided.
- B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- C. Warranty:
 - 1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

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1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 - 1. Diagnostic Test Equipment and Instructions: Provide all diagnostic test devices including one set of supporting information required to interpret test data and troubleshoot system.
 - 2. Maintenance: Vertical transportation system shall be designed such that the installation can be maintained by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.
 - 3. Keys: Provide four sets of keys to operate all keyed switches and locks.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal:
 - 1. Submit a continuing full-service maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 - 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 - 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
 - 1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor.
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

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- a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
- b. Review Contract Document requirements.
- c. Review approved submittals.
- d. Review inspection and testing requirements.
- e. Review environmental conditions and procedures for coping with unfavorable conditions.
- f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.10 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- C. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.11 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion.

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1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.
 - 1. Service Records: Installer shall provide a report of all service calls, maintenance service and repairs made during the initial maintenance service period.
 - 2. Perform maintenance, including emergency callback service, during normal working hours with two hour or less response time.
- B. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
- C. Parts: Contractor guarantees to sell parts, including circuit boards, to the Owner or Owner's Agent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".
 - 1. KONE Inc.
 - 2. TK Elevator.
 - 3. Delaware

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain elevators, including hydraulic passenger elevators when specified in another Section, from single manufacturer. Provide secondary components and car enclosures only as recommended by manufacturer of primary materials.
 - 1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable provisions of ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".

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- B. Accessibility Requirements: Comply with requirements of authorities having jurisdiction and Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.4 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator(s) Description - Elevator No(s). 1 and 2:
1. Machine Location: As indicated on Drawings.
 2. Machine Type:
 - a. Geared traction.
 3. Rated Load: 4000 lb.
 4. Rated Speed: 350 fpm.
 5. Operational and Supervisory Control System: Microprocessor based, variable voltage, variable frequency AC motion control.
 6. Auxiliary Operations:
 - a. Standby power operation.
 - b. Automatic dispatching of loaded car.
 - c. Nuisance call cancel.
 - d. Loaded-car bypass.
 - e. Distributed parking.
 - f. Off-Peak Operation.
 - g. Independent service for service elevator and all cars in group.
 7. Security Features:
 - a. Card-reader operation.
 - b. Car-to-lobby feature.
 8. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches.
 9. Car Enclosures:
 - a. As indicated on Drawings. Sheet A8.20
 - b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
 - c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
 - d. Inside Height: Unless otherwise indicated, 108 inches measured to underside of ceiling.
 - e. Door Faces (Interior):
 - 1) Satin stainless steel, No. 4 finish.
 - f. Door Sills:

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- 1) Aluminum.
 - g. Handrails: Unless otherwise indicated, 1-1/2 inches round at rear of car.
 - 1) Satin stainless steel, No. 4 finish.
 - h. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
10. Hoistway Entrances:
- a. Width: Unless otherwise indicated, 42 inches.
 - b. Height: Unless otherwise indicated, 84 inches.
 - c. Type:
 - 1) Single-speed center opening.
 - d. Doors and Frames at First Floor:
 - 1) Satin stainless steel, No. 4 finish.
 - e. Doors and Frames at Other Floors:
 - 1) Satin stainless steel, No. 4 finish.
 - f. Sills at First Floor:
 - 1) Aluminum, mill finish.
 - g. Sills at Other Floors:
 - 1) Aluminum, mill finish.
11. Hall Fixtures:
- a. Satin stainless steel, No. 4 finish.
12. Additional Requirements:
- a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.
 - b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

C. Elevator Description - Elevator No. 3:

- 1. Machine Location: As indicated on Drawings.
- 2. Machine Type:
 - a. Geared traction.
- 3. Freight Loading Class for Service Elevator: Class A.
- 4. Rated Speed: 350 fpm.
- 5. Operational and Supervisory Control System: Microprocessor based, variable voltage, variable frequency AC motion control.

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6. Auxiliary Operations:
 - a. Standby power operation.
 - b. Automatic dispatching of loaded car.
 - c. Nuisance call cancel.
7. Security Features:
 - a. Card-reader operation.
 - b. Car-to-lobby feature.
8. Single Car-Control Stations. Provide one car-control station in elevator.
9. Car Enclosures:
 - a. As indicated on Drawings. Sheet A8.20
 - b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
 - c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
 - d. Inside Height: Unless otherwise indicated, 108 inches measured to underside of ceiling.
 - e. Door Faces (Interior):
 - 1) Satin stainless steel, No. 4 finish.
 - f. Door Sills:
 - 1) Nickel silver.
 - g. Handrails: Unless otherwise indicated, 1-1/2 inches round at rear of car.
 - h. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
10. Hoistway Entrances:
 - a. Width: Unless otherwise indicated, 42 inches.
 - b. Height: Unless otherwise indicated, 96 inches.
 - c. Type:
 - 1) Two-speed center opening.
 - d. Doors and Frames at First Floor:
 - 1) Satin stainless steel, No. 4 finish.
 - e. Doors and Frames at Other Floors:
 - 1) Satin stainless steel, No. 4 finish.
 - f. Sills at First Floor:
 - 1) Nickel silver, polished.

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- g. Sills at Other Floors:
 - 1) Nickel silver, polished.
- 11. Hall Fixtures:
 - a. Satin stainless steel, No. 4 finish.
- 12. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.
 - b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

2.5 TRACTION SYSTEMS

- A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
 - 1. Provide non-regenerative system.
- B. Fluid for Hydraulic Buffers: If using hydraulic buffers, use only fire-resistant fluid.
- C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- D. Machine Beams: Provide framing as indicated in Drawings to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section "Structural Steel Framing" for materials and fabrication.
- E. Hoist Beams: Provide framing as indicated in Drawings to support elevator installation. Comply with Division 05 Section "Structural Steel Framing" for materials and fabrication.
- F. Car Frame and Platform: Welded-steel units.
- G. Guides: Provide guides at top and bottom of car and counterweight frames.
- H. Guide Rails: Provide guide rails of structural capacity required to span between available structural supports without additional secondary steel, unless indicated otherwise on Drawings.
- I. Counterweights: Provide counterweight for each elevator as required for weight of car and rated load.
 - 1. Provide counterweight safeties for elevators with occupied space below the elevator hoistway.
 - 2. Provide counterweight guards when elevator equipment layout requires compliance with counterweight guarding rules.

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2.6 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
 - 1. Firefighter's Service: Provide equipment and operation in accordance with Code requirements and Authorities Having Jurisdiction.
- B. Auxiliary Operations:
 - 1. Single-Car Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby or fire-command station in accordance with AHJ. Manual operation causes automatic operation to cease.
 - 2. Group Standby Power Operation:
 - a. On activation of standby power, cars are returned to a designated floor and parked with doors open. One car is returned at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby or fire-command station in accordance with AHJ. Manual operation causes automatic operation to cease.
 - 3. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
 - 4. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
 - 5. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
 - 6. Distributed Parking: When cars are not required for response to calls, they are parked with doors closed and distributed in predetermined zones throughout the building. One zone shall include the main floor and adjacent floors; remaining floors shall be divided into approximately equal zones.
 - 7. Off-Peak Operation: During periods of low traffic, half of the elevators in a group shall be taken out of service and switched to low power mode.
 - 8. Independent Service: Key switch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
 - 9. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.
 - 10. Firefighters' Emergency Operation: Provide Phase I and Phase II Firefighters' Service; comply with requirements of authorities having jurisdiction and applicable provisions of ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".

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- a. Firefighters Emergency Operation – Phase I Emergency Recall: The activation of a key switch at the designated level hall station shall express return all cars in the group to the designated floor and by-pass all car and hall calls. The cars shall park at the designated floor with the doors open and will not respond to car or hall calls unless the Phase II switch in the car is activated.
 - b. Firefighters Emergency Operation - Phase II: In-car key switch control of each elevator during the Emergency operation.
- C. Security Features: Security features shall not affect emergency firefighters' service.
 - 1. Card-Reader Operation: System uses card readers at car-control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space as indicated for card reader in car.
 - a. Coordinate requirements with Security access system equipment specified in "Access Control" unless otherwise indicated.
 - 2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations and hall push-button stations. Key is removable only in deactivated position.
 - 3. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car or all cars in a group to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.
- D. Electrical Wiring:
 - 1. Furnish and install complete insulated wiring to connect all parts of the equipment. Properly ground all components as required by National Electric Code.
 - 2. Provide 15% spare wires between each controller, selector, hoistway junction box, and control panel; also provide 15% spare conductors in each trail cable; all spares shall be properly tagged or otherwise identified with clear and indelible markings.
 - 3. Provide a total of twelve (12) shielded pairs for communication and security use in the traveling cables for each elevator. The shielded pairs shall be located in a cable which is not used to carry alternating current circuits. The shielded wiring shall extend to a junction box in the elevator controllers in machine room.

2.7 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.8 CAR ENCLOSURES

- A. General: Provide enameled or powder-coated steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

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1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 1. Floor Finish:
 - a. As scheduled or indicated in Design Selections; match samples accepted by Architect.
 2. Fabricate car with recesses and cutouts for signal equipment.
 3. Fabricate car door frame integrally with front wall of car.
 4. Sight Guards: Provide sight guards on car doors.
 5. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 6. Light Fixture Efficiency: Not less than 35 lumens/W.
 7. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).
 8. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.
 9. Emergency Exits: Provide emergency exits sized and located in each car in accordance with the Elevator Code.

2.9 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Fire-Protection Rating: 1-1/2 hours.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 1. Frames: Not less than 14 gauge.
 2. Doors: Not less than 16 gauge.
 3. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both inside surfaces of hoistway door frames.
 4. Entrance Jamb Plates: Cast metal plates complying with Elevator Code and Accessibility requirements.
 5. Sight Guards: Provide sight guards on doors matching door edges.
 6. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 7. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.
- D. Architecturally Exposed Hoistways: For hoistway equipment exposed to public view, provide finishes as selected by Architect.

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2.10 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs..
- B. Swing-Return Car-Control Stations: Provide car-control stations mounted on hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
 - 1. Unless indicated otherwise, include manufacturer's premium fixture selection and provide full width swing front return and car operating panels. Logos or manufacturer's name are not permitted on exposed surfaces.
 - 2. Mark buttons and switches for function. Use both tactile symbols and Braille.
 - 3. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
 - 4. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."
 - 5. Provide two car control stations in each passenger elevator; equip only one with required keyswitches.
 - 6. Provide two car control stations in each elevator with front and rear doors; locating one station at each door; equip only one with required keyswitches.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
 - 1. Provide emergency elevator communication systems for the deaf, hard of hearing and speech impaired when required Code or Authorities Having Jurisdiction.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet or telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Fire-Alarm System.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than two stations for each three elevators in a group.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
 - 3. Provide Firefighters Emergency Service – Phase I key switch in designated hall station.
 - 4. If required by authorities having jurisdiction, provide telephone jack in each unit for firefighters' two-way telephone communication service.
- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:

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1. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 1. At manufacturer's option, audible signals may be placed on cars.
- I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrances at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
 1. Integrate ground-floor hall lanterns with hall position indicators.
- J. Fire-Command-Center Annunciator Panel: When required by Code or Authorities Having Jurisdiction, provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
- K. Emergency Pictorial Signs: Unless otherwise indicated, Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.11 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
 1. Car Shell: Not less than 14 gauge.
 2. Car Canopy: Not less than 12 gauge.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates and areas to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

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- B. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

3.2 INSTALLATION

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance, unless otherwise indicated.
 - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

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1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- C. Operating Test: Load elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.
 1. Provide operating test on one elevator of each type, capacity, speed, and travel distance.
 2. Damage to car or adjoining structure caused by performance testing shall be repaired or replaced at no cost to Owner.
- D. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Temporary use of elevators for construction purposes is not allowed unless authorized by Owner. Comply with the following requirements for each elevator used for construction purposes:
 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 2. Provide strippable protective film on entrance and car doors and frames.
 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 5. Do not load elevators beyond their rated weight capacity.
 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.
 - a. Restore elevator sill(s) to new condition or replace with new sill(s).

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

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1. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION