Wayne State University
Elliman Fume Hood Relocation
WSU Project Number 629-304592
Prevailing Wage Work
Note – Electronic Bid Submissions

FOR:
Board of Governors
Wayne State University
Detroit, Michigan

Owner’s Agent:
Valerie Kreher, Senior Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3710 / 313-577-3747 fax
rftteam2@wayne.edu and copy leiann.day@wayne.edu

Owner’s Representative:
T. Allen Gligiotti, Project Manager
Facilities Planning & Management
Design & Construction Services
5454 Cass
Wayne State University
Detroit, Michigan 48202

Consultant:
Lord Aeck Sargent
213 S. Ashley Street, Suite 200
Ann Arbor, MI 48104

08/21/2018
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INFORMATION FOR BIDDERS

OWNER: Board of Governors
Wayne State University

PROJECT: Elliman Fume Hood Relocation
Project No. 629-304592

LOCATION: Wayne State University
421 E. Canfield
Detroit, Michigan 48202

OWNER’S AGENT: Valerie Kreher, Senior Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3710 / 313-577-3747 fax
rfpteam2@wayne.edu & copy leiann.day@wayne.edu

OWNER’S REPRESENTATIVE: T. Allen Gigliotti, Project Manager
Facilities Planning & Management
Design & Construction Services
Wayne State University
5454 Cass Avenue
Detroit, Michigan 48202

Architect: Lord Aeck Sargent
213 S. Ashley Street, Suite 200
Ann Arbor, MI 48104

SPECIAL NOTE: Right to reject any and all proposals, either in whole or in part and to waive any irregularities therein is reserved by the Owner.

BIDS ADVERTISED: 08/21/2018

BIDDING: Bidding documents may be obtained by vendors from the University Purchasing Web Site at http://go.wayne.edu/bids beginning 08/21/2018. When visiting the Web Site, click on the "Construction" link in green. Copies of the RFP will not be available at the pre-proposal meeting.

MANDATORY Pre-Bid Conference: 10:00 AM, local time, 08/29/2018 to be held at Wayne State University – Elliman Building 421 E. Canfield, Second Floor Room 2124, Detroit, MI, 48202. Late Arrivals may not be permitted to submit bids.

OPTIONAL Second Walk Through (if needed): To be determined at the conclusion of the pre-bid conference, by those in attendance.

DUE DATE FOR QUESTIONS: Due Date for questions shall be 09/04/2018 at 12:00 Noon. All questions must be reduced to writing and emailed to the attention of Valerie Kreher, Senior Buyer at rfpteam2@wayne.edu, copy to Leiann Day, Associate Director at: leiann.day@wayne.edu.

Bids Due: Sealed proposals for lump-sum General Contract will be received at the office of the Procurement & Strategic Sourcing by electronic submission on 09/11/2018, until 2:00 p.m. (local time). The link for bid submission will be posted with the bid details at http://go.wayne.edu/bids beginning 08/21/2018.

No public bid opening will be held.

Bid Qualification Meeting: Bidders must be available for bid prequalification meeting the day following the bid opening. The lowest qualified bidder will be contacted and requested to meet with Facilities Planning & Management at their office.
located at 5454 Cass Avenue, Detroit, MI 48202. During the bid qualification, the Vendor must provide a Project Schedule and a Schedule of Values, including a list of Contractor's suppliers, subcontractors and other qualifications.

An unsigned contract will be given to the successful Contractor at the conclusion of the bid qualification meeting, if all aspects of the bid are in order. The Contractor has 5 business days to return the contract to the Project Manager for University counter signature. The contractor must also submit a Performance Bond as outlined above and a Certificate of Insurance in the same 5 business day period. In the event the Contractor fails to return the documents in this 5 day period, the University reserves the right to award the contract to the next most responsive bidder.

All available information pertaining to this project will be posted to the Purchasing web site at http://go.wayne.edu/bids.
Information that is not posted to the website is not available/not known
INSTRUCTIONS TO BIDDERS

OWNER:
Board of Governors
Wayne State University

PROJECT:
Elliman Fume Hood Relocation
Project No. 629-304592

LOCATION:
Wayne State University
Elliman Building
421 E. Canfield,
Detroit, Michigan 48202

OWNER’S AGENT:
Valerie Kreher, Senior Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3710 / 313-577-3747 fax
rfpteam2@wayne.edu & copy leiann.day@wayne.edu

1. PROPOSALS

A. The Purchasing Agent will receive sealed Proposals for the work as herein set forth at the place and until the time as stated in the "Information for Bidders", a copy of which is bound herewith in these specifications. No public bid opening will be held.

B. Proposals shall be for a lump-sum General Contract for the entire work of the Project as provided in the Form of Proposal.

C. Proposals shall be submitted by electronic submission on forms furnished with the Bidding documents. The link for bid submission will be posted with the bid details at http://go.wayne.edu/bids beginning 08/21/2018. The forms must be fully filled out in ink or typewritten with the signature in longhand, and the completed forms shall be without alterations, interlineations, or erasures. Forms shall contain no recapitulations of the work to be done. Each proposal shall be delivered in an opaque sealed envelope, marked "PROPOSAL" AND SHALL BEAR THE NAME OF THE PROJECT AND THE NAME OF THE BIDDER. Proposals submitted by telephone or telegraph will not be accepted. Modifications by telephone or telegraph to previously submitted proposals will not be accepted.

D. (revised 5-29-2009) All base bids must be conforming to the detailed specifications and drawings provided by the University, including any Addenda issued. Voluntary Alternates will only be considered if the Contractor has also submitted a conforming base bid. Any stipulation of voluntary alternates or qualifications contrary to the Contract requirements made by the Bidder in or accompanying his proposal as a condition for the acceptance of the Contract will not be considered in the award of the Contract and will cause the rejection of the entire Proposal.

E. The competency and responsibility of Bidders will be considered in making the award. The Owner does not obligate himself to accept the lowest or any other bids. The Owner reserves the right to reject any and all bids and to waive any informalities in the Proposals.

2. PROPOSAL GUARANTEE (revised 3-22-2012)

A. A certified check or bank draft payable to the Owner, or satisfactory Bid Bond executed by the Bidder and Surety Company, in an amount equal to not less than five percent (5%) of the maximum proposal amount shall be submitted with each Proposal, which amount may be forfeited to the Board of Governors, Wayne State University, if the successful Bidder refuses to enter into a Contract within ninety (90) days from receipt of Proposals.
B. Bond must be issued by a Surety Company with an “A rating as denoted in the AM Best Key Rating Guide”

C. The bid deposit of all bidders except the lowest three will be returned within three (3) days after the bids are opened. After the formal Contract and bonds are approved, the bid deposit will be returned to the lowest three bidders, except when forfeited.

D. Bid bonds shall be accompanied by a Power of Attorney authorizing the signer of the bond to do so on behalf of the Surety Company.

E. Withdrawal of Proposals is prohibited for a period of ninety (90) days after the actual date of opening thereof.

3. CONTRACT SECURITY (revised 3-22-2012)

A. The successful Bidder will be required to furnish a Performance Bond and Labor and Material Payment bond in an amount equal to 100% of the contract award amount, and include such cost in the Proposal, complying with the laws of the State of Michigan. The graduated formula no longer applies.

B. Performance Bond and Labor and Material Payment Bond shall be from a surety company acceptable to the Owner and made payable as follows:
   
   (1) A bond for 100% of the contract award amount to the Board of Governors of Wayne State University, and guaranteeing the payment of all subcontractors and all indebtedness incurred for labor, materials, or any cause whatsoever on account of the Contractor in accordance with the laws of the State of Michigan relating to such bonds.
   
   (2) A bond for 100% of the contract award amount to the Board of Governors of Wayne State University to guarantee and insure the completion of work according to the Contract.

C. The only acceptable Performance Bond shall be the AIA A312 – 2010.

D. Bond must be issued by a Surety Company with an “A rating as denoted in the AM Best Key Rating Guide”.

4. BOND CLARIFICATION

For bids below $50,000.00,

A. Bid bond will not be required.
B. Performance Bond will not be required.

5. INSPECTION

A. Before submitting his Proposal, each Bidder shall be held to have visited the site of the proposed work and to have familiarized himself as to all existing conditions affecting the execution of the work in accordance with the Contract Documents. No allowance or extra consideration on behalf of the Contractor will subsequently be made by reason of his failure to observe the Conditions or on behalf of any subcontractor for the same reason.

6. EXPLANATION TO BIDDERS AND ADDENDA

A. Neither the Owner nor Representative nor Purchasing Agent will give verbal answers to any inquiries regarding the meaning of drawings and specifications, and any verbal statement regarding same by any person, previous to the award, shall be unauthoritative.

B. Any explanation desired by Bidders must be requested of the Purchasing Agent in writing, and if
INSTRUCTIONS TO BIDDERS

section 7. INTERPRETATION OF CONTRACT DOCUMENTS

A. If any person contemplating submitting a bid for the proposed Contract is in doubt as to the true meaning of any part of the drawings, specifications, or other Contract Documents, he may submit to the Purchasing Agent, a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the Contract Documents will be made by an addendum duly issued. A copy of such addendum will be mailed and delivered to each registered Bidder. Each proposal submitted shall list all addenda, by numbers, which have been received prior to the time scheduled for receipt of proposal.

section 8. SUBSTITUTION OF MATERIALS AND EQUIPMENT*

A. Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers’ or vendors’ names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided that the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance and function. It shall not be purchased or installed by the Contractor without the Architect's written approval.

section 9. TAXES

A. The Bidder shall include in his lump sum proposal and make payment of all Federal, State, County and Municipal taxes, including Michigan State Sales and Use Taxes, now in force or which may be enacted during the progress and completion of the work covered. Information regarding the State of Michigan sales and use tax laws can be found in SOM Revenue Administrative Bulletin 2016-18.

section 10. REQUIREMENTS FOR SIGNING PROPOSALS AND CONTRACTS

A. The following requirements must be observed in the signing of proposals that are submitted:

(1) Proposals that are not signed by individuals making them shall have attached thereto a Power of Attorney, evidencing the authority to sign the Proposal in the name of the person for whom it is signed.

(2) Proposals that are signed for partnership shall be signed by all of the partners or by an Attorney-in-Fact. If signed by an Attorney-in-Fact, there must be attached to the Proposal a Power of Attorney evidencing authority to sign the Proposal, executed by the partners.

(3) Proposals that are signed for a corporation shall have the correct corporate name thereof and the signature of the President or other authorized officer of the corporation, manually written in the line of the Form of Proposal following the words “signed by”. If such a proposal is signed by an official other than the President of the Corporation, a certified copy of resolution of the Board of Directors, evidencing the authority of such official to sign the bid, shall be attached to it. Such proposal shall also bear the attesting signature of the Secretary of the Corporation and the impression of the corporate seal.

section 11. QUALIFICATIONS OF BIDDERS

A. The Owner may request each of the three (3) low bidders to submit information necessary to satisfy the Owner that the Bidder is adequately prepared to fulfill the Contract. Such information may include past
INSTRUCTIONS TO BIDDERS

performance records, list of available personnel, plant and equipment, description of work that will be done simultaneously with the Owner's Project, financial statement, or any other pertinent information. This information and such other information as may be requested will be used in determining whether a Bidder is qualified to perform the work required and is responsible and reliable.

12. SPECIAL REQUIREMENTS

A. The attention of all Bidders is called to the General Conditions, Supplementary General Conditions, and Special Conditions, of which all are a part of the Specifications covering all work, including Subcontracts, materials, etc. Special attention is called to those portions dealing with Labor Standards, including wages, fringe benefits, Equal Employment Opportunities, and Liquidated Damages.

B. Prior to award of the project, the apparent low bidder will be required to produce a schedule of values which will include the proposed subcontractors for each division of work and whether the subcontractor is signatory or non-signatory. A contract will not be issued to the apparent low bidder until this document is provided. A contractor will have one week to produce this document. If the required document is not received within this time, the bidder will be disqualified.


A. The Proposal shall be deemed as having been accepted when a copy of the Contract (fully executed by both the vendor and the appropriate signatory authority for the University), with any/all Alternates, Addenda, and Pre-Contract Bulletins, as issued by the office or agent of the Owner has been duly received by the Contractor. After signing the Contracts, the Contractor shall then return all copies, plus any required bonds and certificates of insurance, to the office of the Owner's Representative, at 5454 Cass, Wayne State University, Detroit, MI 48202. Construction will begin when the fully-executed contract has been returned to the Contractor.

14. TIME OF STARTING AND COMPLETION

A. It is understood that the work is to be carried through to substantial completion with the utmost speed consistent with good workmanship and to meet the established start and completion dates.

B. The Contractor shall begin work under the Contract without delay, upon receipt of a fully-executed contract from the Owner, and shall substantially complete the project ready for unobstructed occupancy and use of the Owner for the purposes intended within the completion time stated in the Contract.

C. The Contractor shall, immediately upon receipt of fully-executed contract, schedule his work and expedite deliveries of materials and performance of the subcontractors to maintain the necessary pace for start and completion on the aforementioned dates.

15. CONTRACTOR'S PERFORMANCE EVALUATION (2-2015)

In an effort to provide continuous process improvement regarding the construction of various university projects, Wayne State University is embarking upon a process of evaluating the contractor's overall performance following the completion of work. At the conclusion of the construction project a subjective evaluation of the Contractor's performance will be prepared by the Project Manager and the supervising Director of Construction. The evaluation instrument that will be used in this process is shown in Section 00440-01 - Contractor's Performance Evaluation.

16. BIDDING DOCUMENTS

A. Bid specifications are not available at the University, but are available beginning 08/21/2018 through Wayne State University Procurement & Strategic Sourcing's Website for Advertised Bids: http://go.wayne.edu/bids. The plans for this project can be viewed in advance and/or printed from the above website. Copies of the RFP will not be available at the pre-proposal meeting.
B. DOCUMENTS ON FILE (revised 12-2007)

(1) Wayne State University Procurement & Strategic Sourcing’s Website.
All available information pertaining to this project will be posted to the Purchasing web site at http://go.wayne.edu/bids.
Information that is not posted to the website is not available/not known.

(2) Notification of this Bid Opportunity has been sent to those entities registered with our ListServ. Available ListServs can be found at http://www.forms.procurement.wayne.edu/Adv_bid/Adv_Bid_Listserve.html

(3) Please note: Effective December 1, 2007, bid notices will be sent only to those Vendors registered to receive them via our Bid Opportunities list serve. To register, to http://go.wayne.edu/bids, and click on the “Join our Listserv” link at the top of the page.

15. Smoke and Tobacco-Free Policies (9-2015)

On August 19, 2015, Wayne State joined hundreds of colleges and universities across the country that have adopted smoke- and tobacco-free policies for indoor and outdoor spaces. Contractors are responsible to ensure that all employees and all subcontractors’ employees are in compliance anytime they are on WSU’s main, medical, or extension center campuses. The complete policy can be found at http://wayne.edu/smoke-free/policy/.
NOTICE OF MANDATORY PRE-BID CONFERENCE

PROJECT:    Elliman Fume Hood Relocation

PROJECT NOS.: WSU PROJECT NO. 629-304592

It is MANDATORY that each Contractor proposing to bid on this work must attend a pre-bid conference at the following location:

Wayne State University Elliman Building
421 E. Canfield
Detroit, Michigan 48202
2nd Floor Room: 2124

The building is secured and requires card access. Someone will be at the door to admit participants. If someone comes later, dial #049 from the keypad at the left side, closest to the door.

10:00 AM, local time, 08/29/2018

Please use our online registration form at https://forms.wayne.edu/5aa587e3de04c#form-9162, to indicate your attendance at our mandatory Pre-proposal meeting to be held on, 08/29/2018 at 10:00 AM and your intent to submit a proposal for the services listed.

The purpose of this conference is to clarify the procedures, scope of work, and to identify any omissions and/or inconsistencies that may impede preparation and submission of representative competitive bids.

In the event that less than 4 individual contractor firms attend the pre-bid conference, the University reserves the right, at its sole discretion, to either reschedule the pre-bid conference or proceed and offer a second pre-bid conference date. (Attendance at only one pre-bid conference will be required).

An attendance list shall be prepared and minutes of the conference shall be furnished to all those attending.

Any clarifications or corrections that cannot be made at the conference will be by Addendum.

For your convenience a map of the University and appropriate parking lots can be downloaded and printed from: http://campusmap.wayne.edu/. Guest parking in any of the University student and guest lots is $8.00. A detailed list of Cash & Coin operated lots can be viewed at http://procurement.wayne.edu/cash_and_credit_card_lots.php. Cash lots dispense change in quarters. Due to time constraints, Vendors are encouraged to avoid parking at meters on the street (especially blue “handicapped” meters).

All available information pertaining to this project will be posted to the Purchasing web site at http://go.wayne.edu/bids.
Information that is not posted to the website is not available/not known.
AGENDA

I. Welcome and Introductions
   A. Wayne State University Representatives
   B. Vendor Representatives
   C. Sign in Sheet- be sure to include your company name and representative in attendance on the sign in sheet.

II. Brief Overview of Wayne State University
   A. Purpose and Intent of RFP.
   B. Detailed review of the RFP and the requirements for a qualified response.
   C. Review of all pertinent dates and forms that are REQUIRED for a qualified response.

III. Vendor Questions/Concerns/Issues
   A. Questions that can be answered directly by the appropriate person in this meeting will be answered and both question and answer will be recorded in the minutes of the meeting.
   B. Questions that need to be researched will be answered and a nature of clarification will be emailed to the appropriate ListServ. See http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_Bid_Listserve.html for a list of ListServ Bid Lists.
   C. Minutes will be emailed to the appropriate ListServ.
   D. Questions and concerns that come up after this meeting are to be addressed to Valerie Kreher, Procurement & Strategic Sourcing. Discussion with other University members is seriously discouraged and could lead to disqualification from further consideration. All questions and answers will be recorded and emailed to all participants of the RFP.
   E. Due date for questions is 09/04/2018, 12:00 noon.

IV. Minimum Participation
   A. Pre-registration for the Pre-Bid meeting is required. In the event that we do not have four (4) or more eligible bidders pre-registered, the University reserves the right to postpone the Pre-bid meeting with up to 4 business hour notice.
   B. If less than 4 individual contractor firms attend the mandatory pre-bid meeting, the University reserves the right, at its sole discretion, to either reschedule the pre-bid conference or proceed and offer a second pre-bid conference date. (Attendance at only one pre-bid conference will be required).
   C. On the day of the bid opening, if less than 3 sealed bids are received, the University reserves the right, at its sole discretion, to rebid the project in an effort to obtain greater competition. If the specifications are unchanged during the rebid effort, any contractor who submitted a bid will be given the option of keeping its bid on file for opening after the second bid effort, or of having the bids returned to them unopened.

V. Proposal Due Date- 09/11/2018, 2:00 p.m.

VI. Final Comments

VII. Adjourn
Sealed proposals for lump-sum General Contract will be received at the office of the Procurement & Strategic Sourcing by electronic submission on 09/11/2018, until 2:00 p.m. (local time). The link for bid submission will be posted with the bid details at http://go.wayne.edu/bids beginning 08/21/2018.

Please Note – Vendors must Pre-qualify themselves when responding to this bid opportunity. Our Prequalification questions can be found on page 4 of this section.

OWNER: Board of Governors
Wayne State University

PROJECT: Elliman Fume Hood Relocation

PROJECT NO.: WSU PROJECT NO. 629-304592

PROJECT TYPE: General construction including architectural, electrical, mechanical (HVAC & plumbing) Work

PURCHASING AGENT: Valerie Kreher, Senior Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3710/ 313-577-3747 fax
rfpteam2@wayne.edu & copy leiann.day@wayne.edu

OWNER’S REPRESENTATIVE: T. Allen Gigliotti, Project Manager
Design & Construction Services
Facilities Planning & Management
Wayne State University
5454 Cass Avenue
Detroit, Michigan 48202

TO: Board of Governors
Wayne State University
Detroit, Michigan

BASE PROPOSAL: The undersigned agrees to enter into an Agreement to complete the entire work of the Elliman Fume Hood Relocation project (WSU Project No. 629-304592) in accordance with the Bidding Documents for the following amounts:

$ Dollars

LAWN REPLACEMENT: The undersigned agrees that, in the event of existing lawn or landscaping damage, due to the Contractor’s work, that has not been properly addressed and repaired to the satisfaction of the University, the University may repair/replace the lawn and/or landscaping, and that the expense will be at a unit cost of $10.00 per square yard for lawn, and landscaping at a rate of 1.5 times the cost of said repairs, the full cost of which shall be reimbursed by the contractor.

CONTRACT CHANGE ORDERS: (revised 4-17-2017) The undersigned agrees to the following pricing formula and rates for changes in the contract work:
Where changed Work is performed, the Contractor may add to the total estimated actual cost for such Work no more than ten (10%) for subcontractor mark-up and seven and one-half percent (7.5%) for self-performed trade work for profit, overhead, insurance, taxes, indirect supervision, bonds, and any other costs not allowed by section 4.02.01

Within 14 days of the project’s contract execution Contractor shall provide to the Owner; Subcontractor’s hourly labor rate breakdown details. This requirement shall extend to the lowest level of subcontractor participation.

* Job and general overhead includes supervision and executive expenses; use charges on small tools, scaffolding, blocking, shores, appliances, etc., and other miscellaneous job expenses.

** Net labor cost is the sum of the base wages, fringe benefits established by governing trade organizations, applicable payroll taxes, and increased expense for contractor's liability insurance (Workman's Compensation, P.L. and P.D.).

TIME OF COMPLETION:
(revised 4-01-2011)
The Contract is expected to be fully executed on or about 25 calendar days after successful bidder qualification and recommendation of award. The undersigned agrees to start construction immediately after receipt of a fully executed contract, and to complete the work as follows:

Substantial Completion will be completed no later than 12/14/2018.

LIQUIDATED DAMAGES:
It is understood and agreed that, if project is not completed within the time specified in the contract plus any extension of time allowed pursuant thereto, the actual damages sustained by the Owner because of any such delay, will be uncertain and difficult to ascertain, and it is agreed that the reasonable foreseeable value of the use of said project by Owner would be the sum of $500.00, Five Hundred Dollars per day, and therefore the contractor shall pay as liquidated damages to the Owner the sum of $500.00, Five Hundred Dollars per day for each day's delay in substantially completing said project beyond the time specified in the Contract and any extensions of time allowed thereunder.

TAXES:
The undersigned acknowledges that prices stated above include all applicable taxes of whatever character or description. Michigan State Sales Tax is applicable to the work. Bidder understands that the Owner reserves the right to reject any or all bids and to waive informalities or irregularities therein.

ADDENDA:
The undersigned affirms that the cost of all work covered by the following Addenda are included in the lump sum price of this proposal.

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CONTRACTOR’S PREQUALIFICATION STATEMENT & QUESTIONNAIRE:

Our Minimum Requirements for Construction Bids are:

WSU considers this project: General construction including architectural, electrical, mechanical (HVAC & plumbing) Work.
### Elliman Fume Hood Relocation
WSU Project No. 629-304592

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Small Project bid less than $50,000</th>
<th>Medium Project bid between $50,001 and $250,000</th>
<th>Large Project bid between $250,001 and $2 million</th>
<th>Very Large Project bid greater than $2 million</th>
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</thead>
<tbody>
<tr>
<td>EMR Rating (Experience Modification Rating)</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
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<tr>
<td>Bondable Vendor</td>
<td>N.A.</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Length of Time in Construction Business</td>
<td>2 Years</td>
<td>3 Years</td>
<td>5 Years</td>
<td>5 Years</td>
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<tr>
<td>Demonstrated Experience in Projects Similar in Scope and Price in the last 3 years</td>
<td>1 or more</td>
<td>1 or more</td>
<td>2 or more</td>
<td>3 or more</td>
</tr>
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<td>Unsuccessful Projects on Campus in last 3 years</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
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<tr>
<td>Failure to comply with Prevailing Wage and/or Project Labor requirements</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
</tr>
<tr>
<td>Withdrawn University Bid (with or without Bond forfeiture) within the last 3 years **</td>
<td>1 or less</td>
<td>1 or less</td>
<td>1 or less</td>
<td>1 or less</td>
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<tr>
<td>Company currently not in Chapter 11 of the US Bankruptcy Code</td>
<td>1 Year</td>
<td>2 Years</td>
<td>3 Years</td>
<td>3 Years</td>
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** Withdrawal of a bid is subject to the University suspension policy, for a period up to one year.

**Contractors must complete the following information to determine their eligibility to participate in this bid.** This information is required with your Bid to the University.

Failure to complete this form in its entirety will result in your bid being disqualified.

Check one of the following on the makeup of your company:

- [ ] Corporation
- [ ] Individual
- [ ] Partnership
- [ ] Joint Venture
- [ ] Other (Explain below):

- [ ]

---

**Diversity Classification:** Please indicate the appropriate diversity classification for your company. The University recognizes the following groups as diverse or disadvantaged:

- Majority Owned
- Minority Business Enterprises (MBE)
- Women Business Enterprises (WBE)
- Disabled Veteran Enterprises (DVBE)
- Disabled Person Enterprises (DBE)
- Veteran Owned Businesses (VBE)
- Small Businesses per the US Small Business Administration (SBE)
- Other (Please Explain):
1. How many years has your organization been in business as a contractor? _________________

2. How many years has your organization been in business under its present business name? _________________

3. List states in which your organization is legally qualified to do business. _________________

4. Provide the Name and Address of your Liability Insurance Carrier. _________________

5. What is your current EMR Rating?  
The minimum requirement is an EMR Rating of 1.0 or less for all projects. Bidders with a rating higher than 1.0 understand that their bid may be disqualified, at the sole discretion of the University.

6. What percentage of work performed on projects are by company employees; excluding any hired subcontracting and outsourced relationships, for the bid submitted? _______ %

7. What percentage of work performed on your companies behalf are by subcontracted business relationships; disallowing 1099 contracting work forces, for the bid submitted? _______ %

8. Have you ever failed to complete any work awarded to you? If so, attach a separate sheet of explanation. Include the name of the Project, the customer, the dates of the work, and the amount of the contract?

9. Have you withdrawn a bid after a University bid opening and/or refused to enter into a contract with the University upon notification of award within the last 3 years? If so, state the Project Name and Number, and the date of bid submission below.

10. Has any officer or partner of your organization ever been an officer or partner of another organization that failed to complete a construction contract? If so, attach a separate sheet of explanation.

11. List the construction experience of the principals and superintendents of your company.

   Name: __________________________________ Title: _____________________________________
   ___________________________________________________________________________________

   Name: __________________________________ Title: _____________________________________
   ___________________________________________________________________________________

   Name: __________________________________ Title: _____________________________________
   ___________________________________________________________________________________

12. List the construction Projects, and approximate dates, when you performed work similar in Scope to this project.

   ____________________________________________________________
   ____________________________________________________________
13. List the construction Projects, and approximate dates, when you performed work similar in Dollar Amount to this project.

<table>
<thead>
<tr>
<th>Project</th>
<th>Owner</th>
<th>Contract Amount</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Owner</td>
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</tr>
<tr>
<td>Project</td>
<td>Owner</td>
<td>Contract Amount</td>
<td>Date Completed</td>
</tr>
</tbody>
</table>

14. Is your Company “bondable”? Yes ______ No ______

15. What is your present bonding capacity? $ __________________________

16. Who is your bonding agent?

NAME: __________________________
ADDRESS: __________________________
PHONE: ( ______ ) __________________________
CONTACT: __________________________

17. Does your company agree to provide financial reports to the University upon request? Failure to agree may result in disqualification of your bid. Yes ______ No ______

18. Does your company agree that all of the Terms and Conditions of this RFP and Vendor’s Response Proposal become part of any ensuing agreement? Yes ______ No ______

19. Does your company agree to execute a contract containing the clauses shown in Section 00500 “Agreement Between Contractor and Owner for Construction”? Yes ______ No ______

   If “No”, clearly note any exceptions to any information contained in the contract documents and include with your proposal.

20. Did your company quote based upon Prevailing Wage Rates? Yes ______ No ______

21. Does your company agree to comply with the University Smoke and Tobacco Free Policies? Yes ______ No ______

   Note: Contractors submitting proposals for this project may, at the discretion of the University, be required to submit references including contact information to be used to assist in the post bid evaluation process for the subject project.

ACKNOWLEDGEMENT OF

The undersigned has read and understands the minimum qualifications.
MINIMUM QUALIFICATIONS: for University construction projects, and has completed the Prequalification section completely and accurately. The undersigned understands that a contractor, who fails to meet the minimum qualifications in the category identified for this project, will be disqualified from consideration for the project.

ACCEPTANCE OF PROPOSAL: The undersigned agrees to execute a Contract, being the Wayne State University standard form titled “Agreement Between Contractor and Owner for Construction” (see section 00500 of the bid documents), provided that we are notified of the acceptance of our Proposal within sixty (60) days of the date set for the opening thereof.

The undersigned below understands that the bid will be disqualified if the Prequalification information above is not completed in its entirety.

NAME OF COMPANY: __________________________________________

OFFICE ADDRESS: __________________________________________

PHONE NUMBER: __________________________ DATE ____________

FAX NUMBER: __________________________________________

SIGNED BY: __________________________________________

______________________________

Signature

______________________________

(Please print or type name here)

TITLE: __________________________________________

EMAIL ADDRESS: __________________________ @ ____________
PREVAILING WAGE RATE SCHEDULE (revised 4-05-2010)

A. See also Page 00100-4 Section 12.B

B. Wayne State University requires all project contractors, including subcontractors, who provide labor on University projects to compensate at a rate no less than prevailing wage rates.

C. The rates of wages and fringe benefits to be paid to each class of laborers and mechanics by each VENDOR and subcontractor(s) (if any) shall be not less than the wage and fringe benefit rates prevailing in Wayne County, Michigan, as determined by the United States Secretary of Labor. Individually contracted labor commonly referred to as “1099 Workers” and subcontractors using 1099 workers are not acceptable for work related to this project.

D. Certified Payroll must be provided for each of the contractor’s or subcontractor’s payroll periods for work performed on this project. Certified Payroll should accompany all Pay Applications. Failure to provide certified payroll will constitute breach of contract, and pay applications will be returned unpaid, and remain so until satisfactory supporting documents are provided.

A Prevailing Wage Rate Schedule is enclosed as Appendix A.

Additional information can be found on the University Procurement & Strategic Sourcing’s web site at the following URL address:

http://procurement.wayne.edu/vendors/wage-rates.php

E. Wayne State University's Prevailing Wage Requirements:

When compensation will be paid under prevailing wage requirements, the University shall require the following:

A. The contractor shall obtain and keep posted on the work site, in a conspicuous place, a copy of all current prevailing wage and fringe benefit rates.

B. The contractor shall obtain and keep an accurate record showing the name and occupation of and the actual wages and benefits paid to each laborer and mechanic employed in connection with this contract.

C. The contractor shall submit a completed certified payroll document [U.S. Department of Labor Form WH 347] verifying and confirming the prevailing wage and benefits rates for all employees and subcontractors for each payroll period for work performed on this project. The contractor shall include copies of pay stubs for all employee or contract labor payments related to Wayne State University work. The certified payroll form can be downloaded from the Department of Labor website at http://www.dol.gov/whd/forms/wh347.pdf.

D. A properly executed sworn statement is required from all tiers of contractors, sub-contractors and suppliers which provide services or product of $1,000.00 or greater. Sworn statements must accompany applications for payment. All listed parties on a sworn statement and as a subcontractor must submit Partial or Full Conditional Waivers for the amounts invoiced on the payment application. A copy of the acceptable WSU Sworn Statement and Waiver will be provided to the awarded contractor.

E. Apprentices for a skilled trade must provide proof of participation in a Certified Apprenticeship Program and the level of hours completed in the program.

F. Daily project sign-in sheets and field reports for the project must be turned in weekly.

Note: Contractor invoices WILL NOT be processed until all listed certified payroll documents are received.

G. If the VENDOR or subcontractor fails to pay the prevailing rates of wages and fringe benefits and does not cure such failure within 10 days after notice to do so by the UNIVERSITY, the UNIVERSITY shall have the right, at its option, to do any or all of the following:
1. Withhold all or any portion of payments due the VENDOR as may be considered necessary by the UNIVERSITY to pay laborers and mechanics the difference between the rates of wages and fringe benefits required by this contract and the actual wages and fringe benefits paid.

2. Terminate this contract and proceed to complete the contract by separate agreement with another vendor or otherwise, in which case the VENDOR and its sureties shall be liable to the UNIVERSITY for any excess costs incurred by the UNIVERSITY.

3. Propose to the Director of Purchasing that the Vendor be considered for Debarment in accordance with the University’s Debarment Policy, found on our website at http://procurement.wayne.edu/docs/appm28.pdf

Terms identical or substantially similar to this section of this RFP shall be included in any contract or subcontract pertaining to this project.

H. Prior to award of the project, the apparent low bidder will be required to produce a schedule of values which will include the proposed subcontractors for each division of work and whether the subcontractor is signatory or non-signatory. A letter of intent or contract will not be issued to the apparent low bidder until this document is provided. The apparent low bidder will have one week to produce this document. If the required document is not received within this time, the bidder will be disqualified, and the next low bidder will be required to provide this schedule of values.
APPENDIX A FOR THE
PREVAILING WAGE SCHEDULE FOR THIS PROJECT

See web site:

http://go.wayne.edu/bids
Key Performance Indicator Tracking
Sworn Statement Requirements

The University tracks its level of spend along a number of socio-economic categories. This includes its spend with Diverse organizations, its spend with Detroit based organizations, and its spend with Michigan based organizations. To assist with this, The University has the following requirements for submission of your bid and for Pay Applications submitted by the successful contractor.

Submission of Bid

1. **Diverse or disadvantaged prime contractor:** Please specify in your bid whether ownership of your company is a certified diverse or disadvantaged business, according to the categories listed previously in section 00300. In accordance with guidelines from the MMSDC and GL-WBC, the University considers a business to be diverse when it is at least 51% owned, operated, and controlled by one or more members of a diverse classification. Section 00300 has a place for this information on page 00300-3.

2. **Detroit based and Michigan Based contractor:** It is presumed that the contractor is headquartered at the location we submit our Purchase Orders to, and that it should be the same address as listed in Section 00300 at the signature line. If a supplier is headquartered elsewhere, please make note of this information, so we do not inaccurately include or exclude spend.

Pay Applications and Sworn Statements

1. **Applicability:** The University requires Sworn Statements with Pay Applications for all construction projects that use
   - Subcontractors greater than $1,000.00
   - Significant suppliers (those with a purchase value of $1,000 or more).

2. **Sworn Statements:** The Supplier must submit applicable monthly sworn statements to the Project Manager and the Buyer of Record, in the format shown on page 2 of Section 00420. Sworn Statements are “always required” for this project, and are to be submitted to **(Project Manager)**, the project manager, and to **Valerie Kreher, Senior Buyer**

3. **Inclusion:** Sworn Statements are to detail the inclusion of recognized diverse and disadvantaged groups in the following 2 categories; Subcontracts or Suppliers. The University recognizes the following groups as diverse or disadvantaged:
   - Minority Business Enterprises (MBE)
   - Women Business Enterprises (WBE)
   - Disabled Veteran Enterprises (DVBE)
   - Disabled Person Enterprises (DBE)
   - Veteran Owned Businesses (VBE)
   - Small Businesses per the US Small Business Administration (SBE)

4. A complete set of the University’s Supplier Diversity Program, which includes complete definitions of each of the above, can be downloaded from our web site at [http://policies.wayne.edu/administrative/04-02-supplier-diversity.php](http://policies.wayne.edu/administrative/04-02-supplier-diversity.php).
STATE OF MICHIGAN

COUNTY OF ____________________ } §

____________________________________________________________________________

__________________________, being duly sworn, deposes and says that (s)he makes the Sworn Statement on behalf of ________________________, who is the Contractor for an improvement to the following described real property situated in County, Michigan, and described as follows:

That the following is a statement of each subcontractor and supplier and laborer, for which laborer the payment of wages or fringe benefits and withholdings is due but unpaid, with whom ______________________ has subcontracted for performance under the contract with the Owner or lessee thereof, and that the amounts due to the persons as of the date thereof are correctly and fully set forth opposite their names, as follows. (Subcontracts or suppliers of values of less than $1,000 are omitted.)

<table>
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<tr>
<th>NO.</th>
<th>SUBCONTRACTOR</th>
<th>TYPE OF ENTITY</th>
<th>TYPE OF IMPROVEMENT</th>
<th>TOTAL CONTRACT PRICE</th>
<th>CONTRACT CHANGE +/-</th>
<th>ADJUSTED CONTRACT AMOUNT</th>
<th>AMOUNT PAID TO DATE</th>
<th>AMOUNT CURRENTLY OWING</th>
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**TOTALS**

*Type of Entity: MBE=Minority Business Enterprises; WBE=Women Business Enterprises; DVBE=Disabled Veteran Enterprises; DBE=Disabled Person Enterprises; VBE=Veteran Owned Businesses; SBE=Small Businesses per the US Small Business Administration

Please attach additional sheets if the number of items exceeds the page limit.
Elliman Fume Hood Relocation
WSU Project No. 629-304592

That ________________________________________________ has not procured material from, or subcontracted with, any person other than those set forth above and owes no money for the improvement.

Deponent further says that ________________________________________________ makes the foregoing statement as a representative of _________________________________________________________, for the purpose of representing to the owner or lessee of the above-described premises and his or her agents that the above-described property is free from claims of construction liens, or the possibility of construction liens, except as specifically set forth above and except for claims of construction liens by laborers which may be provided pursuant to section 109 of the construction lien act, Act No. 497 of the Public Acts of 1980, as amended, being section 570.1109 of the Michigan Compiled Laws.

__________________________
Deponent Signature

WARNING TO DEPONENT: A PERSON, WHO WITH INTENT TO DEFRAUD, GIVES A FALSE STATEMENT IS SUBJECT TO CRIMINAL PENALTIES AS PROVIDED IN SECTION 110 OF THE CONSTRUCTION LIEN, ACT, ACT NO. 497 OF THE PUBLIC ACTS OF 1980, AS AMENDED, BEING SECTION 570.2220 OF THE MICHIGAN COMPILED LAWS.

ON RECEIPT OF THIS SWORN STATEMENT, THE OWNER OF LESSEE, OR THE OWNER’S OR LESSEE’S DESIGNEE, MUST GIVE NOTICE OF ITS RECEIPT, EITHER IN WRITING, BY TELEPHONE, OR PERSONALLY, TO EACH SUBCONTRACTOR, SUPPLIER AND LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING UNDER SECTION 109 OR, IF A NOTICE OF FURNISHING IS EXCUSED UNDER SECTION 108 OR 108A, TO EACH SUBCONTRACTOR, SUPPLIER OR LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING OR WHO IS NAMED IN THE SWORN STATEMENT MAKES A REQUEST, THE OWNER, LESSEE, OR DESIGNEE SHALL PROVIDE THE REQUESTER A COPY OF THE SWORN STATEMENT WITHIN 10 BUSINESS DAYS AFTER RECEIVING THE REQUEST.

WARNING TO OWNER: AN OWNER OR LESSEE OF THE ABOVE-DESCRIBED PROPERTY MAY NOT RELY ON THIS SWORN STATEMENT TO AVOID THE CLAIM OF A SUBCONTRACTOR, SUPPLIER, OR LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING OR A LABORER WHO MAY PROVIDE A NOTICE OF FURNISHING PURSUANT TO SECTION 109 OF THE CONSTRUCTION LIEN ACT TO THE DESIGNEE IS NOT NAMED OR HAS DIED.

Subscribed and sworn to before me this ___________ day of ________________

__________________________
Notary Public

__________________________
County, Michigan - My commission expires: ____________________________
WAYNE STATE UNIVERSITY
PAYMENT PACKAGE DOCUMENT REQUIREMENTS (Revised 7-23-2015):

Review and comply with Section 410 of Bid Front End Documents.
Review and comply with Article 15 of the Supplemental General Conditions.

PAYMENT APPLICATION - AIA document G702 & G703 (or equivalent) – Checklist:

- Correct Project Name – Found on your contract.
- Correct Project Number – Found on your contract.
- Purchase Order Number – Required prior to beginning work.
- Correct Application Number.
- Correct Period Reporting Dates – Applications support docs must be sequential and within application range.
- Approved & Executed Change Orders Listed. (Cannot invoice for unapproved Change Orders)
- Schedule of Values percentages and amounts match the approved Pencil Copy Review – Signed by the Architect, Contractor, and University Project Manager.
- Correct Dates – Back dating not accepted.
- Signed and Notarized.

SWORN STATEMENT – Checklist:

- List all contractors, sub-contractors, suppliers… ≥ $1000.00
- A sworn statement is required from every Sub Contractor on the job with a material purchase or sub-contract of $1,000 or more. (All tiers.)
- Purchase Order Number
- Dates – Back dating not accepted.
- Signed and Notarized.

CERTIFIED PAYROLL - Dept. of Labor Form WH-347 – Checklist: (Union and Non-Union)

- For every contractor & sub-contractors work, for each week within the application reporting period.
- Correct Project Number
- List ALL workers on-site.
- Make sure their addresses are listed.
- Social Security Numbers MUST be blackened out or listed in XXX-XX-1234 format.
- Work classifications based on the job specific Prevailing Wage Schedule descriptions.
- For any workers paid at the Apprenticeship rates - proof of enrolled program and current completion required.
- Rate of Pay verified against the Prevailing Wage Schedule with an hourly cost breakdown of fringes paid.
- Authorized signatures on affidavit.
- Dates – must represent the weeks within the application period.

APPLICATION PACKAGE SUPPORTING DOCUMENTATION –

- Copies of Pay Stubs for each Certified Payroll period reported may be required– (Social Security Numbers MUST be blackened out or listed in XXX-XX-1234 format. Pay stubs need to reflect claimed participation of fringes like Medical, Dental, Retirement or 1099 classification.)
Proof of Ownership for any ‘Owner Operator’ contractors not wishing to claim their time on prevailing wage. – (Must list their hours and dates worked on the WH-347 Form and enter EXEMPT on the income brackets.) The Owner must provide copies of “DBA” registration form confirming status as exempt from prevailing wage requirements.

Proof of Stored Materials – Bill of Lading, Delivery Receipts, Pictures, Certificate of Insurance or endorsement pate specifically insuring stored material at location, and pictures with materials clearly separated and labeled for WSU. The University reserves the right to on site verification of stored materials.

Partial Conditional Waivers – The contractor shall provide covering the entire amount of the application. For non-bonded projects all sub-contractors must provide for all applications which they have a draw.

Partial Unconditional Waivers – Must release amount paid for work and be delivered starting with application #2 and in no case after payment application #3, through all sequential applications for contractors, sub-contractors, and suppliers listed on the Sworn Statements.

Full Unconditional Waivers – Must be delivered with final payment application, releasing all contractors, sub-contractors, suppliers listed on the sworn statements and any legitimate notice of furnishings reconciled.

FINAL PAYMENT APPLICATION – Checklist:
- Clear and concise As-Built drawings.
- Operation and Maintenance Manuals
- Process and training directions (if applicable).
- Warranty of work in accordance with project documents.
- Submittals log and samples installed on the job.
- Certificate of Substantial Completion
- Full Unconditional Waiver

The Project Manager may provide additional requirements as may apply to individual jobs

Revised 7-23-2015
Contractor Performance Evaluation

In an effort to provide continuous process improvement regarding the construction of various university projects, Wayne State University is embarking upon a process of evaluating the contractor’s overall performance following the completion of work. At the conclusion of the construction project a subjective evaluation of the Contractor’s performance will be prepared by the Project Manager and the supervising Director of Construction. The evaluation instrument that will be used in this process is presented below:
## Contractor Evaluation Sheet

**Contractor Name:** ____________________________________  **Project Name:** ______________________________________

**Contractor’s PM:** ____________________________________  **PM Name:** ________________________________________

**Superintendent:** ____________________________________  **Project Number:** ________________

**Designer:** ________________________________________  **PO#:** ___________________

### EVALUATION SCORING:

1 = Unacceptable, 2 = Less than Satisfactory, 3 = Satisfactory or Neutral, 4 = Good, 5 = Excellent

Note: Comments are REQUIRED if any score is less than 3. Write comments on the back of the evaluation.

### Field Management

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<tr>
<th>Field Management</th>
<th>Score</th>
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<td>1) Work Planning / Schedule:</td>
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<td>2) Compliance with Construction Documents:</td>
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<tr>
<td>3) Safety Plan &amp; Compliance:</td>
<td>1 2 3 4 5</td>
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<td>4) Compliance with WSU procedures:</td>
<td>1 2 3 4 5</td>
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<td>5) Effectiveness of Project Supervision:</td>
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<td>6) Project Cleanliness:</td>
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<td>7) Punch List Performance:</td>
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<td>8) Contractor Coordination with WSU Vendors:</td>
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<td>9) Construction Quality:</td>
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<td>12) Contractor Professionalism:</td>
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<td>13) Subcontractor Professionalism:</td>
<td>1 2 3 4 5</td>
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<tr>
<td>14) Compliance with Contract Requirements:</td>
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<td>15) Submittal\RFI Process:</td>
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<td>16) Close-out - Accuracy of Documents</td>
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### Invoice and Change Management

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<td>18) Applications for Payment</td>
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<td>19) Timely payment of Subs/Suppliers:</td>
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### One year follow up

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<td>20) Level of Self-Performance:</td>
<td>Low Med High</td>
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<tr>
<td>21) Would you work with this Contractor again?</td>
<td>Yes No</td>
<td></td>
<td></td>
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<tr>
<td>22) Would you work with this team again?</td>
<td>Yes No</td>
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**Evaluator**

Signature__________________________________  Date:________________________

Title:______________________________________

Name:______________________________________

Please Print

CONTRACTOR'S EVALUATION EVALUATION

Rev. 2-17-2015 RGP
We are providing the evaluation instrument at this time to allow the bidder's to review and understand the criterion that the University's project management team will use to evaluate the successful bidder's performance at the conclusion of the project. It is the intent of the university to utilize the results of this evaluation to determine if it will continue to conduct business with the Contractor in future bidding opportunities.

The scoring range is between 100 to 500 points, with 100 being low and 500 being high. Each question has an associated 'weight' factor, and the higher the weight; the greater the importance of satisfactory performance on the final score. At the conclusion of the project, and after the Project Manager and the supervising Director has prepared their independent evaluation, the University's project representative will meet with the Contractor to review the results. Acceptable contractor performance is essential to avoid having the University decline future work with the Contractor. An appeals process is available for Contractor disagreement with evaluation scores.

Contractors engaged in work are encouraged to maintain an open and regular dialog with the Design and Construction Department over the course of the construction project to ensure that the final evaluation is an accurate representation of the Contractor's performance.
CONSOLIDATED AGREEMENT FOR CONSTRUCTION GENERAL CONTRACTING

BOARD OF GOVERNORS OF WAYNE STATE UNIVERSITY
DETROIT, MICHIGAN

With

[GENERAL CONTRACTOR'S NAME]

For

[NAME PROJECT]

Wayne State University Contract Number [ ]

This Agreement is entered into on [ ], by and between the Board of Governors of Wayne State University, called "University" in this Agreement, and [CONTRACTOR NAME], called "Contractor" in this Agreement, to provide construction labor and materials as outlined in the Bid accepted [ENTER DATE HERE], attached to this Agreement as Exhibit A, for the Project described in this Agreement.

[ENTER A BRIEF DESCRIPTION OF THE PROJECT]
1.00 CONTRACT DOCUMENTS

The Contract Documents shall consist of this Agreement, the Contractor’s Bid or Proposal attached to this Agreement as Exhibit A only insofar as consistent with the other Contract Documents, the General Conditions of Construction, the Supplementary General Conditions, the approved plans and specifications, and other documents listed in Article 11, Inclusion by Reference. In the case of conflicts between the Contractor’s Bid and this Agreement or other Contract Documents, the language of this Agreement and the other Contract Documents shall prevail over the Contractor’s Bid or Proposal.

2.00 DESIGN PROFESSIONAL

The Design Professional for this Project is:

[NAME]
[ADDRESS]

The University intends that the relationship between the Contractor, Design Professional and University will be one of mutual cooperation and respect in order to promote efficiency and quality in the Project work.

3.00 CONTRACTOR’S RESPONSIBILITIES

3.01 Scope of Work

The Contractor shall furnish all labor, materials, equipment, project management and construction superintendent services necessary to construct the Work in accordance with the approved Contract Documents and executed Change Orders, including requirements reasonably inferable therefrom.

3.02 Skill and Judgment

The Contractor covenants with the University to furnish its best skill and judgment in furthering the interests of the University as defined in the Contract Documents. The Contractor shall perform all obligations under the Contract Documents using efficient business administration, superintendence and best efforts to facilitate the expeditious and timely completion of the Project consistent with the interests of the University as expressed in the Contract Documents. The Contractor acknowledges that significant effort will be invested in complying with the Contractor’s Construction Schedule, and in maintaining construction quality. Accordingly, the Contractor further acknowledges that the greatest degree of professionalism is expected from the Contractor and the Design Professional in accomplishing their respective contractual obligations and that when potential conflicts exists, each shall demonstrate appropriate respect, professionalism and cooperation with each other in resolving such conflicts.

3.03 Scheduling

The Contractor shall develop a Contractor’s Construction Schedule that clearly indicates the interrelationship of activities and defines the critical path of the entire Project. The Contractor shall submit a preliminary Contractor’s Construction Schedule, by the earlier of fifteen (15) days from either the Notice to Proceed or the execution of this Agreement. The Contractor shall provide iterative updates to the
Contractor’s Construction Schedule with each Application for Payment, but no less than monthly. Upon request by the University, the Contractor shall prepare and submit a resource-loaded Contractor’s Construction Schedule to the University and Design Professional for approval.

3.04 Construction

3.04.1 Subcontracts and Purchase Agreements

The Subcontracts shall be solely between the Contractor and the Subcontractors. Nothing in any Subcontract shall establish any contractual relationship between the University and any Subcontractor. However, the University is an intended third-party beneficiary of all Subcontracts, purchase orders and other agreements; the Contractor shall incorporate the obligations of the Contract Documents into its respective Subcontracts, supply agreements and purchase orders.

The Contractor will screen and pre-qualify, utilizing appropriate industry standards, potential Subcontractors for the Work keeping in mind the requirement to recruit and encourage Minority/Women Business Enterprise participation. The University shall have the right to review and approve all Subcontractors qualified or rejected for qualification by the Contractor. The Contractor shall notify the University of all Subcontractors to be used, and the Contractor shall remove any Subcontractor to which the University has an objection.

The Contractor shall obtain appropriate guarantees and warranties acceptable to the University from the Subcontractors, which shall be for the direct benefit of the University.

3.04.2 Construction Supervision

a) The Contractor shall establish sufficient on-site organization, staffing and support as well as clear lines of authority in order to expeditiously complete the Project in accordance with the Contract Documents, in every aspect, on a totally coordinated basis.

b) The Contractor shall maintain a competent full-time staff available at the site while Work is being performed to supervise, schedule and coordinate the performance of the Work of all Subcontractors in accordance with the University’s objectives including cost, time for completion and quality of the Work. Contractor’s Staffing Plan is attached as Exhibit D to this Agreement. The Staffing Plan shall not be changed, except with the written consent of the University’s Representative unless members of the Project Staff cease to be in the employ of the Contractor.

c) The Contractor shall notify the University of the dates, times and locations of conferences with Subcontractors and schedule and conduct regular progress meetings to be attended by all parties in interest including the University to discuss such matters as procedures, progress, job problems, scheduling, coordination, changes, and related matters.

d) The Contractor shall take, transcribe and promptly distribute to all parties, including the University, minutes of such progress meetings with the Subcontractors, weekly job meetings and monthly management meetings.

e) The Contractor shall maintain an on-site daily log of construction progress, problems and items of special interest. The Contractor shall provide digital photographic files and digital recording showing Project status or progress. Such logs, records, photographs and videos shall be immediately available to the University upon request.
f) The Contractor shall furnish monthly written progress reports on the Subcontractors’ work in a form acceptable to the University and assist the Design Professional and the University with periodic and final inspections of the Work. At all inspections preceding the final inspection, the Contractor shall furnish a detailed report to the University of observed discrepancies, deficiencies, and omissions in the Work performed by any Subcontractor.

g) The Contractor shall provide and maintain a correct layout of the structures and monitor the Work to verify that all lines and levels are adhered to by the Subcontractors. The Contractor shall immediately report in writing all discrepancies with respect to design details for prompt resolution by the Design Professional.

h) The Contractor shall submit any Request for Information (RFI) to the Design Professional and University only after attempting to determine if the requested clarification is contained in the Contract Documents; any RFI shall contain sufficient detail to allow a response within seven (7) calendar days of when the RFI is submitted. In no event shall the response to an RFI be considered delayed unless more than fourteen days have passed since the RFI was submitted.

i) The Contractor shall supervise and direct the Work using the Contractor’s best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents or that which is reasonably inferable for the completion of the Project.

j) The Contractor shall be responsible to the University for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing any portion of the Work related to a contract with the Contractor.

k) The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities of the University, Design Professional, or by tests, inspections or approvals required or performed by persons other than the Contractor, except where such relief is authorized by the University in writing in accordance with this Agreement.

l) The Contractor shall inspect portions of Work performed or portions of existing facilities being renovated in this Project to determine that such portions are in proper condition to receive subsequent Work. Further, the Contractor shall plan for and call for the review of the Work by the University’s commissioning agents as required. The Contractor's Construction Schedule shall include activities that recognize this coordination responsibility.

3.04.2.1 Safety

The Contractor shall protect adjoining property and nearby buildings, roads, and other facilities and improvements from dust, dirt, debris and other nuisances arising out of Contractor’s operations or storing practices. Dust shall be controlled by sprinkling, negative pressure exhausting or other effective methods acceptable to University. Fugitive dust from interior demolition shall be controlled by negative pressure exhausting. An erosion and sedimentation control program shall be initiated, which includes measures addressing erosion caused by wind and water and sediment in runoff from site. A regular watering program shall be initiated to adequately control the amount of fugitive dust.

The Contractor is knowledgeable of and understands that the University may intend to maintain occupancy of certain portions of the existing facility. The Contractor shall exercise precaution at all times for the
protection of persons and their property. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (1) employees on the Work and other persons who may be affected thereby; (2) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's subcontractors or sub-subcontractors; and (3) other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall install adequate safety guards and protective devices for all equipment and machinery, whether used in the Work or permanently installed as part of the Project.

The Contractor shall also provide and adequately maintain all required means of egress, including but not limited to, proper temporary walks, roads, guards, railings, lights, and warning signs. The Contractor shall comply with all applicable laws relating to safety precautions. The Contractor shall establish, maintain and update a Project Specific Safety Program.

The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the University and Design Professional.

The Contractor shall require each and every one of its subcontractors and Trade subcontractors to comply with all of the provisions of this section.

The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in the Contract.

3.04.2.2 Hazardous Condition

The University and/or the Design Professional may bring to the attention of the Contractor a possible hazardous situation in the field regarding the safety of personnel on the site. The Contractor shall be responsible for verifying that all local, state, and federal workplace safety guidelines are being observed. In no case shall this right to notify the Contractor absolve the Contractor of its responsibility for monitoring safety conditions. Such notification shall not imply that anyone other than the Contractor has assumed any responsibility for field safety operations.

Explosives shall not be used without first obtaining written permission from the University and then shall be used only with the utmost care and within the limitations set in the written permission and in accordance with prudence and safety standards required by law. Storage of explosives on the Project site or University is prohibited. Powder activated tools are not explosive for purposes of this Article; however, such tools shall only be used in conformance with State safety regulations.

The Contractor shall immediately make a report to the University’s Police Department and report in writing to the University’s Representative, within eight (8) hours, all accidents whatsoever arising out of, or in connection with, the performance of the Work, whether on or off the Site but on University property, which caused death, personal injury or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger. If any claim is made by anyone against the Contractor or any
subcontractor on account of any accident, the Contractor shall report promptly the facts in writing to the University’s Representative, giving full details of the claim.

3.04.2.3 University's Right to Stop the Work

If the Contractor fails to correct work which is not in accordance with the requirements of the Contract Documents as required, or persistently fails to carry out work in accordance with the Contract Documents, the University Representative, by written order may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the University to stop the Work shall not give rise to a duty on the part of the University to exercise this right for the benefit of the Contractor or any other person or entity.

It is understood that while the Contractor is fully responsible for the safety of the Work, and for the methods of its execution, if the University deems that the Contractor is failing to provide safe conditions, the University may stop the Work under such conditions. However, this ability shall not create such duty on the University. Under no circumstance shall the Contractor be granted a time extension or Contract Sum increase for conditions resulting by a stop work order.

3.04.2.4 University's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a three (3) day period after receipt of written notice from the University to commence and continue correction of such default or neglect with diligence and promptness, the University may after such three (3) day period, without prejudice to other remedies the University may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Design Professional’s additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the University.

3.04.3 Document Management

The Contractor shall maintain at the job site, on a current basis, all Project documents including plans, specifications, shop drawings, samples, submittal, purchase orders, Subcontracts, material specifications, and any other related documents, and revisions thereto, which arise out of or relate to the Project, this Agreement or the Work. Prior to final payment, copies of all such records shall be provided to the University.

The Contractor shall be responsible for reviewing, processing and paying applications by Subcontractors for progress and final payment. The University will compensate the Contractor monthly based on the requirements of Article 4.04, Application For Payment.

The Contractor shall prepare and submit to the University every three months a report of the total M/WBE participation in the Project to demonstrate compliance with Paragraph 3.04.6 together with a projection of M/WBE participation through Final Completion.

3.04.3.1 Review of Contract Documents and Field Conditions by Contractor

Execution of the Contract by the Contractor is a representation that the Contractor shall have thoroughly and carefully examined the site of the of Work; investigated any and all conditions which can affect the
Work or its cost, including but not limited to, availability of labor, materials, supplies, water, electrical power, roads, access to the site, University episodic and scheduled closures, uncertainties of weather, water tables, the character of equipment and facilities needed to perform the Work, and local conditions under which the Work is to be performed; and further, that the Contractor shall insure that the documents issued for bidding by Trade Contractors reflect the results of this investigation and are adequate to complete the Work. It is the responsibility of the Contractor to be familiar with the materials, equipment, or procedures to be used in the Work, or which in any other way could affect the completion of the Work. Any failure to properly familiarize themselves with the proposed Work shall not relieve the Contractor from the responsibility for completing the Work in accordance with the Contract Documents.

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Project. Contract Documents are complementary, and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to be consistent with the Contract Documents and the highest standard of care. In the case of an inconsistency between, or perceived omission or error in the Drawings, Specifications, or other Contract Documents which is not clarified by addendum or RFI, or should the Contractor be in doubt as to their exact meaning, the Contractor shall notify the Design Professional and the University prior to performing any related Work. The University shall not be responsible for the Contractor's misinterpretations of Drawings and Specifications and/or other Contract Documents.

The Contractor shall have a continuing duty to read, carefully study and compare the Contract Documents and product data with each other and with information furnished by the University, and shall at once report to the Design Professional and the University errors, inconsistencies, ambiguities and omissions before proceeding with the affected Work. The Contractor shall be liable to the University for damage resulting from errors, inconsistencies or omissions in the Contract Documents, relating to constructability if the Contractor recognized or should have recognized such error, inconsistency, ambiguity or omission and failed to report it to the Design Professional and the University. If the Contractor performs any construction activity which involves such error, inconsistency, ambiguity or omission in the Contract Documents relating to constructability, without such notice to the Design Professional and the University, the Contractor shall assume responsibility for such performance and shall bear all costs attributable for correction. If the Contractor submits authorized substitutes that cost in excess of the Contract Sum which cause coordination conflicts, the Contractor shall bear all costs attributable to correction.

The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Design Professional prior to performing any affected Work.

The Contractor shall perform the Work in accordance with the Contract Documents.

3.04.4 Cash Flow Estimates and Cost Control

At the University’s request, the Contractor shall prepare a Cash Flow Estimate indicating the anticipated schedule of payment application amounts within fifteen (15) days after the Contractor’s Bid has been accepted. The Cash Flow Estimate shall be revised periodically, at least every three months, unless significant deviations are expected or otherwise more frequently as requested by the University.

The Contractor shall review requests for changes with the University, and with the University’s approval, obtain quotations from affected Subcontractors. Bulletins to Subcontractors shall define the scope of the change and require pricing using either lump sum, time and materials or cost of Work for all items of Work,
including overhead and profit as may be defined in the Bid and this Agreement and shall include costs related to schedule delays, if applicable. Where both additions and deductions are involved, each should be calculated separately. Contractor shall be responsible for reviewing the pricing submitted by Subcontractors for accuracy, completeness, and reasonableness.

3.04.5 Minority/Women Business Enterprise Participation

The University makes a continuous effort to strongly encourage Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) contractors and supplier to bid on and participate in University contracts. To the fullest extent permitted under federal and Michigan law, you are strongly encouraged to retain the services of WBE and MBE Subcontractors and suppliers of goods and services in connection with performance of this Contract. For purposes of this Contract, MBE is defined as a business entity in which 51% or minority individuals hold more of the voting shares and interest in the enterprise. The minority ownership of the enterprise shall have management and investment control of the company. WBE is defined as a business entity in which 51% or a woman or women hold more of the voting shares and interest in the enterprise. The female ownership of the enterprise shall have management and investment control of the company.

3.04.7 Time of Completion

The Contractor acknowledges that time is of the essence in performing and completing the Work on the Project. Accordingly, the Contractor shall comply with the activity and milestone completion dates as defined in the Contractor’s Construction Schedule as mutually agreed by the Contractor, the University and the Design Professional. The Contractor shall provide, prepare and/or participate in developing schedules, submittals, shop drawings, construction schedules, close out documents, or other activities consistent with the conditions of the Contract Documents and as set forth below:

A. Substantial Completion: [ENTER COMPLETION DATE]

B. Punchlist Completion: [ENTER COMPLETION DATE]

C. Final Completion: [ENTER COMPLETION DATE]

3.04.8 Timely Completion

Contractor acknowledges that the University has scheduled use of the Project immediately following the Dates of Substantial Completion. In scheduling that use, the University may have signed contracts and otherwise made financial commitments relating to the use of the Project no later than the date of Substantial Completion. In the event that the Contractor fails to complete on or before the date for Substantial Completion, the Contractor shall be responsible to reimburse the University for all direct, indirect and administrative costs and expenses incurred in locating, coordinating and securing alternate sites, refunding deposits, and taking any other reasonable action as a consequence of the Contractor’s failure to achieve Substantial Completion by the date stated in this Agreement.

The University shall be entitled to retain from the Contractor those damages incurred upon the Contractor’s default of Substantial Completion, as provided above.

The Contractor further agrees to complete 100% of all punchlist items, documented on the Substantial Completion certificate, within forty-five (45) days of the date of Substantial Completion.
Nothing in this Article 3.04.08 shall be construed as a limitation or waiver on such other rights as the University may have.

3.04.8.1 Substantial Completion

"Substantial Completion" shall mean the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the University can occupy or utilize the Work for its intended use. Substantial Completion shall only be determined as described in the Contract Documents.

3.04.8.2 Final Completion

“Final Completion” means the completion of all the Work in accordance with the Contract Documents and the acceptance thereof by the University. Completion of the Work includes (1) full performance of all Contract terms; (2) acceptance of the Work by University; (3) resolution of all outstanding Changes of Contract; (4) completion of all "punch-list" items; and (5) delivery of all Close-out Documents.

3.05 Contractor's Insurance

The Contractor shall not commence Work under this Contract until it has obtained all the insurance required by the Contract Documents and such insurance has been approved by the University; likewise, no subcontractor or subconsultant shall be allowed to commence Work until the insurance required has been obtained. The Contractor shall, at its expense, purchase and maintain in full force and effect such insurance as will protect itself and the University from claims, such as for bodily injury, death, and property damage, which may arise out of or result from the Work required by the Contract Documents, whether such Work is done by the Contractor, by any subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The types of such insurance and any additional insurance requirements are specified herein with the amounts and limits set forth in the Supplementary General Conditions.

3.05.1 Policies and Coverage

The following policies and coverages shall be furnished by the Contractor promptly upon request by the University:

(1) Comprehensive or Commercial Form General Liability Insurance covering all Work done by or on behalf of the Contractor and providing insurance for bodily injury, personal injury, property damage, and Contractual liability. Except with respect to bodily injury and property damage included within the products and completed operations hazards, the aggregate limit shall apply separately to work required of the Contractor by these Contract Documents. This insurance shall include the contractual obligations assumed under the Contract Documents and specifically section 4.06.

(2) Business Automobile Liability Insurance on an “Occurrence” form covering owned, hired, leased, and non-owned automobiles used by or on behalf of the Contractor and providing insurance for bodily injury, property damage, and Contractual liability.

(3) Worker’s Compensation and Employer’s Liability Insurance as required by Federal and Michigan law. The Contractor shall also require all of its Subcontractors to maintain this insurance coverage.
3.05.2 Proof of Coverage

Certificates of Insurance, or other evidence of the insurance required by these Contract Documents or requested by the University, shall be submitted by the Contractor to the University. The Certificates of Insurance shall state the scope of coverage and deductible, identify any endorsements to the policies and list the University as an additional named insured. Any deductible shall be the Contractor's liability. The Certificates of Insurance shall provide for no cancellation or modification of coverage without thirty (30) days prior written notice to the University. Acceptance of Certificates of Insurance by the University shall not in any way limit the Contractor's liabilities under the Contract Documents. In the event the Contractor does not comply with these insurance requirements, the University may, at its option, provide insurance coverage to protect the University; the cost of such insurance shall be deducted from the Contract Sum or otherwise paid by the Contractor. Renewal certifications shall be filed in a timely manner for all coverage until the Project is accepted as complete. Upon the University's request, the Contractor shall provide copies of the policies obtained from the insurers.

3.05.3 Subcontractor's Insurance

The Contractor shall either require subcontractors to carry the insurance or the Contractor shall insure the activities of the subcontractors in the amount, types and form of insurance required by the Contract Documents. If the Contractor elects to have its subcontractors purchase individual insurance policies, the Contractor's subcontracts shall include a clause requiring that copies of any insurance policies which provide coverage to the Work shall be furnished to the University. The Contractor shall supply the University with a list of all subcontractors showing whether or not they have individual insurance policies and certifying that those subcontractors without individual insurance policies are insured by the Contractor.

3.05.4 Scope of Insurance Coverage

The Contractor’s insurance as required by the Contract Documents (including subcontractors’ insurance), by endorsement to the policies and the Certificates of Insurance, shall include the following and may be presented in the form of a rider attached to the Certificates of Insurance:

(1) The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents including the Design Professional, shall be included as additional named insureds for and relating to the Work to be performed by the Contractor and subcontractors. This shall apply to all claims, costs, injuries, or damages.

(2) A Severability of Interest Clause stating that, “The term ‘insured’ is hereby used severally and not collectively, but the inclusion herein of more than one insured shall not operate to increase the limits of the insurer’s or insurers’ liability.”

(3) A Cross Liability Clause stating that, “In the event of claims being made under any of the coverages of the policy or policies referred to herein by one or more insured hereunder for which another
or other insured hereunder may be liable, then the policy or policies shall cover such insured or insured against whom a claim is made or may be made in the same manner as if separate policies had been issued to each insured hereunder. Nothing contained herein, however, shall operate to increase the insurer’s limits of liability as set forth in the insuring agreements.”

(4) The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents, shall not by reason of their inclusion as insured incur liability to the insurance carriers for payment of premiums for such insurance. However, the Board of Governors of Wayne State University may, in their sole discretion after receiving a notice of cancellation for nonpayment, elect to pay the premium due and deduct such payment from any sums due to the Contractor or recover the amount paid from the Contractor if the sums remaining are insufficient.

(5) Coverage provided is primary and is not in excess of or contributing with any insurance or self-insurance maintained by the Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents.

3.05.5 Miscellaneous Insurance Provisions

The form and substance of all insurance policies required to be obtained by the Contractor shall be subject to approval by the University. All such policies shall be issued by companies lawfully authorized to do business in Michigan and be acceptable to the University. All property insurance policies to be obtained by the Contractor shall name the University as loss payee as its interest, from time to time, may appear.

The Contractor shall, by mutual agreement with the University and at the University’s cost, furnish any additional insurance as may be required by the University. The Contractor shall provide appropriate endorsements evidencing such additional insurance.

In the event that the scope of Work includes asbestos abatement, the Contractor or subcontractor, as appropriate, shall provide $1,000,000 asbestos liability insurance.

The University is not required to provide or purchase any additional insurance with respect to this Project or the Work required of the Contractor for the Project.

3.05.6 Loss Adjustment

Any insured loss is to be adjusted with the University and made payable jointly to the University and the Contractor. The Contractor shall cooperate with the University in a determination of the actual cash value or replacement value of any insured loss. Any deductible amount shall be the responsibility of the Contractor to resolve.

3.05.7 Compensation Distribution

The University upon the occurrence of an insured loss shall account for any money so received and shall distribute it in accordance with such agreement as the interested parties may reach. Claim payments received shall be distributed proportionately according to the actual percentages of losses to both. If after such loss no other special agreement is made, replacement of damaged work shall be covered by an appropriate contract change order. Any dispute shall be resolved by the University.

3.05.8 No Waiver of Subrogation
The University does not waive any rights of Subrogation that it may possess on this Project.

3.06 Indemnification

3.06.1

To the fullest extent permitted by law, the Contractor shall hold harmless, defend, and indemnify the Board of Governors of Wayne State University, the University, and officers, employees, representatives and agents of each of them, from and against any and all claims or losses arising out of or are alleged to be resulting from, or relating to (1) the failure of the Contractor to perform its obligations under the Contract or the performance of its obligation in a willful or negligent manner; (2) the inaccuracy of any representation or warranty by the Contractor given in accordance with or contained in the Contract Documents; and (3) any claim of damage or loss by any subcontractor, or supplier, or laborer against the University arising out of any alleged act or omission of the Contractor or any other subcontractor, or anyone directly or indirectly employed by the Contractor or any subcontractor.

3.06.2

To the fullest extent permitted by law, the Contractor shall be liable for and hereby agrees to defend, discharge, fully indemnify and hold the University harmless from and against any and all claims, demands, damages, liability, actions, causes of action, losses, judgments, costs and expenses of every nature (including investigation costs and/or expenses, settlement costs, and attorney fees and expenses incident thereto) sustained by or asserted against the University arising out of, resulting from, or attributable to the performance or nonperformance of any Work and/or obligation covered by the Contract or to be undertaken in connection with the construction of the Project contemplated by the Contract (collectively, "Claim"), including, but not limited to, any Claim for: (a) any personal or bodily injury, illness or disease, including death at any time resulting therefrom of any person, (including, but not limited to, employees of the University, the Contractor, any subcontractor, and any materialman and the general public); (b) any loss, damage or destruction of any property; (c) any loss or damage to the University's operations, arising out of, resulting from, or attributable in whole or in part to (i) any negligence or other act or omission of the Contractor, and any subcontractor, any materialman and/or any other person or any of the directors, officers, employees or agents of any of them or (ii) any defects in material or equipment furnished hereunder; (d) any payments allegedly owed to subcontractors, sub-subcontractors or materialmen; (e) any acts or omissions relative to conditions of safety and protection of persons on the Project site; and/or (f) any act or omission relative to the Contractor's breach of obligations and regarding non-discrimination as set forth in these General Conditions. The Contractor shall not be liable hereunder to indemnify the University against liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence or willful misconduct of the University, its agents or employees. The Contractor, at its own cost and expense, shall take out and maintain at all times during the effective period of the Contract, contractual liability insurance insuring the performance by the Contractor of its contractual duties and obligations under this Article, which insurance shall name the University as additional insured and shall be in form and amount and from an insurance company satisfactory to the University. The Contractor's duty to fully indemnify the University shall not be limited in any way by the existence of this insurance coverage.

3.06.3

The Contractor shall also be liable for and hereby agrees to pay, reimburse, fully indemnify and hold the University harmless from and against all costs and expenses of every nature (including attorney fees and
expenses incident thereto) incurred by the University in collecting the amounts due from the Contractor, or otherwise enforcing its rights, under the indemnifications described in this Article.

3.06.4

In claims against any person or entity indemnified under this Article made by an employee of the Contractor or a Subcontractor, supplier or indirectly employed by any of them, or anyone for whose acts is made liable, the indemnification obligation under this Article shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor, Subcontractor or supplier under workers compensation laws, disability benefit laws, or other laws providing employee benefits.

3.06.5

The indemnification obligations under this Article shall not be limited by any assertion or finding that the person or entity indemnified is liable by reason of a non-delegable duty.

3.06.6

The Contractor shall hold harmless, defend, and indemnify the University from and against losses resulting from any claim of damage made by any separate contractor of the University against the University arising out of any alleged acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by either the Contractor or subcontractor, or anyone for whose acts either the Contractor or subcontractor may be liable.

3.06.7

The Contractor shall hold harmless, defend, and indemnify the separate Contractors of the University from and against losses arising out of the negligent acts or omissions or willful misconduct of the Contractor, a subcontractor, anyone directly or indirectly employed by the Contractor or subcontractor, or anyone for whose acts the Contractor or subcontractor may be liable.

3.07 Guarantee

The Contractor unconditionally guarantees the Work under this Contract to be in conformance with the Contract Documents and to be and remain free of defects in workmanship and materials not inherent in the quality required or permitted. Contractor shall repair or replace any Work, together with any adjacent Work which may be displaced in so doing, which is not in accordance with the requirements of the Contract or which is defective in its workmanship or material, all without any expense whatsoever to the University for a period of one (1) year / two (2) years from the date of Substantial Completion, unless a longer guarantee period is stipulated in the Contract Documents or otherwise available from the manufacturer (“Repair Period”).

Special guarantees that are required by the Contract Documents shall be signed by the Contractor who is responsible for the entire work and countersigned by the subcontractor who performs the work.

The Contractor further agrees that within five calendar days after being notified in writing by the University of any Work not in accordance with the requirements of the Contract Documents or of any defects in the Work, it shall commence and prosecute with due diligence all Work necessary to fulfill the terms of this guarantee and to complete the Work in accordance with the requirements of the Contract with sufficient manpower and material to complete the repairs as expeditiously as possible. The Contractor, in the event
of failure to so comply, does hereby authorize the University to proceed to have the Work done at the Contractor’s expense, and it agrees to pay the cost thereof upon demand. The University shall be entitled to all costs necessarily incurred upon the Contractor’s refusal to pay the above cost.

Notwithstanding the foregoing paragraph, in the event of an emergency constituting an immediate hazard to health, safety or damage of the University's employees, property, or licenses, the University may undertake at the Contractor’s expense, without prior notice, all Work necessary to correct such hazardous conditions caused by the Work of the Contractor not being in accordance with the requirements of this Contract.

The Contractor shall require a similar guarantee in all subcontracts, including the requirement that the University be reimbursed for any damage or loss to the Work or to other Work resulting from such defects.

If required by the Contract Documents, the Maintenance and Guarantee Bond shall be in full force and effect during the entire Repair Period, unless a longer bond period is stipulated in the Contract Documents.

4.00 CONTRACTOR’S COMPENSATION

4.01 Basis of Compensation
In consideration of the full performance of this Agreement by the Contractor, the University shall compensate the Contractor as stated in Exhibit B.

4.02 Change Orders and Construction Change Directives

4.02.1 Generally
The University reserves the right to issue written orders whether through a formal Change Order or Construction Change Directive, directing changes in the Contract at any time prior to the acceptance of the Project without voiding the Contract, and Contractor shall promptly comply with such order. A Construction Change Directive may be issued in writing by the University directing the Contractor to perform changed Work in the absence of a final agreement on a Change Order and the costs will be calculated as provided in 6.01.4. The Contractor may request changes in the Work, but shall not act on the changes until approved in writing by the University. Any change made without authority in writing from the University shall be the responsibility of the Contractor.

Any such changes in the Work that have a cost impact shall only be authorized by Change Orders approved by the University. No action, conduct, omission, prior failure or course of dealing by the University shall act to waive, modify, change or alter the requirement that Change Orders must be in writing and signed by the University and Contractor and that such written Change Orders are the exclusive method for changing or altering the Contract Sum or Contract Time. The University and Contractor understand and agree that the Contract Sum and Contract Time cannot be changed by implication, oral agreements, actions, inaction, course of conduct or Construction Change Directive.

On the basis set forth herein, the Contract Sum may be adjusted for any Change Order requiring a different quantity or quality of labor, materials or equipment from that originally required, and the partial payments to the Contractor, set forth in section 8.01, may be adjusted to reflect the change. Whenever the necessity for a change arises, the Contractor shall take all necessary steps to mitigate the effect of the ultimate change on the other Work in the area of the change. Changed Work shall be performed in accordance with the original Contract requirements except as modified by the Change Order. Except as herein provided, the Contractor shall have no claim for any other compensation including lost productivity or increased overhead expenses due to changes in the Work. The amounts set forth in the Change Order constitute full compensation for both direct and indirect costs of the Work described in the Change Order.
Payment by the University pursuant to the Change Order shall constitute full satisfaction of any and all claims for compensation and extension of time by the Contractor for the performance of the Work by the Contractor and all subcontractors.

4.02.2 Proposed Change Orders

The Design Professional, with approval of the University, shall issue to the Contractor a cost request Bulletin for a proposed change order describing the intended change and shall require the Contractor to indicate thereon a proposed amount to be added to or subtracted from the Contract Sum due to the change supported by a detailed estimate of cost. Upon request by the University, the Contractor shall permit inspection of the original Contract estimate, subcontract agreements, or purchase orders relating to the change. Any request for adjustment in Contract Time which is directly attributable to the changed Work shall be included with substantiating detailed explanation by the Contractor in its response to the cost request bulletin. Failure by Contractor to request adjustment of Contract Time in the response to the cost request Bulletin shall waive any right to subsequently claim an adjustment of the Contract Time based on the changed Work. The Contractor shall submit the response to the cost request Bulletin with detailed estimates and any time extension request thereon to the Design Professional and the University's Representative within ten (10) calendar days after issuance of the cost request bulletin. Upon its submission the Design Professional will review it and advise the University who will make the decision. If the Contractor fails to submit the response within the required ten (10) calendar days, and the Contractor has not obtained the Design Professional's and the University's permission for a delay in submission, the University may order the Contractor in writing to begin the Work immediately, and the Contract Sum shall be adjusted in accordance with the University's estimate of cost. In that event, the Contractor, within fifteen days following completion of the changed Work, may present information to the University that the University's estimate was in error; the University, in its sole discretion, may adjust the Contract Sum. The Contractor must keep and submit to the University time and materials records verified by the University to substantiate its costs. The University may require the Contractor to proceed immediately with the changed Work in accordance with section 4.02.4, “Failure to Agree as to Cost” or section 4.02.6 “Emergency Changes.”

When the University and the Contractor agree on the amount to be added to or deducted from the Contract Sum and the time to be added to or deducted from the Contract Time and an Impact Report or a Contract Change Order is signed by the University and the Contractor, the Contractor shall proceed with the changed Work. If agreement is reached as to the adjustment in compensation for the performance of changed Work but agreement is not reached as to the time adjustment for such Work, the Contractor shall proceed with the Work at the agreed price, reserving the right to further pursue its Claim for a time adjustment. Any costs incurred to acquire information relative to a proposed Change Order shall not be borne by the University.

4.02.3 Allowable Costs Upon Change Orders

The only estimated or actual costs that will be allowed because of changed Work and the manner in which those costs shall be computed is described by this section.

4.02.3.1 Labor

Costs are allowed for the actual payroll cost to the Contractor for direct labor, engineering or technical services directly required for the performance of the changed Work, (but not site management such as field office estimating, clerical, project engineering, management or supervision) including payments, assessments, or benefits required by lawful labor union collective bargaining agreements, compensation
insurance payments, contributions made to the State pursuant to the Unemployment Insurance Code, and for taxes paid to the federal government required by the Social Security Act of August 14, 1935, as amended, unless the time of completion adjustments affect the general condition inclusion of the Contract Sum.

No labor cost will be recognized at a rate in excess of the appropriate wage rates established for that portion of the Work, nor will the use of a classification which would increase the labor cost be permitted unless the Contractor established to the satisfaction of the University the necessity for payment at a higher rate.

4.02.3.2 Materials

Costs are allowed for the actual cost to the Contractor for the materials directly required for the performance of the changed Work. Such cost of materials may include the costs of transportation, sales tax, and delivery if necessarily incurred. However, overhead costs shall not be included. If a trade discount by the actual supplier is available to the Contractor, it shall be credited to the University. If the materials are obtained from a supply or source owned wholly or in part by the Contractor, payment therefor will not exceed the current wholesale price for such materials.

If, in the opinion of the University, the cost of materials is excessive, or if the Contractor fails to furnish satisfactory evidence of the cost from the actual suppliers thereof, then in either case the cost of the materials shall be deemed to be the lowest wholesale price at which similar materials are available in the quantities required at the time they were needed.

4.02.3.3 Equipment

Costs are allowed for the actual cost to the Contractor for the use of equipment directly required in the performance of the changed Work except that no payment will be made for time while equipment is inoperative due to breakdowns or for non-working days. The rental time shall include the time required to move the equipment to the Project site from the nearest available source for rental of such equipment, and to return it to the source. If such equipment is not moved by its own power, then loading and transportation costs will be paid. However, neither moving time nor loading and transportation costs will be paid if the equipment is used on the Project in any other way than upon the changed Work. Individual pieces of equipment having a replacement value of $500.00 or less shall be considered to be tools or small equipment, and no payment therefor will be made.

For equipment owned or furnished by the Contractor, no cost therefor shall be recognized in excess of the rental rates established by distributors or equipment rental agencies in the locality where the Work is performed. Blue Book rates shall not be used for any purpose.

The amount to be paid to the Contractor for the use of equipment as set forth above shall constitute full compensation to the Contractor for the cost of fuel, power, oil, lubrication, supplies, small tools, small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators who shall be paid for as provided in Article 4.02.3.1) and any and all costs to the Contractor incidental to the use of such equipment.

4.02.3.4 Work by Subcontractors and Vendors

For any portion of the changed Work which is to be performed by a subcontractor, the Contractor shall furnish to the University a detailed estimate prepared and signed by subcontractor of the cost to
subcontractor for performing the changed Work. At the sole discretion of the University, a lump sum estimate of such cost to subcontractor may be accepted in lieu of the detailed estimate. The combined costs for subcontractor's overhead, profit, taxes, indirect supervision, insurance, bonds shall not exceed ten percent (10%). Estimates of the amount to be deleted from subcontractor's portion of the Work shall be a lump sum of the deducted Work plus eight percent (8%). For changed Work to be furnished by a supplier, the Contractor shall furnish upon demand of the University, a lump sum estimate of the cost of the items including taxes and cartage to the Contractor prepared by the supplier. No supplier mark-up for overhead, profit, layout, supervision or bonds will be allowed for changed Work furnished by a supplier.

4.02.3.5 Contractor Mark-up for Added Work

Where changed Work is performed, the Contractor may add to the total estimated actual cost for such Work no more than ten (10%) for subcontractor mark-up and seven and one-half percent (7.5%) for self-performed trade work for profit, overhead, insurance, taxes, indirect supervision, bonds, and any other costs not allowed by section 4.02.01.

4.02.3.6 Credit for Deleted Work

The amount to be deducted from the Contract Sum shall be the total estimated actual cost of the deducted Work plus eight percent (8%).

Where an entire item or section of Work is deleted from the Contract, the entire subcontract cost or bid cost shall be considered the appropriate deduction less the value of Work performed. If the subcontract cost or bid cost is not identifiable, then estimates of the amount to be deducted from the Contract Sum shall be the gross cost of the deducted work plus six percent (6%) for saved overhead, bonds, insurance, and taxes.

For proposed change orders which involve both added and deleted Work, the Contractor shall separately estimate the cost of the added Work before mark-ups, and separately estimate the cost of the deleted Work before allowance of a credit. If the difference between the costs results in an increase to the Contract Sum, the mark-up for added Work shall be applied to the difference, and if the difference in the costs results in a decrease, then the mark-up for deleted Work shall be applied to the difference.

4.02.3.7 Market Values

Cost for added Work shall be no more than market values prevailing at the time of the change, unless the Contractor can establish to the satisfaction of the University that it investigated all possible means of obtaining Work at prevailing market values and that the excess cost could not be avoided.

When a change order deletes Work from the Contract, the computation of the cost thereof shall be the values which prevailed at the time bids for the Work were opened or the Contract Sum established.

4.02.4 Failure to Agree as to Cost

4.02.4.1 For Added Work

Notwithstanding the failure of the University and the Contractor to agree as to the cost of the proposed Change Order, the Contractor, upon written order from the University, shall proceed immediately with the changed Work. A Construction Change Directive or letter signed by the University shall be used for this written order. At the start of each day’s Work on the change, the Contractor shall notify the University in
writing as to the size of the labor force to be used for the changed Work and its location. Failure to so notify may result in the non-acceptance of the costs for that day. At the completion of each day’s Work, the Contractor shall furnish to the University a detailed summary of all labor, materials, and equipment employed in the changed Work. The University will compare his/her records with Contractor’s daily summary and may make any necessary adjustments to the summary. After the University and the Contractor agree upon and sign the daily summary, the summary shall become the basis for determining costs for the additional Work. The sum of these costs when added to an appropriate mark-up will constitute the payment for the changed Work. Subsequent adjustments, however, may be made based on later audits by the University. When changed Work is performed at locations away from the job site, the Contractor shall furnish in lieu of the daily summary, a summary submitted at the completion of the Work containing a detailed statement of labor, material, and equipment used in the Work. This latter summary shall be signed by the Contractor who shall certify thereon that the information is true.

The Contractor shall maintain and furnish on demand of the University itemized statements of cost from all vendors and subcontractors who perform changed Work or furnish materials and equipment for such Work. All statements must be signed by the vendors and the subcontractors.

4.02.4.2 For Deleted Work

When a proposed Change Order contains a deletion of any Work, and the University and the Contractor are unable to agree upon the cost thereof, the University’s estimate shall be deducted from the Contract Sum and may be withheld from any payment due the Contractor until the Contractor presents adequate substantial information to the University that the University’s estimate was in error. The amount to be deducted shall be the actual costs to the Contractor for labor, materials, and equipment which would have been used on the deleted Work together with an amount for mark-up as defined in the Contract Documents.

4.02.5 Allowable Time Extensions

For any change in the Work, the Contractor shall only be entitled to such adjustments in Contract Time due solely to performance of the changed Work. The procedure for obtaining an extension of time is set forth in Section 4.08 of these General Conditions. No extension of time shall be granted for a change in the Work unless the Contractor demonstrates to the satisfaction of the University that the Work is on the critical path and submits an updated CPM schedule showing that an extension of time is required and that the Contractor is making, or has made, every reasonable effort to guarantee completion of the additional Work called for by the change within the time originally allotted for the Contract. Failure by the Contractor to make the required submission or showing constitutes a waiver of any possible adjustment in Contract Time.

Any adjustment in Contract time shall specify the exact calendar day.

4.02.6 Emergency Changes

Changes in the Work made necessary due to unforeseen site conditions, discovery of errors in plans or specifications requiring immediate clarification in order to avoid a serious Work stoppage, changes of a kind where the extent cannot be determined until completed, or under any circumstances whatsoever when deemed necessary by the University are kinds of emergency changes which may be authorized by the University in writing to the Contractor. The Contractor shall commence performance of the emergency change immediately upon receipt of written direction from the University.
If agreement is reached as to compensation adjustment for the purpose of any emergency change, then compensation will be as provided in this section relating to ordinary changes. If agreement is not reached as to compensation at the time of commencing the emergency change, then compensation will be as provided in section 4.02.4, that is, time and materials records and summaries shall be witnessed and maintained until either a lump sum payment is agreed upon, or the changed Work is completed.

4.03 Records and Audit

4.03.1

Contractor’s records, which shall include but not be limited to accounting records (hard copy, as well as computer readable data if it can be made available), written policies and procedures; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original estimates; estimating work sheets, correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; and any other supporting evidence deemed necessary by the University to substantiate changes related to the Agreement (collectively referred to as "Records") shall be maintained in accordance with Generally Accepted Accounting Principles and open to inspection and subject to audit and/or reproduction by University’s agent or its authorized representative to the extent necessary to adequately permit evaluation and verification of Cost of the Work, and any invoices, change order, payments or claims submitted by the Contractor or any of his payees pursuant to the execution of the contract.

4.03.2

Such audits may require inspection and copying from time to time and at reasonable times and places of any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase order, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in University’s judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Documents. Such records subject to audit shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs, (including overhead allocations) as they may apply to costs associated with this Agreement.

4.03.3

The University or its designee shall be afforded access to all of the Contractor’s Records, and shall be allowed to interview any of the Contractor’s employees, pursuant to the provisions of this article throughout the term of this contract and for a period of six (6) years after Final Payment or longer if required by law. To the extent University deems is allowed by law, the Contractor’s records shall remain confidential. Contractor recognizes and agrees that University will disclose documents it deems is required or appropriate pursuant to law, defense against lawsuits or other claims, or other reason deemed necessary by University.

4.03.4

Contractor shall require all Subcontractors, insurance agents, and material suppliers (payees) to comply with the provisions of this article by insertion of the requirements hereof in a written contract agreement between Contractor and payee. Such requirements will also apply to Subcontractors and all lower tier
Subcontractors. Contractor will cooperate fully and will cause all of Contractor's Subcontractors (including those entering into lump sum contracts, payees or lower tier Subcontractors) to cooperate fully by furnishing or making available to University from time to time whenever requested in an expeditious manner any and all such information, materials and data.

4.03.5

University's agent or its authorized representative shall have access to the Contractor's facilities, shall have access to all records deemed necessary by University; and shall be provided adequate and appropriate work space, in order to conduct review or audits in compliance with this article.

4.03.6

Contractor agrees that University's designee shall have the right to examine the Contractor's records (during the contract period and up to six(6) years after Final Payment is made on the contract) to verify the accuracy and appropriateness of the pricing data used to price change proposals or claims. Contractor agrees that if the University determines the cost and pricing data submitted (whether approved or not) was inaccurate, incomplete, not current or not in compliance with the terms of the contract regarding pricing of change orders, an appropriate contract price reduction shall be made. Such post-approval contract price adjustments will apply to all levels of Contractors and/or Subcontractors and to all types of change order proposals specifically including lump sum change orders, unit price change orders and cost-plus change orders.

4.03.7

If an audit, inspection or examination in accordance with this article, discloses overcharges (of any nature) by the Contractor to the University in excess of one percent (1%) of the total contract billings, the actual cost of the University's audit shall be reimbursed to the University by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of University's findings to Contractor.

4.03.8

If this Agreement is determined to be subject to Section 1861(v)(1)(I) of the Social Security Act, as amended from time to time, the Contractor agrees that for a period of four (4) years following the expiration or earlier termination of this Agreement, the Contractor shall retain and make available to the Secretary of Health and Human Services, the Comptroller General of the United States, or any of their duly authorized representatives, this Agreement, and any books, documents, and records of the Contractor which are necessary to certify the nature and extent of amounts paid by the University pursuant to this Agreement. In the event access to books, documents, and records is requested by the Secretary, the Comptroller General, or any of their duly authorized representatives, the Contractor shall immediately notify the University and make such books, documents and records available to the University unless prohibited by law.

4.04 Applications for Payment

The Contractor shall prepare and deliver to the University monthly an itemized Application for Payment. The University shall pay the Contractor within thirty (30) days of receipt of a properly submitted, complete and correct Application for Payment. The Applications for Payment shall include a Schedule of Values.
describing the services included and Work completed in the Application for Payment. No interest shall accrue on any unpaid portion of the Applications for Payment or any other sums that the Contractor or any Subcontractor or supplier claim are or may be due under this Agreement.

The Application for Payment shall constitute a representation by the Contractor to the University that the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment. No progress payment, partial use or entire use of the Project by the University shall constitute acceptance of work not in strict conformity with the Contract Documents.

The Contractor shall keep records of cost and expense to support the Contractor's Applications for Payment, including without limitation records of staff time, material costs, and reimbursable expense items in connection with the Work. Financial records shall be kept on a generally recognized accounting basis, as approved by the University. Contractor shall make them readily available to the University or its representatives for inspection and audit for a period of six (6) years after the Project Close-out and Final Payment to the Contractor.

The Application for Payment shall be accompanied by a Sworn Statement completed by the Contractor, together with Certified Payrolls prepared in accordance with Section 5.02, as well as other documentation that may be required by the University, stating that all Subcontractors and suppliers have been paid in full for Work performed through the last or most recent progress payment.

4.05 Retainage

Payments to the Contractor shall be subject to retainage of ten percent (10%) of the Cost of Work for each Application for Payment until the Work is fifty percent (50%) complete; at that time, no further retainage will be deducted from the Applications for Payment. Draws on retainage may only be submitted after Substantial Completion and in the following quantities: (1) at the completion of all Punchlist items, the retainage may be reduced to two percent (2%); and (2) at delivery of all Closeout Documents and warranties, the remainder of the retainage may be paid to the Contractor. Any release of retainage shall be at the sole discretion of the University.

4.06 Final Payment

Issuance of Final Payment shall be expressly conditioned on certification of Substantial Completion, certification of Punchlist completion and written acceptance of closeout documents by the Design Professional and University.

5.00 PREVAILING WAGES

5.01 Applicable Wage Rates

The Contractor acknowledges and shall abide by the University’s prohibition on use of 1099 independent contractors and owner / operator business entities wherein such individuals or entities are not able to secure and maintain workers compensation insurance. The Contractor shall ensure that all classifications of laborers and construction mechanics performing Work on the Project job site are employees of the Contractor or any subcontractor for any tier thereof, and that each worker is covered by workers compensation insurance.
For this project, it is a University requirement that the Contractor and all Subcontractors and sub-subcontractors who provide labor on this project shall compensate each worker, regardless of their employment status, not less than the wage and fringe benefit rates prevailing in the locality in which the work is to be performed. At the time of advertising for bids on the project, the University shall provide the prevailing rates of wages and fringe benefits for all classes of construction mechanics called for in the Contract. A schedule of these rates shall be made a part of the specifications for the work to be performed and shall be printed on the bidding forms where the work is to be done by contract. Contractor shall also post on site, in a conspicuous place, a copy of all applicable wage and benefit rates, and shall provide the University with a copy of the applicable wage and benefit rates posted.

5.02 Certified Payroll Records and Supporting Documents

The Contractor and each Subcontractor shall keep an accurate record showing the name and occupation of and the actual benefits and wages paid to each laborer and mechanic working in connection with this contract and shall be submitted with each pay application in accordance with Section 4.04. Contractor shall be required to 1) collect all certified payroll records from Contractor and Subcontractors and sub-subcontractors; 2) provide and require Subcontractors and sub-subcontractors to provide the University access to supporting documentation, and 3) shall provide this information, records, and/or access to documentation to the University or its agent(s) or auditors for review or audit promptly on request. Contractor shall, and shall also require all subcontractors and sub-subcontractors to, promptly provide information relating to payroll and job classification and work duties to University upon request. The University reserves the right to audit Contractor, Subcontractors, and sub-subcontractors for compliance with wage and hour requirements, prevailing wage, employee classifications and other applicable requirements.

5.02.1 Audit

In connection with the prevailing wage rate audit conducted by the University, the Contractor is required to maintain and/or promptly obtain the following information, records and documentation from Contractor, all Subcontractors, and all sub-subcontractors and to promptly provide them to the University upon request:

1. Canceled payroll checks
2. Pay stubs
3. Weekly time cards on time sheets
4. Payroll registers
5. Employee handbook
6. Fringe benefit plan documents
7. Minutes of Board of Directors meetings
8. Worksheets for calculation of non-cash fringe benefit amounts included in compensation
9. Apprentice certificates and other documents to verify registration of all apprentices in recognized apprentice program certified by the Bureau of Apprenticeship and Training (B.A.T.) of the U.S. Dept. of Labor or an acceptable equivalent
10. Other related documents as requested by the University.

5.02.2 Failure to Comply with Audit

If the requested information and/or records are not promptly provided pursuant to University’s request, in addition to all other rights and remedies it has pursuant to law, equity and contract, the University, by written notice to Contractor and the sureties of the contractor known to the University may, but has no obligation or duty to, 1) terminate the contract with Contractor and University owe Contractor and be liable
only for that prorated portion of satisfactorily completed work up to the date of termination; 2) withhold further payments owed until Contractor supplies the requested information and records and/or otherwise complies with the request for records and/or access to documentation; and 3) inform the Vice-President for Finance and Business Operations of what has been requested and what has not been provided by Contractor and/or subcontractor or sub-subcontractor. Contractor is hereby given express notice that failure to comply with University’s requests for information and records may disqualify Contractor and/or non-complying Subcontractors/sub-subcontractors from bidding and/or receiving work on future University projects. The University may proceed to complete this contract by separate agreement with another contractor or otherwise and the original Contractor and its sureties shall be liable to the University for any excess cost occasioned thereby.

5.03 Classification of Workers

All apprentices utilized on this University project must be registered in a recognized apprentice program, i.e., one that is certified by the Bureau of Apprenticeship (B.A.T.), U.S. Department of Labor. The workers used on a University project by either Contractor or a Subcontractor must be employees of the Contractor or Subcontractor and not individuals claimed as subcontractors or independent contractors, such as individuals whose compensation is reflected on IRS form 1099. The use of individuals as independent contractors is prohibited without express written permission of the University.

5.04 Failure to Pay

If a Contractor or subcontractor fails to pay the prevailing rates of wages and fringe benefits and does not cure such failure within fourteen (14) days after notice to do so by the University, the University shall have the right, at its option, to do any or all of the following:

5.04.1 Withhold all or any portion of payments due the Contractor as may be considered necessary by the University to pay laborers and mechanics the difference between the rates of wages and fringe benefits required by this Agreement and the actual wage and fringe benefits paid.

5.04.2 Terminate part or all of this Agreement or any subcontract and proceed to complete the Agreement or subcontract by separate agreement with another contractor or otherwise, in which case the Contractor and its sureties shall be liable to the University for any excess costs incurred by the University.

5.04.3 University’s Rights Cumulative

It is expressly understood by both parties that the above are in addition to University’s other rights and remedies, and University retains all other rights and remedies it has pursuant to this Agreement, or otherwise, to enforce its rights to require that prevailing wages and fringe benefits be paid for the construction work on this Project, but the University shall have no duty or contractual obligation to enforce these provisions. Contractor agrees that it shall be solely responsible for ensuring that these requirements are met and shall handle and defend all complaints or claims regarding wage payments to construction mechanics without assistance or involvement of the University. Contractor shall permit its employees and workers, and its Subcontractors and sub-subcontractors and their employees and workers, to discuss payment and work duty information with University staff, but otherwise Contractor shall continually prohibit its employees and workers, and all subcontractors and sub-subcontractors and their employees and
workers, from directing or making any claims or complaints regarding the payment of wages to any employee or official of the University, and shall indemnify and reimburse University for all expenses and fees, including attorney fees, which it incurs for defending or representing itself against such claims or complaints. The University shall not be asked to nor be responsible to address or resolve any disputes with or between Subcontractors on the Project.

5.05 Application to Subcontractors

The Contractor shall include terms identical or substantially similar to this section in all Subcontracts, Purchase Orders and other agreements pertaining to the Project.

6.00 OWNERSHIP OF ELECTRONIC OR HARD-COPY DOCUMENTS

All drawings and specifications and other data and materials prepared and furnished whether in electronic or hard-copy format by the University, the Design Professional and/or the Contractor shall become the property of the University. The Contractor shall have no claim for further employment or additional compensation as a result of exercise by the University of its full rights to ownership of such documents, information, data and materials. The Contractor shall not use or copy such documents, information, data or materials in any format for any purpose other than for the Project.

7.00 SUCCESSORS AND ASSIGNS

This Agreement shall be binding upon and inure to the benefit of the parties to this Agreement and their respective successors and assigns; provided, however, that none of the parties hereto shall assign this Agreement without the prior written consent of the other.

8.00 CLAIMS, DISPUTES AND GOVERNING LAW

8.00 CLAIMS AND DISPUTES

8.01 Claims Definition

A Claim is a demand or assertion by one of the parties seeking adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question between the parties arising out of or relating to the Contract. Claims must be made by written notice within a specified time period. The responsibility to substantiate Claims shall rest with the party making the Claim.

8.01.1 Policy of Cooperation

The parties shall endeavor to resolve all of their claims and disputes amicably and informally through open communication and discussion of all issues relating to the Project. To the greatest extent possible, the parties shall avoid invoking the formal dispute resolution procedures contained in the Contract Documents.

8.02 Recommendation of Design Professional

Claims must be referred initially to the Design Professional for action as provided in paragraph 8.10 as an express condition precedent to proceeding further in resolving any claim.

8.03 Time Limits on Claims
Claims must be made within 5 business days after occurrence of the event giving rise to such Claim or within 5 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been resolved by Change Order will not be valid.

8.04 Continuing Contract Performance

Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the University shall continue to make payments in accordance with the Contract Documents subject to the University’s rights relative to payments, withholding of payments, termination, or all other rights afforded it in the Contract Documents.

8.05 Claims for Concealed or Unknown Conditions

If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then written notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 24 hours after first observance of the conditions. The Design Professional will promptly investigate such conditions and, if the conditions differ materially and cause an increase or decrease in the Contractor’s cost of, or time required for, performance of any part of the Work, the Design Professional will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Design Professional determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Professional shall so notify the University and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 5 days after the Design Professional has issued such determination. If the University and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Design Professional for initial determination, subject to further proceedings pursuant to Paragraph 8.09.

8.06 Claims for Additional Cost

Any Claim by the Contractor for an increase in the Contract Sum shall be submitted in writing as required by the Contract Documents before proceeding to execute the Work. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Design Professional, (2) an order by the University to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Design Professional, (4) failure of payment by the University, (5) termination of the Contract by the University, (6) University’s suspension or (7) changes in the scope of Work, the Contractor’s claim shall be filed in strict accordance with the procedure established herein.

8.07 Claims for Additional Time

Any Claim by Contractor for an increase in the Contract Time shall be submitted in writing as required by this provision and the Contract Documents. The Contractor’s Claim shall include an estimate of the probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.
As a precondition for the Claim to be considered by the University, Contractor must identify the precise activities affected as located on the approved network Project Schedule. Contractor must also describe the efforts that it has made to mitigate the effects of any negative schedule impact.

If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and location and could not have been reasonably anticipated, and that the abnormal weather conditions had an adverse effect on the scheduled construction.

8.08 Injury or Damage to Person or Property

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party’s employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 5 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in the Contract Documents.

8.09 Verification of Claims Submitted

With respect to any Claim asserted by Contractor for itself or on behalf of a Subcontractor for additional time or cost, the Contractor shall evaluate the claim and verify that any amounts claimed are valid, compiled in accordance with generally accepted accounting principles and are consistent with the terms of the existing contractual agreements regarding entitlement before presentation of the Claim to the Owner. Any Claim not verified in accordance with this requirement shall be denied without further recourse by the Contractor or Subcontractor.

8.10 Resolution of Claims and Disputes

8.10.1 Review by Design Professional

Design Professional will review all Claims and take one or more of the following preliminary actions within 10 days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Design Professional expects to take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Design Professional may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

If a Claim has been resolved, the Design Professional will prepare or obtain appropriate documentation. If a Claim has not been resolved, the party making the Claim shall, within 10 days after the Design Professional’s preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Design Professional, (2) modify the initial Claim or (3) notify the Design Professional that the initial Claim stands.

If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Design Professional, the Design Professional will notify the parties in writing that the Design Professional’s opinion will be rendered within 5 days. Upon expiration of such time period, the Design Professional will render to the parties the Design Professional’s written opinion relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor’s default, the Design Professional may, but is not obligated to,
notify the surety and request the surety’s assistance in resolving the controversy. The opinion of the Design Professional shall be subject to the review of the Vice-President for Finance and Business Operations Wayne State University (VPFBO).

8.10.2 Review by Vice-President for Finance and Business Operations

The Vice-President for Finance and Business Operations (VPFBO) shall review the Design Professional's opinion and the supporting information submitted by the parties for the purpose of upholding the Design Professional's opinion, modifying the Design Professional's opinion, or rejecting the Design Professional's opinion. The VPFBO shall render a decision within forty-five days of the completion of any submissions by the parties. The decision of the VPFBO is final unless it is challenged by either party by filing a lawsuit in the Court of Claims of the State of Michigan within one year of the issuance of the decision.

8.10.3 Jurisdiction

Jurisdiction over all claims, disputes, and other matters in question arising out of or relating to this Contract or the breach thereof, shall rest in the Court of Claims of the State of Michigan. No provision of this agreement may be construed as the University's consent to submit any claim, dispute or other matter in question for dispute resolution pursuant to any arbitration or mediation process, whether or not provisions for dispute resolution are included in a document which has been incorporated by reference into this agreement.

8.10.4 Condition Precedent

The process and procedures described in Section 8.10 are an express condition precedent to filing or pursuing any legal remedy including litigation. Pursuing litigation prior to exhaustion of the Dispute Resolution process set forth herein shall be premature and a material breach of this Agreement.

8.10.5 Governing Law

This Agreement shall be governed by and construed in accordance with the laws of the State of Michigan.

9.00 NON-DISCRIMINATION

9.01 General

The Contractor shall not discriminate against any job applicant, contractor, or employee because of race, color, religion, national origin, age, sex (including gender identity) height, weight, or familial, disability, or veteran status, and shall include terms identical or substantially similar to this section in all Subcontracts, Purchase Orders and other agreements pertaining to the Project.

9.02 Solicitation/Advertisements

The Contractor shall in all solicitation or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, age, sex (including gender identity), height, weight, or familial, disability or veteran status.

9.03 Rules/Laws
The Contractor shall comply with all applicable federal and state laws, and current published rules, regulations, directives, and orders of the Michigan Civil Rights Commission and other governmental agencies/departments.

9.04 Reports

The Contractor shall furnish and file compliance reports within such time and upon such forms as provided by the Michigan Civil Rights Commission; these forms may also elicit information as to the practices, policies, program, and employment statistics of the Contractor and of each Subcontractor. The Contractor shall permit access to all books, records, and accounts by the Michigan Civil Rights Commission and/or its agents, for purposes of investigation to ascertain compliance with this contract and with rules, regulations, and orders of the Michigan Civil Rights commission.

9.05 Persons with Disabilities

The Contractor shall comply with the provisions of the Michigan Persons with Disabilities Civil Rights Act (M.C.L. 37.1101, et seq.).

9.06 Contract Provisions

The Contractor shall include, or incorporate by reference, the provisions of this Article in every Subcontract, Subcontract and purchase order unless exempted by the rules, regulations or orders of the Michigan Civil Rights Commission, and shall provide in every Subcontract, subcontract or purchase order that said provisions shall be binding upon each Subcontractor, subcontractor or seller.

10.00 ADDITIONAL PROVISIONS

10.01 Prohibited Contracts or Subcontracts due to Unfair Labor Practices

Public Act No. 278 of 1980 prohibits State of Michigan from awarding Contract or Subcontract to employer who has been found in contempt of court by a Federal court of appeals, on not less than three (3) occasions involving different violations during preceding seven (7) years, for failure to correct unfair labor practice as prohibited by Section 8 of Chapter 372 of National Labor Relations Act, 29 U.S.C. 158. Contractor may not in relation to that Contract subcontract with such employer. The University may rescind, or require Contractor to rescind a contract if the employer or Subcontractor, manufacturer, or supplier of employer subsequently appears in register of such employers which will be compiled by Michigan’s Department of Licensing and Regulatory Affairs, pursuant to Section 2 of Public Act No. 278 of 1980.

10.02 Buy-American

University endeavors to buy products made in the United States of America whenever an American-made product is available that meets or exceeds the specifications requested and the price is equal to or lower than foreign-made product. Vendors and Contractors are instructed to bid American-made products and/or services whenever available. Vendors and Contractors may bid foreign-made products or services when:

1. those products or services are specified, or
2. as an alternate as long as the products or services are technically acceptable to the University and American-made goods or services that are competitively price and of comparable quality are not available.
A product or service shall be considered “American-made” if more than 50% of the product is manufactured or assembled in the United States or more than 50% of the services are performed in the United States.

10.03 Michigan Products

Contractor and its Subcontractors and suppliers shall utilize Michigan-made products whenever possible where price, quality and performance are equal to or better than non-Michigan products.

10.04 Drug and Alcohol Testing

The University is a “DRUG FREE WORKPLACE”, and the University requires Contractors, Subcontractors and sub-subcontractors with access to the work site to abide by the University’s policies on drugs, alcohol and tobacco, which can be found at http://bog.wayne.edu/code/2_20_04.php and http://policies.wayne.edu/administrative/00-03-smoke-free-campus.php. All costs for initial and periodic testing shall be borne by the Contractor.

1. The Contractor and University shall reserve the right to administer drug and alcohol tests to any and/or all site personnel at random periods and without notice.
   
   a. The Contractor shall be responsible for all costs including wages for those individuals testing drug or alcohol-free at the Contractor’s direction.
   
   b. Subcontractors shall be responsible for all costs including wages for those individuals not testing drug or alcohol-free at the direction of the Contractor, and the Subcontractor shall immediately remove those individuals from the site.

2. Any individual not testing drug or alcohol-free shall not be allowed to return to the site under any circumstances.

10.05 Other University Policies

The University’s policies related to Duty to Report Criminal Acts and Weapons on Campus shall apply to this Project and Contractor shall include this requirement in all Subcontracts, purchase orders and supply agreements.

10.06 University Representative

The University’s Representative shall be the Associate Vice President of Facilities Planning and Management, the Senior Director of Design and Construction Services, the Director of Design and Construction Services and the Project Manager. Any project decision on behalf of the University may only be in accordance with the Authorization Matrix that is attached as Exhibit C and incorporated by reference.

11.00 INCLUSION BY REFERENCE

This Contract and Contract Documents hereby include and incorporate by reference the General Conditions of Construction and Supplementary General Conditions, the Request for Proposal by University, the approved plans and specifications, Contractor’s Bid or Proposal insofar as it is not inconsistent with the other Contract Documents and other Project documents attached as Exhibits.
12.00 TERMINATION

12.01 Termination by the University for Cause

12.01.1

The University may terminate the Contract if the Contractor: (a) becomes insolvent; (b) files or has filed against it any Petition in Bankruptcy or makes a general assignment for the benefit of its creditors; (c) fails to pay, when due, for materials, supplies, labor, or other items purchased or used in connection with the Work; (d) refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will ensure the completion of the Work in accordance with the Master Project Schedule; (e) in the University’s opinion, persistently fails, refuses or neglects to supply sufficient labor, material or supervision in the prosecution of the Work; (f) interferes with or disrupts, or threatens to interfere with or disrupt the operations of the University, or any other Contractor, supplier, subcontractor, or other person working on the Project, whether by reason of any labor dispute, picketing, boycotting or by any other reason; or (g) commits any other breach of this Contract.

When any of the above reasons exist, the University may, without prejudice to any other rights or remedies of the University and after giving the Contractor and the Contractor’s surety, if any, three days written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety: (1) take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; (2) accept assignment of subcontracts; and (3) finish the Work by whatever reasonable method the University may deem expedient.

When the University terminates the Contract for one of the stated reasons, the Contractor shall not be entitled to receive further payment until the Work is finished.

12.01.2

If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Design Professional’s services and expenses made necessary thereby, the remaining balance shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the University. The amount to be paid to the Contractor or University, as the case may be, shall be certified by the Design Professional, upon application, and this obligation for payment shall survive termination of the Contract.

12.02 Suspension by the University for Convenience

12.02.1

The University may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the University may determine.

12.02.2
An adjustment shall be made for increases in the cost and/or time of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent: (1) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or (2) that an equitable adjustment is made or denied under another provision of this Contract.

Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

12.03 Termination By The University For Convenience

12.03.1

The University, with or without cause, may terminate all or any portion of the services by the Contractor under this Agreement, upon giving the Contractor 30 days written notice of such termination. In the event of termination, the Contractor shall deliver to the University all reports, estimates, schedules, subcontracts, Contract assignments, purchase order assignments, and other documents and data prepared by it, or for it, pursuant to this Agreement.

12.03.2

Unless the termination is for cause, the Contractor shall be entitled to receive only the payments provided for in Article 4, pro-rated to the date of termination (including payment for the period of the 30-day notice) plus reimbursement for approved and actual costs and expenses incurred by the Contractor to the date of termination. Prior to payment, the Contractor shall furnish the University with a release of all claims against the University.

12.04 Termination By The Contractor

12.04.1

The Contractor may terminate the Contract if the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor, sub-subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor, for any of the following reasons: (1) issuance of an order of a court or other public authority having jurisdiction; (2) an act of government, such as a declaration of national emergency, making material unavailable; (3) because the Design Professional has not approved a Certificate for Payment and has not notified the Contractor of the reason for withholding approval, or because the University has not made payment of undisputed amounts on an approved Certificate for Payment within the time stated in the Contract Documents; (4) if repeated suspensions, delays or interruptions by the University constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

If one of the above reasons exists, the Contractor may, upon seven additional days’ written notice to the University and Design Professional, terminate the Contract and recover from the University payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit.

12.04.2
If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor because the University has persistently failed to fulfill the University’s obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days’ written notice to the University and the Design Professional, terminate the Contract and recover from the University as provided in Subparagraph 12.03.2

13.00 COMPLETE AGREEMENT

The Contract Documents constitute the entire agreement between the parties and supersede any prior discussions or negotiations. Any modification of these Contract Documents must be in writing and signed by the duly authorized representatives of the parties.

IN WITNESS WHEREOF, each of the parties has caused this Agreement to be executed by its duly authorized representative on the dates shown beside their respective signatures, with the contract to be effective upon the date set forth above.

CONTRACTOR  Wayne State University
By: ______________________________  By: ______________________________
Name: ______________________________  Name: William R. Decatur
Title: ______________________________  Title: VP Finance & Business Operations
Date: ______________________________  Date: ______________________________

Exhibit A – Contractor’s Bid or Proposal

[GENERAL CONTRACTOR’S NAME] bid/proposal dated ____________.

Exhibit B – Basis of Compensation

a. The University shall pay the Contractor a not to exceed amount [of $$$$$$ ($"Amount in words 00" ]/100 dollars) based on unit pricing in the proposal which will be adjusted to reflect actual units used for the performance of all work associated with the Contractor’s Base Bid "and Alternates (List)".

b. List of Alternates. The University may, at its sole discretion, during the life of the contract, award the following alternates at the amounts indicated: (If this section is not used, delete all text and enter Deleted)

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate 1</td>
<td></td>
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<tr>
<td>Alternate 2</td>
<td></td>
</tr>
<tr>
<td>Alternate 3</td>
<td></td>
</tr>
</tbody>
</table>

c. List of unit prices. In the event additional work becomes necessary, the following unit prices will apply:
"(If section 3.3 is not used, delete all text and enter Deleted"

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
</tbody>
</table>

d. Liquidated Damages. It is understood and agreed that, if the project is not completed within the time specified in the Agreement plus any extension of time allowed pursuant thereto, the actual damages sustained by the University because of any such delay will be uncertain and difficult to ascertain, and it is agreed that the reasonable foreseeable value of the use of said project by the University would be the sum of $\text{_______} (\text{_______ Hundred 00/100 dollars}) \text{ per day. Therefore, the Contractor shall pay as liquidated damages to the University the sum of } $\text{_______} (\text{_______ Hundred 00/100 dollars}) \text{ per day for each day’s delay in substantially completing said project beyond the time specified in this Agreement and any extensions of time allowed thereunder.}
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GENERAL CONDITIONS OF CONSTRUCTION

1.00 DEFINITIONS

**Bulletin** - A bulletin is defined as a compilation of changes to the scope of the work issued by the Design Professional or University which requests the Contractor to submit a quote for the changes.

**Change Order** - A written agreement entered into after the award of the Contract which alters or amends the executed Contract.

**Claim** - A Claim is a demand or assertion by one of the parties seeking adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question between the parties arising out of or relating to the Contract. Claims must be made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

**Close-out Documents** - Close-out Documents shall include as-built record drawings and specifications, Operations and Maintenance Manuals, Requests for Information (RFIs), submittals, shop drawings, coordination drawings, warranties, unconditional lien waivers and governing approvals.

**Cost of Work** - The term Cost of Work, as used herein, is that portion of the Project Cost, that is the estimated or actual labor and material costs of that Work performed (or to be performed) on the Project by the Contractor and all subcontractors, and is inclusive of the cost of construction as described by divisions of the Construction Specifications Institute or other standard format, which constitutes the Direct Cost of Work. However, Cost of Work shall not include the Indirect Cost of Work as herein defined.

**Contract** - The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a duly executed written Change Order.

**Contract Documents** - The Contract Documents consist of the bonds, insurance certificates, plans, specifications, drawings, bulletins, addenda, Agreement, General Conditions of Construction, Supplementary General Conditions, Change Orders, Contractor’s Bid, and to the extent not otherwise inconsistent with any other Contract Document.

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Project. Contract Documents are complementary, and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to be consistent with the Contract Documents and the highest standard of care. In the case of an inconsistency between, or perceived omission or error in the Drawings, Specifications, or other Contract Documents which is not clarified by addendum or Requests for Information (RFI), or should the Contractor be in doubt as to their exact meaning, the Contractor shall notify the Design Professional and the University at once. The University shall not be responsible for the Contractors misinterpretations of Drawings and Specifications and/or other Contract Documents.

Nothing contained in the Contract Documents shall create a contractual relationship between University and any third party; however, the University is an intended third-party beneficiary of all contracts for design and
engineering services, all subcontracts, purchase orders and other agreements between Contractor or Design Professional and third parties. The Contractor and Design Professional shall incorporate the obligations of the Contract Documents into its respective subcontracts, agreements and purchase orders.

Contractor: The term “Contractor” as used in the General Conditions shall include the term “Construction Manager” as used in the Contract for Construction Management Services.

Contractor’s Construction Schedule- The construction schedules required by the Contract Documents shall be a logic network prepared in the critical path method or other sequential network in use within the construction industry and shall depict: (1) a sequence of operations mutually agreeable to the University, Design Professional and Contractor; (2) the dates of commencement and completion of each task of the Work (including lead time activities, drawing and sample submissions, bidding, awarding Trade Contracts, manufacturing and shipping); (3) delivery dates for materials and equipment; and (4) at the University’s request shall include all Finish Work to be performed by separate Contractors. The construction schedule includes a complete itemized breakdown of the Work.

Contract Sum- The Contract Sum shall be the total dollar value of the Agreement between the University and Contractor.

Delay – A delay shall be recognized as a time of completion impact on the performance of the Work by the Contractor that extends the overall duration of the Project beyond the substantial completion and final completion dates specified in the Agreement. A delay shall not be recognized if the time of completion impact on the performance of the Work occurs on a non-critical path activity, and does not extend the overall duration of the Project.

Day - “Days” means calendar days unless specifically provided to the contrary herein or in the Construction Agreement; provided, however, if any day falls on a weekend or a holiday, same shall refer to the next business day thereafter.

Design Professional - The Design Professional is the person lawfully licensed to practice architecture or engineering or an entity lawfully practicing architecture or engineering identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Design Professional” means the Design Professional or the Design Professional’s authorized representative.

Final Completion - “Final Completion” means the completion of all the Work in accordance with the Contract Documents and the acceptance thereof by the University. Completion of the Work includes (1) full performance of all Contract terms; (2) acceptance of the Work by University; (3) resolution of all outstanding Changes of Contract; (4) completion of all “punch-list” items; and (5) delivery of all Close-out Documents.

Incomplete Construction List – The Incomplete Construction List is prepared by the Contractor for review by Design Professional and University identifying Work remaining to be completed at the time of Substantial Completion and the date by which Contractor shall complete the Work on the Incomplete Construction List.

Knowledge - The terms "knowledge," "recognize" or "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows or should know, recognizes or should reasonably recognize and discovers or should reasonably discover in exercising the care, skill and diligence required by the Contract Documents.
**Master Project Schedule** - The Master Project Schedule shall show the sequence, duration in calendar days, interdependence for the complete performance of all Work. The Master Project Schedule shall begin with the date of issuance of the Notice to Proceed and conclude with the date of final completion.

**Notice to Proceed** - A "Notice to Proceed" means written notice given by the University to the Contractor fixing the date on which the Contract Time will commence to run and/or on which Contractor shall start to perform Contractor’s obligations under the Contract Documents. A Notice to Proceed by the University shall authorize all or a portion of the Work for the Costs so defined.

**Persistently fails** - The phrase "persistently fails" and other similar expressions, as used in reference to the Contractor, shall be interpreted to mean any combination of acts and omissions, which cause the University to reasonably conclude that the Contractor will not complete the Work within the Contract Time, or for the Contract Sum or in substantial compliance with the requirements of the Contract Documents.

**Plans** - The drawings prepared by the Design Professional and accepted by the University which include elevations, sections, details, schedules, diagrams, information, notes, or reproductions or any of these, and which show the location, character, dimension, or details of the Work. These include the graphic and pictorial portions of the Contract Documents as listed in the Agreement.

**Preliminary Project Cost and Schedule Impact Report** – The direction from the University to perform changed Work in the absence of agreement between the University and Contractor, which may result in a Change Order upon agreement of the cost or schedule impact.

**Project** - The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the University or by separate Contractors.

**Punchlist** - Punchlist items shall include all Work remaining on the Contractor’s Incomplete Construction List and additional items documented by the Design Professional, Contractor and University and issued to the Contractor and may be issued with a Certificate of Substantial Completion. It is understood and accepted that the Punchlist included with the Certificate of Substantial Completion may not represent all remaining Work for which the Contractor is obligated and that Punchlist may be expanded prior to Final Completion.

**Reasonably inferable** - The phrase "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a Contractor familiar with the Project and exercising the care, skill and diligence required by Contract Documents.

**Site** - The area specified in the Contract Documents and the area made available for the Contractor’s operation.

**Soft Costs** - "Soft Costs" are those costs derived by the University and shall include, but not be limited to, items such as Environmental services, State administration fees, Design Professional fees, moving furniture, fixtures and equipment, and telecommunications, unless otherwise agreed to by the Parties.

**Specifications** - The term Specifications shall mean the written instructions and requirements prepared by the Design Professional which complement the plans and which describe the manner of executing the Work or the qualities and types of materials to be furnished.

**Statement of Probable Cost** - The Statement of Probable Cost, as developed by the Contractor, is essential to the budgetary and management processes of the University. The Statement of Probable Cost,
once established and accepted by the University, is relied upon by the University for its subsequent budgetary planning and financial needs for the Project.

The Statement of Probable Cost, applicable to either an estimated or actual cost, is the sum of all costs for a completely constructed, functionally ready-for-use project, in accordance with the scope, scheme, concept, and statement, as developed, documented and accepted by the University, and as constructed by the accepted contracting method or methods. The Contractor shall provide Statements of Probable Cost as needed during the Project to aid the University and Design Professional in making scope of work selection decisions, especially during design phase and minimally at the end of each design phase of the Project and shall include all costs included in the Contract Sum. The University shall be responsible for the derivation and provision of all Soft Costs that comprise the Project scope and budget.

Subcontractor - The term “subcontractor” shall mean any business entity under contract to the Contractor for services on or regarding the Project. The term “Subcontractor” as used in the General Conditions shall be synonymous with the term “Trade Contractor” as used in the Contract for Construction Management Services. Nothing contained in this contract shall create any contractual relationship between the University and any subcontractor. However, the University is the intended third-party beneficiary of all contracts for design, engineering or consulting services, all Trade Contracts, subcontracts, purchase orders and other agreements between the Contractor and third parties. The Contractor shall incorporate the obligations of this Agreement into its respective Trade Contracts, subcontracts, supply agreements and purchase orders.

Substantial Completion - “Substantial Completion” shall mean the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the University can occupy or utilize the Work for its intended use. Substantial Completion shall only be determined as described in the Contract Documents.

Unsafe Persons – Unsafe persons shall be those individuals that present a safety hazard to themselves or others.

University - The University is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “University” means the University or the University’s authorized representative. Any reference to “Board of Governors” shall be considered to mean “University.”

University’s Representative - The University’s Representative shall include the Associate Vice President for Facilities Planning and Management, the Senior Director of Design and Construction Services, the Director of Design and Construction Services and the Project Manager. Any project decision on behalf of the University may only be in accordance with the Authorization Matrix.

Vice President of Finance and Business Operations - The Vice President of Finance and Business Operations shall be the level of review over the Associate Vice President of Facilities Planning & Management.

Work - The term “Work” means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, licenses, permits, insurance and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.
2.00 BIDDING

2.01 Duty to Carefully Examine These Instructions

Prospective bidders for this project shall carefully examine the instructions contained herein and be cognizant of and satisfied with the conditions which must be satisfied prior to submitting a proposal and to the conditions which affect the award of the Contract.

2.02 Disclosure of Bidders

The Contractor shall only accept proposals from Subcontractors who are acceptable to the University.

2.03 Clarification During Bidding

The Contractor shall examine the plans and specifications in preparing the bid and shall immediately report to the Design Professional any omissions, discrepancies, or apparent errors found in the plans and specifications. Prior to the date of bid opening, bidders shall submit a written request for clarification in accordance with the instruction contained in the request for bids. If time permits, such clarification shall be issued in the form of addenda to all bidders.

2.04 Bidding Documents

2.04.1 Bid Proposal Package

Each bidder will receive a bid proposal package containing a standard proposal form which shall be used for bidder’s proposal. Each proposal shall give the prices proposed in the manner required by the proposal and shall be signed by the bidder or the bidder’s duly authorized representative, with its address and telephone number. If the proposal is made by an individual, the individual’s name, postal address, and telephone number must be shown. If made by a partnership, the proposal shall have the signature of all partners or an affidavit signed by all partners empowering one partner as an agent to act in their behalf and the address and telephone number of the partnership. A proposal submitted by a corporation shall show the name of the state in which the corporation is chartered, the name of the corporation, its address and telephone number, and the title of the person who signs on behalf of the corporation.

2.04.2 Listing of Proposed Subcontractors Acceptable to the University

The Contractor will require every subcontractor to provide the name and location of the place of business of each Subcontractor and subordinate Subcontractor which will perform work or labor or render services for the Project.

2.04.3 Bidder’s Security

All bids shall be presented under sealed cover and have enclosed an amount as directed in the instructions to bidders as bid security. The bid security may be a cashier’s check made payable to Wayne State University or as otherwise directed in the instructions to bidders.

2.05 Bid Proposals

2.05.1 Submission of Proposals
Proposals shall be submitted to the office indicated on the bid proposal. It is the responsibility of the bidder to see that its bid is received in the proper time. Delays in timely receipt of the bid caused by the United States or the University mail system, independent carriers, acts of God, or any other cause shall not excuse late receipt of a bid. Any bid received after the scheduled closing time for receipt of bids shall not be considered and will be rejected by the University, opened, retained by the University or returned to the bidder unopened.

2.05.2 Withdrawal of Proposals

Any bid may be withdrawn at any time prior to the time fixed for receiving bids but only by a written request from the bidder or its authorized representative filed with the University. An oral, faxed, or telephonic request to withdraw a bid proposal is not acceptable. The withdrawal of a bid shall not prejudice the right of a bidder to file a new bid. This paragraph does not authorize the withdrawal of any bid after the time fixed for receiving bids.

2.05.3 Public Opening of Proposals – SECTION DELETED

2.05.4 Rejection of Irregular Proposals

Proposals may be rejected if they show any alterations of forms, additions not called for, conditional bids, incomplete bids, erasures, or irregularities of any kind. If the bid amount is changed after the amount has been once inserted, the change shall be initialed.

2.05.5 Power of Attorney or Agent

When proposals are signed by an agent, a power of attorney shall either be on file with the University prior to the opening of bids or be submitted with the proposal. Failure to submit a power of attorney may result in the rejection of the proposal as irregular and unauthorized. A power of attorney is not necessary in the case of a general partner of a partnership.

2.05.6 Waiver of Irregularities/University’s Right to Reject Bids

The University reserves the right to waive any or all irregularities in proposals submitted. The University reserves the right to reject any or all of the bids submitted.

2.05.7 Exclusion from Contract Documents

Nothing in any of the bidding documents, including but not limited to Request for Proposal form, Notice to Contractors, Proposal by Contractor and Design Professional and bids including any attachments or exhibits by Contractor, shall be considered part of the Contract Documents unless specifically incorporated.

2.06 Mistake in Bid

A bidder shall not be relieved of a bid nor shall any change be made in a bid because of mistakes without consent of the University. Failure by the Contractor to honor its proposal following the opening of bids for any reason shall result in the forfeiture of the Bid Security and possible suspension from future work consideration by and with the University.

2.07 Non-Discrimination
Wayne State University is an affirmative action/equal opportunity employer. The University has a strong commitment to the principle of diversity in all areas.

The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, color, religion, national origin, age, sex (including gender identity), height, weight or familial, disability or veteran status. The Contractor will ensure that applicants are employed and that employees are treated during employment, without regard to their race, color, religion, national origin, age, sex (including gender identity), height, weight or familial, disability, or veteran status. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor shall, in all solicitation or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, age, (including gender identity), height, weight or familial, disability or veteran status.

The Contractor shall comply with all requirements of the Elliott-Larsen Civil Rights Act being 1976 PA 453, as amended.

The Contractor shall also comply with the Persons with Disabilities Civil Rights Act being 1976 PA 220, as amended.

The Contractor shall include, or incorporate by reference, the provisions of this Article 2.07 in each and every subcontract or purchase order and shall provide in each and every subcontract or purchase order that said provisions will be binding upon each and every subcontractor and Supplier and Vendor.

Any breach of the requirements and covenants of this Article 2.07 shall constitute a material breach of the Contract Documents.
3.00 AWARD AND EXECUTION OF CONTRACT

3.01 Contract Bonds and Insurance

3.01.1 Payment and Performance

The Contractor shall forward to the University fully executed Payment & Performance Bonds in the amount of 100 percent of the Contract value on the AIA Form 312 or an equivalent form that is acceptable to the University and in compliance with MCL 129.201 et seq. within five (5) days after execution of the Agreement.

In the same five (5) day period, the Contractor shall present to the University, in an acceptable form, evidence of the insurance as required by the Contract Documents. Actual Work shall not commence until the bond and insurance is received by the University. Failure to provide the bond and insurance in the time-frame allowed shall not be cause for an extension of Contract Time.

All alterations, extensions of time, extra and additional work, and other changes authorized by any part of the Contract, including determinations made under Article 7.00, Claims and Disputes, shall be made without securing the consent of the surety or sureties on the Contract bonds.

Whenever the University has cause to believe that the surety has become insufficient, the University may demand in writing that the Contractor provide such further bonds or additional surety, not exceeding that originally required, as in the University’s opinion is necessary, considering the extent of the work remaining to be done. Thereafter no payment shall be made to the Contractor or any assignee of the Contractor until the further bonds or additional surety have been furnished.

Contract bonds shall remain in full force and effect during the repair and guarantee period required by the Contract Documents.

3.02 Execution of Contract

The Contract shall be signed by the Contractor in three (3) duplicate counterparts and returned to the University within five days of receipt from the University, not including Saturdays, Sundays, or legal holidays. No Contract shall be binding upon the University until it has been executed by the Contractor and a University official in accordance with the Authorization Matrix.

3.03 Failure or Refusal to Execute Contract

Failure or refusal by the Contractor to execute the Contract within the time set in Section 3.02 shall be just cause for the rescission of the award and the forfeiture of bidder’s security. Failure or refusal to file acceptable bonds within the time set in Section 3.01 constitutes a failure or refusal to execute the Contract. If the Contractor fails or refuses to execute the Contract, the University may award the Contract to another contractor and the Contractor shall forfeit his Cashier’s Check.
4.00 RESPONSIBILITIES OF THE PARTIES

4.01 University

4.01.1 Information and Services Required of the University

The University shall make available existing surveys describing physical characteristics, legal limitations and utility locations for the site of the Project. The University does not warrant or guarantee the accuracy of the information provided.

Unless otherwise agreed to, the University shall be responsible for the abatement of asbestos containing materials and/or site related environmental hazards. The University will provide documentation regarding the presence of asbestos containing materials or other possible environmental hazards to the Contractor. Second opinions on previously documented clean conditions shall be provided at the Contractor's expense. Positive results regarding environmental hazards shall become the University's obligation. If, during the execution of the Work, previously unknown environmental hazards are encountered, the University shall be allowed a reasonable amount of time to abate environmental hazards.

The University shall provide available information regarding requirements for the Project including plans and specifications for the buildings and a survey of the site where required. The Contractor shall review the plans and specifications and survey, if provided, for errors, inconsistencies, ambiguities or omissions as required by Article 4.02.2, Review of Contract Documents and Field Conditions by Contractor. In the event errors, inconsistencies, ambiguities or omissions in the plans, drawings, and specifications were not reasonably identifiable in the Contractor’s review as specified in Article 4.02.2, Review of Contract Documents and Field Conditions by Contractor, and such errors, inconsistencies, ambiguities or omissions result in changes in time and cost, the University may make reasonable adjustment in the Contract Sum in accordance with Article 6.00, CHANGES IN THE WORK of the General Conditions.

Except for permits and fees, which are the responsibility of the Contractor under the Contract Documents, the University shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

Information or services under the University’s control shall be furnished by the University with reasonable promptness to avoid delay in orderly progress of the Work.

All reproduction required for construction is the obligation of the Contractor.

4.01.2 University's Right to Stop the Work

If, in the University’s determination, the Contractor fails to correct work which is not in accordance with the requirements of the Contract Documents as required, or persistently fails to carry out work in accordance with the Contract Documents, the University Representative, by written order may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the University to stop the Work shall not give rise to a duty on the part of the University to exercise this right for the benefit of the Contractor or any other person or entity.

It is understood that while the Contractor is fully responsible for the safety of the jobsite, and for the methods of its execution, if the University deems that the Contractor is failing to provide safe conditions, the University may stop or restrict the Work under such conditions. However, this right shall not create such duty on the University. Under no circumstance shall the Contractor be granted a time extension or Contract
4.01.3 University's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a three (3) day period after receipt of written notice from the University to commence and continue correction of such default or neglect with diligence and promptness, the University may after such three (3) day period, without prejudice to other remedies the University may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Design Professional’s additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the University.

4.01.4 University's Right to Audit

4.01.4.1

Contractor’s records, which shall include but not be limited to accounting records (hard copy, as well as computer readable data if it can be made available), written policies and procedures; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original estimates; estimating work sheets, correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; and any other supporting evidence deemed necessary by the University to substantiate changes related to the Agreement (collectively referred to as "Records") shall be maintained in accordance with Generally Accepted Accounting Principles and open to inspection and subject to audit and/or reproduction by University’s agent or its authorized representative to the extent necessary to adequately permit evaluation and verification of Cost of the Work, and any invoices, change order, payments or claims submitted by the Contractor or any of his payees pursuant to the execution of the contract that are or have been charged on a basis other than a lump sum approved in writing by the University.

4.01.4.2

Such audits may require inspection and copying from time to time and at reasonable times and places of any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase order, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in University’s judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Documents. Such records subject to audit shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs, (including overhead allocations) as they may apply to costs associated with this Agreement.

4.01.4.3

The University or its designee shall be afforded access to all of the Contractor’s Records, and shall be allowed to interview any of the Contractor’s employees, pursuant to the provisions of this article throughout the term of this contract and for a period of five (5) years after Final Payment or longer if required by law.
To the extent feasible, the Construction Manager’s records shall remain confidential, and the University’s third party auditors will enter into a confidentiality agreement between and among the University, the third-party auditor and the Contractor prior to any audits being conducted.

4.01.4.4

Contractor shall require all Subcontractors and material suppliers (payees) to comply with the provisions of this article by insertion of the requirements hereof in a written agreement between Contractor and payee so as to allow the University to verify any amounts charged to the Project by a payee on a basis other than a lump sum approved in writing by the University. Such requirements will also apply to Subcontractors and all lower tier Subcontractors. Contractor shall cooperate fully and shall cause all of Contractor’s Subcontractors to cooperate fully by furnishing or making available to University from time to time whenever requested in an expeditious manner any and all such information, materials and data.

4.01.4.5

University’s agent or its authorized representative shall have access to the Contractor’s facilities, shall have access to all necessary records; and shall be provided adequate and appropriate work space, in order to conduct audits in compliance with this article.

4.01.4.6

Contractor agrees that University’s designee shall have the right to examine the Contractor’s records (during the contract period and up to five (5) years after Final Payment is made on the contract) to verify the accuracy and appropriateness of the pricing data used to price change proposals or claims. Contractor agrees that if the University determines the cost and pricing data submitted (whether approved or not) was inaccurate, incomplete, not current or not in compliance with the terms of the contract regarding pricing of change orders, an appropriate contract price reduction will be made. Such post-approval contract price adjustments will apply to all levels of contractors and/or subcontractors and to all types of change order proposals specifically including lump sum change orders, unit price change orders and cost-plus change orders.

4.01.4.7

If an audit, inspection or examination in accordance with this article, discloses overcharges (of any nature) by the Contractor to the University in excess of five percent (5%) of the total contract billings, the actual cost of the University’s audit shall be reimbursed to the University by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor’s invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of University’s findings to Contractor.

4.02 Contractor

The Contractor recognizes the relationship of trust and confidence established between the University and the Contractor by this Contract. The Contractor shall furnish the University with its best skill and judgment and fully cooperate with the University in furthering its best interests. All the Work is to be done in the best manner by persons skilled in the type of Work to be performed.
4.02.1 Contractor's Responsibility for the Work

The Contractor shall be responsible to the University for all Work performed under this Contract. For purposes of assessing responsibility to the Contractor by the University, all persons engaged in the Work shall be considered employees of the Contractor. The Contractor shall give its personal attention to the fulfillment of the Contract and keep all phases of the Work under its control.

4.02.2 Review of Contract Documents and Field Conditions by Contractor

The Contractor shall have a continuing duty to read, carefully study and compare the Contract Documents as defined in Article 1.00, DEFINITIONS, and product data with each other and with information furnished by the University. The Contractor shall perform construction coordination and constructability review of the Contract Documents and shall at once report to the Design Professional and the University, any errors, inconsistencies, ambiguities and omissions before proceeding with the affected Work. The Contractor shall be liable to the University for damage resulting from the Contractor’s failure to properly perform such reviews or failure to promptly report any errors, inconsistencies, ambiguities or omissions identified in the Contract Documents to the Design Professional and the University. If the Contractor performs any construction activity that involves such error, inconsistency, ambiguity or omission in the Contract Documents without such notice to the Design Professional and the University, the Contractor shall assume responsibility for such performance and shall bear all costs attributable for correction. If the Contractor submits authorized substitutes that cost in excess of the Contract Sum or which cause coordination conflicts, the Contractor shall bear all costs attributable to correction.

The Contractor shall perform the Work in accordance with the Contract Documents.

The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Design Professional and University at once.

4.02.3 Supervision and Construction Procedures

The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. The Contractor shall be solely responsible to the University for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.

The Contractor shall be responsible to the University for acts and omissions of the Contractor’s employees, subcontractors and their agents and employees, and other persons performing portions of the Work under a Contract with the Contractor.

The Contractor agrees to furnish efficient business administration, coordination, supervision and superintendent of the Work and to furnish at all times a competent and adequate administrative and supervisory staff and an adequate supply of workmen and materials to perform the Work in the best and most sound way in the most expeditious and economical manner consistent with the interests of the University. The Contractor agrees from time to time at the University’s request to furnish estimates and technical advice as to construction methods and equipment to the University and Design Professional.

The Contractor agrees to cooperate with the Design Professional, University’s Representative, commissioning agents, and all persons or entities retained by the University to provide consultation and advice, and to coordinate the Work with the Work of such parties so that the Project shall be completed in
the most efficient and expeditious manner. In the event that Contractor's failure to efficiently sequence or coordinate the Work results in additional costs to the University, the Contractor shall promptly reimburse the University for the actual costs incurred. Contractor shall remain responsible for any delays resulting from its failure to efficiently coordinate and schedule the Work; any delays or extensions shall be addressed as provided in Sections 4.08, 4.09 and 4.10 of these General Conditions.

4.02.4 Quality Control

The Contractor shall be fully responsible for the quality of materials and workers' skill in the Project. The Contractor shall not rely upon the inspection and testing provided by the University or Design Professional other than those special inspections and tests performed at the University's direction for which there are written reports. Reports issued by the University's commissioning agent are to be considered complementary in nature and in no way relieve the Contractor of its responsibility to deliver Work in compliance with the Contract Documents.

The Contractor shall inspect the Work of the subcontractors on the Project, while the Work is being performed through final completion and acceptance of the Project by the University to assure that the Work performed and the materials furnished are in strict accordance with the drawings and specifications; the Contractor shall also inspect the Work to verify that Work on the Project is progressing on schedule.

The Contractor shall be responsible for inspection of portions of Work performed under this Contract to determine that such portions are in proper condition to receive subsequent Work. In the event that it becomes necessary to interpret the meaning and intent of the plans and specifications during construction and the meaning is not reasonably inferable, the Contractor shall submit as a Request for Information (RFI) to the Design Professional to make the interpretation in writing and transmit same to appropriate Subcontractors and the University in accordance with the procedures established in section 5.02 of these General Conditions.

The Contractor shall not be relieved of obligations to performing the Work in accordance with the Contract Documents either by activities or duties of the Design Professional in the Design Professional's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

4.02.5 Labor and Materials

The Contractor shall provide an analysis of the types and quantity of labor required for the Project and review the availability of the appropriate categories of labor required for all Work, and the Contractor shall be responsible to provide the necessary and adequate labor needed to complete the Project by the Contract Time. During the course of the Project, the Contractor shall endeavor to maintain harmonious labor relations on the Project.

Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

Unless otherwise noted in the Information to Bidders, the Contractor shall provide and pay for water, heat, electric and other utilities.

The Contractor shall enforce strict discipline and good order among the Contractor's employees and Subcontractors and others carrying out the Work of the Contract. The Contractor shall not permit employment of unsafe persons or persons not skilled in tasks assigned to them.
4.02.6 Disputes with Subcontractors

Wherever any provision of any section of the Plans and Specifications conflicts with any agreement or regulation of any kind at any time in force among members of any Trade Associations, Unions or Councils which regulate or distinguish what Work shall or shall not be included in the Work of any particular trade, the Contractor shall make all necessary arrangements to reconcile any such conflict without delay, damage, increase to the Contract Sum or recourse to the University. The University will not arbitrate disputes among subcontractors nor between the Contractor and one or more subcontractors concerning responsibility for performing any part of the Project.

In case the progress of the Work is affected by any undue delay in furnishing or installing any items of material or equipment required under the Contract Documents because of conflict involving any agreement or regulation of the type described above, the University’s Representative may require that other material or equipment of equal kind and quality be provided at no additional cost to the University.

4.02.7 Project Manager and Superintendent

The Contractor shall have at the Project site, during the full term of the Contract, an approved, competent project staff, which may include a Project Manager and Superintendent, and any necessary assistants, all satisfactory to the University’s Representative and in accordance with the Contract Documents and the Contractor’s Staffing Plan. The Project Manager or the Superintendent shall not be changed, except with the written consent of the University’s Representative unless the Project Manager or the Superintendent ceases to be in the employ of the Contractor. The Project Manager or the Superintendent shall represent the Contractor and all directions given to either of them by the University or the University’s Representative shall be as binding as if given to the Contractor. All directions and communications shall be confirmed in writing.

If a Project Manager or a Superintendent approved by the University’s Representative ceases to be in the Contractor’s employ, the Contractor shall immediately replace him with a person acceptable to the University’s Representative. The University in its sole discretion shall have the right to require the removal of any agent or employee of the Contractor or any subcontractor without cause at any time.

4.02.8 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect and such taxes are included in the Contract Sum.

4.02.9 Permits and Notices

The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, policies and lawful orders of public authorities and the University bearing on performance of the Work.

4.02.10 Allowances

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such stated amounts including identified unit cost, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection. Unless otherwise provided in the Contract Documents:
1. materials and equipment under an allowance shall be selected promptly by the University to avoid delay in the Work;

2. allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

3. the Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the allowances;

4. if allowance assumptions prove inappropriate, the Contract Sum may be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between actual costs and the allowances.

4.02.11 Use of Site

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. The site shall be safely maintained and kept clean, orderly and neat.

4.02.12 Safety

The Contractor shall protect adjoining property and nearby buildings, roads, and other facilities and improvements from dust, dirt, debris and other nuisances arising out of Contractor's operations or storing practices. Dust shall be controlled by sprinkling, misting or other effective methods acceptable to University and in accordance with legal requirements. An erosion and sedimentation control program shall be initiated, which includes measures addressing erosion caused by wind and water and sediment in runoff from site. A regular watering program shall be initiated to adequately control the amount of fugitive dust.

The Contractor is knowledgeable of and understands that the University may intend to maintain occupancy of certain portions of the existing facility. The Contractor shall exercise caution at all times for the protection of persons and their property. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (1) employees on the Work site together with Subcontractors and other persons who may be affected thereby; (2) the Work and materials and equipment to be incorporated therein, whether in storage on or offsite, under care, custody or control of the Contractor or the Contractor’s Subcontractors or sub-subcontractors; and (3) other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall install adequate safety guards and protective devices for all equipment and machinery, whether used in the Work or permanently installed as part of the Project.

The Contractor shall also provide and adequately maintain all proper temporary walks, roads, guards, railings, lights, and warning signs. The Contractor shall comply with all applicable laws relating to safety precautions. The Contractor shall establish and maintain and update as required a Project Specific Safety Program.

The Contractor shall designate a responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the University and Design Professional.

The Contractor shall require each and every one of its subcontractors and Trade Contractors to comply with all of the provisions of this section.
The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor’s discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in the Contract.

4.02.13 Hazardous Condition

The University and/or the Design Professional may bring to the attention of the Contractor a possible hazardous situation in the field regarding the safety of personnel on the site. The Contractor shall be responsible for verifying that all local, state, and federal workplace safety guidelines are being observed. In no case shall this right to notify the Contractor absolve the Contractor of its responsibility for monitoring safety conditions. Such notification shall not imply that anyone other than the Contractor has assumed any responsibility for field safety operations.

Explosives shall not be used without first obtaining written permission from the University and then shall be used only with the utmost care and within the limitations set in the written permission and in accordance with prudence and safety standards required by law. Storage of explosives on the Project site or University is prohibited. Powder activated tools are not explosive for purposes of this Article; however, such tools shall only be used in conformance with State safety regulations.

The Contractor shall report in writing to the University’s Representative, within eight (8) hours, all accidents whatsoever arising out of, or in connection with, the performance of the Work, whether occurring on or off the Site, which caused death, personal injury or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the University Representative and the University Police at (313) 577-2222. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall report promptly the facts in writing to the University’s Representative, giving full details of the claim.

4.02.14 Cutting, Patching and Sequencing

The Contractor shall be responsible for all cutting, fitting or patching required to complete the Work and to ensure the complete and effective coordination of the Work.

The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the University or separate Contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the University or a separate Contractor except with written consent of the University and of such separate Contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the University or a separate Contractor the Contractor’s consent to cutting or otherwise altering the Work.

4.02.15 Access to Site

The Contractor shall at all times permit the University and the Design Professional to visit and observe the Work, and the shops where Work is in preparation, and shall maintain proper facilities and provide safe access for such observation. Work requiring testing, observation or verification shall not be covered up without such test, observation, or approval. Appropriate advance coordination of such testing, observation or verification is expected. University must provide prior written approval for any work to be performed on a
Saturday, Sunday, or holiday. In the event that Contractor desires to perform Work on a weekend or holiday, Contractor shall provide a minimum of 48 hours written notice to the University of such desire prior to performing such Work. However, if the Work involves an actual or potential interruption to a utility or service, the Contractor shall provide no less than seven (7) days' written notice to the University.

The Contractor acknowledges that during the performance of the Work, the affected building and surrounding campus buildings will remain occupied and will require access by the public. The Contractor further acknowledges that other Contractors will be working on or near the Project site to accomplish the University’s purposes and projects. To the greatest extent possible, the Contractor shall cooperate fully with the University and its guests, students, employees, invitees, and other Contractors in performing the Work required under the Contract. The Contract Sum includes any and all reasonably necessary costs expended to minimize interference with the University's activities as well as to coordinate schedules with other contractors' projects as required by the University.

4.02.16 Burden for Damage

From the issuance of the official Notice to Proceed until the formal acceptance of the Project by the University, the Contractor shall have the charge and care of and shall bear all risk of damage to the Project and materials and equipment for the Project other than damage directly caused by the University or the University's other contractors.

4.02.17 Payments by Contractor

The Contractor agrees to promptly pay all subcontractors upon receipt of each progress payment, unless otherwise agreed in writing by the parties, the respective amounts allowed Contractor on account of the Work performed by its subcontractors to the extent of each such subcontractor's interest therein.

In the event the University becomes informed that the Contractor has not paid a subcontractor as herein provided, the University shall have the right, but not the duty, to issue future checks in payment to the Contractor of amounts otherwise due hereunder naming the Contractor and such subcontractor as joint payees. Such joint check procedure, if employed by the University, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit or obligate the University to repeat the procedure in the future. This provision shall not supersede the procedures set forth in Article 8.00 of these General Conditions.

4.02.18 Responsibility to Secure and Pay for Permits, Licenses, Utility Connections, Etc.

The Contractor shall secure all permits and licenses required for any operations required under this Contract and shall pay all costs relating thereto as well as all other fees and charges that are required by the United States, the State, the county, the city, a public utility, telephone company, special district, or quasi-governmental entity. It is the responsibility of the Contractor to ascertain the necessity of such permits and licenses in preparing its bid, Contract Sum and include in its bid, Contract Sum the cost thereof, as well as any time requirements for securing such permits and licenses.

4.02.19 Patented or Copyrighted Materials

The Contractor shall pay all royalties and license fees for the use of patented or copyrighted processes or materials. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the University and Design Professional harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be
responsible for such loss unless such information is promptly furnished to the Design Professional and University in writing.

4.02.20 Property Rights in Materials and Equipment

Nothing in the Contract shall be construed as vesting in the Contractor any property right in the materials or equipment after the materials or equipment have been attached to or permanently placed in or upon the Work or the soil or after payment has been made for fifty percent or more of the value of the materials or equipment delivered to the site of the Work whether or not they have been so attached or placed. All such materials or equipment shall become the property of University upon being so attached or placed, or upon payment of fifty percent or more of the value of the materials or equipment delivered on the site but not yet installed and the Contractor warrants that all such property shall pass to the University free and clear of all liens, claims, security interests, or encumbrances.

4.02.21 Utilities

The Contractor shall refer to and abide by the policies included in the Supplementary General Conditions and shall provide the notices as required by University’s Utility Disturbance and Interruption Request form.

The Contractor shall provide as-built drawings of all utilities encountered and constructed for the University, indicating the size, horizontal location, and vertical location based on the Project bench mark or a stable datum.

Unless otherwise specifically stated, the Contractor shall provide or otherwise make all arrangements for utilities required to deliver the Work.

4.02.22 Asbestos and Hazardous Materials

The Contractor is prohibited from installing any asbestos containing materials or products, and other prohibited and hazardous materials in the Work. The Contractor shall be responsible for removal and replacement costs should it be determined this provision has been violated, regardless of whether the job has been completed.

4.02.23 Photographic Site Survey

Contractor shall perform a photographic survey of construction site and adjoining structures prior to commencing Work. The survey shall be provided to the University and shall include photographs of pathways, flat concrete paving, foundations, walls, landscaping.

4.02.24 Compliance with University Policies on Drugs, Alcohol and Tobacco.

The University requires Contractors, Subcontractors and sub-subcontractors with access to the work site to abide by the University’s policies on drugs, alcohol and tobacco, which can be found at: http://bog.wayne.edu/2_20_04.php and http://policies.wayne.edu/administrative/00-03-smoke-free-campus.php. All costs for initial and period testing shall be borne by the Contractor.

1. The Contractor and University shall reserve the right to test any and/or all site personnel at random periods and without notice.

   a. The Contractor shall be responsible for all costs including wages for those individuals testing drug or alcohol-free at the Contractor’s direction.
b. Subcontractors shall be responsible for all costs including wages for those individuals not testing drug or alcohol-free at the direction of the Contractor, and the Subcontractor shall immediately remove those individuals from the site.

2. Any individual not testing drug or alcohol-free shall not be allowed to return to the site under any circumstances.

4.03 Design Professional

4.03.1 Design Professional's Administration of Contract

The Design Professional will provide one or more Project Representatives to assist in the administration of the Contract as described in the Contract Documents, and to assist the University’s Representative (1) during the construction, (2) until final payment is due and (3) with the University’s concurrence, from time to time during the correction and warranty period. The Design Professional will advise and consult with the University on issues relating to contract performance and interpretation. The Design Professional will have no authority to act on behalf of the University except as provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

The Design Professional will visit the site at intervals defined in the Design Professional's Proposal to become familiar with the progress and quality of the completed Work and to determine if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. On the basis of on-site observations, the Design Professional will keep the University and Contractor informed of progress of the Work by written field reports, and will endeavor to guard the University against defects and deficiencies in the Work.

The Design Professional will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor’s responsibility. The Design Professional will not be responsible for the Contractor’s failure to carry out the Work in accordance with the Contract Documents. The Design Professional will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

4.03.2 Communications Facilitating Contract Administration

The Design Professional and Contractor shall communicate directly concerning the Project and shall keep the University advised of their communications. Communications by and with the Design Professional's consultants shall be through the Design Professional. Communications by and with subcontractors and material suppliers shall be through the Contractor. Communications by and with separate Contractors shall be through the University.

4.03.3 Evaluation of Applications for Payment

Based on the Design Professional’s observations and evaluations of the Contractor’s Applications for Payment, the Design Professional must approve and sign any Contractor Applications for Payment as an express condition precedent to release of any progress or final payment. In the absence of Design Professional, the University will review and authorize applications for payment.
The Design Professional will have authority to reject Work which does not conform to the Contract Documents. Whenever the Design Professional considers it necessary or advisable for implementation of the intent of the Contract Documents, the Design Professional will have authority to require additional observation or testing of the Work in accordance with section 5.06, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Design Professional nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Design Professional to the Contractor, subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

4.03.4 Review of Shop Drawings, Product Data and Samples

The Design Professional shall review and approve or take other appropriate action upon the Contractor’s submittal of Shop Drawings, Product Data and Samples. The Design Professional’s action will be taken within 10 days from receipt so as not to cause delay in the Work or in the activities of the University, Contractor or separate Contractors, while allowing sufficient time in the Design Professional’s professional judgment to permit adequate review. Review of such submittal is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Design Professional’s review of the Contractor’s submittal shall not relieve the Contractor of the obligations under Article 5.04. The Design Professional’s review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Design Professional, of any construction means, methods, techniques, sequences or procedures. The Design Professional’s approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.03.5 Site Observations to Determine Substantial and Final Completion

The Design Professional will conduct observations to determine the date or dates of Substantial Completion and the date of Final Completion, will receive and forward to the University for the University’s review and retention all written warranties and related documents required by the Contract and assembled by the Contractor, and will issue an approval of final payment upon compliance with the requirements of the Contract Documents.

4.04 Delegation of Performance and Assignment of Money Earned

The performance of all or any part of this Contract may not be delegated by the Contractor or Design Professional without the written consent of the University. Consent will not be given to any proposed delegation which would relieve the Design Professional, the Contractor or its surety of their responsibilities under the Contract.

The Contractor may assign moneys due or to become due under the Contract, only upon written consent of the University. Assignments of moneys earned by the Contractor shall be subject to proper retention in favor of the University and to all deductions provided for in the Contract and such moneys shall be subject to being used by the University for the completion of the Work in the event the Contractor is in default. Any assignment attempted without the written consent of the University shall be void.

4.05 Contractor’s Insurance

The Contractor shall not commence Work under this Contract until it has obtained all the insurance required by the Contract Documents and such insurance has been approved by the University; likewise, no subcontractor or subconsultant shall be allowed to commence Work until the insurance required has been obtained. The Contractor shall, at its expense, purchase and maintain in full force and effect such
insurance as will protect itself and the University from claims, such as for bodily injury, death, and property damage, which may arise out of or result from the Work required by the Contract Documents, whether such Work is done by the Contractor, by any subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The types of such insurance and any additional insurance requirements are specified herein with the amounts and limits set forth in the Supplementary General Conditions.

4.05.1 Policies and Coverage

The following policies and coverages shall be furnished by the Contractor:

1. Comprehensive or Commercial Form General Liability Insurance on an “Occurrence” form covering all Work done by or on behalf of the Contractor and providing insurance for bodily injury, personal injury, property damage, and Contractual liability. Except with respect to bodily injury and property damage included within the products and completed operations hazards, the aggregate limit shall apply separately to Work required of the Contractor by these Contract Documents. This insurance shall include the contractual obligations assumed under the Contract Documents and specifically section 4.06.

2. Business Automobile Liability Insurance on an “Occurrence” form covering owned, hired, leased, and non-owned automobiles used by or on behalf of the Contractor and providing insurance for bodily injury, property damage, and Contractual liability.

3. Worker’s Compensation and Employer’s Liability Insurance as required by Federal and Michigan law. The Contractor shall also require all of its Subcontractors to maintain this insurance coverage. The Contractor acknowledges and shall abide by the University’s prohibition on the use of 1099 independent contractors and owner/operator business entities wherein such individuals are not able to secure and maintain such insurance. The Contractor shall ensure that all classifications of laborers and construction mechanics performing Work on the Project job site are traditional employees of the Contractor or any Trade Contractor for any tier thereof, and that each is covered by such insurance.

4. The Umbrella Excess Liability insurance must be consistent with and follow the form of the primary policies, except that Umbrella Excess Liability insurance shall not be required for the Medical Expense Limit.

5. Builder’s Risk Insurance: The Contractor, at his sole expense, shall purchase and maintain property insurance upon the entire Project for the full replacement cost at the time of any loss. This insurance shall include “All Risk” coverage against physical loss or damage including the perils of Fire and Extended Coverage, Theft, Vandalism, and Malicious Mischief, Transit and Collapse. The Contractor will be responsible for any co-insurance penalties and/or deductibles.

6. Professional Liability (Errors and Omissions) including tail-coverage for claims made after final completion.

4.05.2 Proof of Coverage

Certificates of Insurance or Declarations pages as may be requested by the University, as evidence of the insurance required by these Contract Documents, shall be submitted by the Contractor to the University. The Certificates of Insurance and Declarations shall state the scope of coverage and deductible, and list the University as an additional insured as required by Section 4.05.04 below. Any deductible shall be the Contractor’s liability. The Declarations shall provide for no cancellation or modification of coverage without thirty (30) days prior written notice to the University. Acceptance of Certificates of Insurance or
Declarations pages by the University shall not in any way limit the Contractor’s liabilities under the Contract Documents. The Contractor shall maintain required insurance for the entire duration of the Contract. In the event the Contractor does not comply with these insurance requirements, the University may, at its option, provide insurance coverage to protect the University; the cost of such insurance shall be deducted from the Contract Sum or otherwise paid by the Contractor. Renewal certifications shall be filed in a timely manner for all coverage until the Project is accepted as complete as requested by the University. Upon the University’s request, the Contractor shall provide copies of the policies obtained from the insurers.

4.05.3 Subcontractor’s Insurance

The Contractor shall either require Subcontractors to carry insurance as set forth in the CCIP Insurance Manual and the Subcontract, or the Contractor shall insure the activities of the Subcontractors in the amount, types and form of insurance required under by the Contract Documents. If the Contractor elects to have its Subcontractors purchase individual insurance policies, the Contractor shall cause its trade contracts and subcontracts to include a clause requiring that copies of any insurance policies which provide coverage to the Work shall be furnished to the University upon request. The Contractor shall supply the University with a list of all Subcontractors, including those enrolled in the CCIP coverage, and copies of the enrolled Subcontractors’ certificates of insurance evidencing coverage, showing whether or not they have individual insurance policies and certifying that those subcontractors without individual insurance policies are insured by the Contractor.

4.05.4 Scope of Insurance Coverage

The Contractor’s insurance as required by the Contract Documents (including subcontractors’ insurance), by endorsement to the policies and the Certificates of Insurance, shall include the following and may be presented in the form of a rider attached to the Certificates of Insurance:

1. The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents including the Design Professional, shall be included as additional insured under the general liability, builder’s risk and automobile liability policies for and relating to the Work to be performed by the Contractor and subcontractors. This shall apply to all claims, costs, injuries, or damages.

2. A Severability of Interest Clause stating that, “The term ‘insured’ is hereby used severally and not collectively, but the inclusion herein of more than one insured shall not operate to increase the limits of the insurer’s or insurers’ liability.”

3. A Cross Liability Clause stating that, “In the event of claims being made under any of the coverages of the policy or policies referred to herein by one or more insured hereunder for which another or other insured hereunder may be liable, then the policy or policies shall cover such insured or insured against whom a claim is made or may be made in the same manner as if separate policies had been issued to each insured hereunder. Nothing contained herein, however, shall operate to increase the insurer’s limits of liability as set forth in the insuring agreements.”

4. The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents, shall not by reason of their inclusion as insured incur liability to the insurance carriers for payment of premiums for such insurance. However, the Board of Governors of Wayne State University may, in their sole discretion after receiving a notice of cancellation for nonpayment, elect to pay the premium due and deduct such payment from any sums due to the Contractor or recover the amount paid from the Contractor if the sums remaining are insufficient.
(5) Coverage provided is primary and is not in excess of or contributing with any insurance or self-insurance maintained by the Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents.

4.05.5 Miscellaneous Insurance Provisions

The form and substance of all insurance policies required to be obtained by the Contractor shall be subject to approval by the University. All such policies shall be issued by companies lawfully authorized to do business in Michigan and acceptable to the University. All property insurance policies to be obtained by the Contractor shall name the University as loss payee as its interest, from time to time, may appear.

The Contractor shall, by mutual agreement with the University and at the University’s cost, furnish any additional insurance as may be required by the University. The Contractor shall provide Certificates of Insurance evidencing such additional insurance.

Should the Project involve asbestos abatement, the Contractor or subcontractor, as appropriate, shall provide asbestos liability insurance.

The Contractor acknowledges that the University is self-insured and participates in the Michigan Universities Self-Insurance Corporation program and the Contractor agrees that the University is not required to provide or purchase any additional insurance with respect to this Project or the Work required by the Contractor for the Project.

4.05.6 Loss Adjustment

Any insured loss is to be adjusted with the Contractor and made payable jointly to the University and the Contractor. The Contractor shall cooperate with the University in a determination of the actual cash value or replacement value of any insured loss. Any deductible amount shall be the responsibility of the Contractor.

4.05.7 Compensation Distribution

The University upon the occurrence of an insured loss shall account for any money so received and shall distribute it in accordance with such agreement as the interested parties may reach. Claim payments received shall be distributed proportionately according to the actual percentages of losses to both. If after such loss no other special agreement is made, replacement of damaged work shall be covered by an appropriate contract change order. Any dispute shall be resolved by the University.

4.05.8 Waivers of Subrogation

The University and Contractor waive all rights against (1) each other and any of their subcontractors, subcontractors, agents and employees, each of the other, and (2) the Design Professional, Design Professional’s consultants, separate Contractors if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this paragraph or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the University as fiduciary. The University or Contractor, as appropriate, shall require of the Design Professional, Design Professional’s consultants, separate Contractors, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or
otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

4.06 Indemnification

4.06.1

To the fullest extent permitted by law, the Contractor shall hold harmless, defend, and indemnify the Board of Governors of Wayne State University, the University, and officers, employees, representatives and agents of each of them, and against any and all claims or losses arising out of or are alleged to be resulting from, or relating to (1) the failure of the Contractor to perform its obligations under the Contract or the performance of its obligation in a willful or negligent manner; (2) the inaccuracy of any representation or warranty by the Contractor given in accordance with or contained in the Contract Documents; and (3) any claim of damage or loss by any subcontractor, or supplier, or laborer against the University arising out of any alleged act or omission of the Contractor or any other subcontractor, or anyone directly or indirectly employed by the Contractor or any subcontractor.

4.06.2

To the fullest extent permitted by law, the Contractor shall be liable for and hereby agrees to defend, discharge, fully indemnify and hold the University harmless from and against any and all claims, demands, damages, liability, actions, causes of action, losses, judgments, costs and expenses of every nature (including investigation costs and/or expenses, settlement costs, and attorney fees and expenses incident thereto) sustained by or asserted against the University arising out of, resulting from, or attributable to the performance or nonperformance of any Work and/or obligation covered by the Contract or to be undertaken in connection with the construction of the Project contemplated by the Contract (collectively, "Claim"), including, but not limited to, any Claim for: (a) any personal or bodily injury, illness or disease, including death at any time resulting therefrom of any person, (including, but not limited to, employees of the University, the Contractor, any subcontractor, and any materialman and the general public); (b) any loss, damage or destruction of any property; (c) any loss or damage to the University’s operations, arising out of, resulting from, or attributable in whole or in part to (i) any negligence or other act or omission of the Contractor, and any subcontractor, any materialman and/or any other person or any of the directors, officers, employees or agents of any of them or (ii) any defects in material or equipment furnished hereunder; (d) any payments allegedly owed to subcontractors, sub-subcontractors or materialmen; (e) any acts or omissions relative to conditions of safety and protection of persons on the Project site; and/or (f) any act or omission relative to the Contractor's breach of obligations and regarding non-discrimination as set forth in these General Conditions. The Contractor shall not be liable hereunder to indemnify the University against liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence or willful misconduct of the University, its agents or employees. The Contractor, at its own cost and expense, shall take out and maintain at all times during the effective period of the Contract, contractual liability insurance insuring the performance by the Contractor of its contractual duties and obligations under this Article, which insurance shall name the University as additional insured and shall be in form and amount and from an insurance company satisfactory to the University. The Contractor's duty to fully indemnify the University shall not be limited in any way by the existence of this insurance coverage.

4.06.3

The Contractor shall also be liable for and hereby agrees to pay, reimburse, fully indemnify and hold the University harmless from and against all costs and expenses of every nature (including attorney fees and expenses incident thereto) incurred by the University in collecting the amounts due from the Contractor, or otherwise enforcing its rights, under the indemnifications described in this Article.
4.06.4

In claims against any person or entity indemnified under this Article made by an employee of the Contractor or a subcontractor, or indirectly employed by either of them, or anyone for whose acts either made by liable, the indemnification obligation under this Article shall not be limited by any limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a subcontractor under workers compensation laws, disability benefit laws, or other laws providing employee benefits.

4.06.5

The indemnification obligations under this Article shall not be limited by any assertion or finding that the person or entity indemnified is liable by reason of a non-delegable duty.

4.06.6

The Contractor shall hold harmless, defend, and indemnify the University from and against losses resulting from any claim of damage made by any separate Contractor of the University against the University arising out of any alleged acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by either the Contractor or subcontractor, or anyone for whose acts either the Contractor or subcontractor may be liable.

4.06.7

The Contractor shall hold harmless, defend and indemnify the Design Professional and the separate Contractors of the University from and against losses to the extent they arise from the negligent acts or omissions or willful misconduct of the Contractor, a subcontractor, anyone directly or indirectly employed by the Contractor or subcontractor, or anyone for whose acts the Contractor or subcontractor may be liable.

4.07 Occupancy by University Prior to Acceptance

The University may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the University and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a description of the area substantially complete to the Design Professional. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the University and Contractor or, if no agreement is reached, by decision of the Design Professional.

Immediately prior to such partial occupancy or use, the University together with the Contractor and Design Professional shall jointly observe and/or inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents. Likewise,
partial occupancy or use of a portion or portions of the Work shall not alter, change or modify the requirements for Substantial or Final Completion within Contract Time.

4.08 Contract Time

4.08.1 Time of the Essence

All time limits specified in this Contract are of the essence of the Contract.

4.08.2 Starting and Completion Date

The University shall designate in the Notice to Proceed the starting date of the Contract on which the Contractor shall immediately begin and thereafter diligently prosecute the Work to completion. The Contractor agrees to complete the Work on the date specified for completion of the Contractor’s performance in the Contract unless such time is adjusted, in writing, by change order issued by the University. The Contractor may complete the Work before the completion date if it will not interfere with the University or their other Contractors engaged in related or adjacent Work. The date of Substantial Completion shall be used as the commencement date of the guarantee.

4.08.3 Delay

Within ten (10) days from the commencement of a delay, Contractor shall submit to the University’s Representative a written notice of the delay. Such notice of delay shall describe the nature and cause of the delay, provide a preliminary estimate of the impact of said delay on the construction schedule and provide a recovery plan to mitigate the delay. The Contractor’s failure to give such notice to the University shall constitute a waiver by the Contractor of its ability to request an extension of time. In the case of a continuing cause of delay, only one claim shall be necessary. The giving of such notice shall not of itself establish the validity of the cause of delay or of the extension of the time for completion. Submission of reports and/or updates required at regularly scheduled meetings or as a part of a regularly submitted report shall not constitute such required notice.

The Contractor expressly agrees that delays to construction activities which do not affect the overall time of completion of the Work shall not entitle the Contractor to an extension of the Contract Time or provide a basis for additional cost or damages. No delay, obstruction, interference, hindrance, or disruption, from whatever source or cause in the progress of the Contractor’s Work shall be a basis for an extension of time unless the delay, obstruction, interference, hindrance, or disruption is without the fault and not the responsibility of the Contractor and directly affects the overall completion of the Work as reflected in the Contractor’s updated and accepted Project schedule.

Within fifteen (15) days from the submittal to the University of the notice of delay detailed in the previous paragraphs, Contractor shall submit to the University’s Representative a request for an extension of time which shall include all documentation supporting the request. Such submittal shall include a detailed description of all changes in activity duration, logic, sequence, or otherwise in the Project schedule. The filing of such a request for an extension of time shall not of itself establish the validity of the cause of delay or of the extension of time for completion. Submission of construction reports and/or updates required by these General and Supplementary Conditions shall not constitute such a request.

4.08.4 Adjustment of Contract Time and Cost

If the Contractor is delayed, obstructed or hindered at any time in the progress of the Work by any act or neglect of the University or by any contractor employed by the University, or by changes
ordered in the scope of the Work, or by fire, adverse weather conditions not reasonably anticipated, or any other causes beyond the control of the Contractor with the exception of labor disputes or strikes of the Contractor’s or a Subcontractor’s own personnel, then the duration set forth in the Master Project Schedule, and established for Substantial and Final Completion may be extended as agreed to by the University, Contractor and Design Professional. When such delays result in an agreement to adjust the Time of Completion, then the Contractor may also request, and the University may make a reasonable adjustment to the Contract Sum for Project costs directly attributable to the delay pursuant to Article 6.00, CHANGES IN THE WORK. It will be the Contractor’s obligation to demonstrate to the complete satisfaction of the University, that the direct Project costs associated with such delays are justified, fair, and reasonable.

The University will not recognize labor disputes, strikes, work stoppages, picketing or boycotting by employees of or under the control or direction of the Contractor or its subcontractors, to be cause for extending the Construction Project Schedule or the Contract Time or adjusting the Contract Sum. The University may recognize labor disputes, strikes, work stoppages, picketing or boycotting that are not within the Contractor’s or its subcontractors’ control as cause for extending the Construction Project Schedule or Contract Time. Pursuant to section 9.01.1 such labor disputes, strikes, work stoppages, picketing or boycotts may constitute grounds for termination of the Contractor.

4.08.5 Contractor to Fully Prosecute Work

No extension of time will be granted unless the Contractor demonstrates to the satisfaction of the University that the Contractor has made every reasonable effort to complete all Work under the Contract not later than the date prescribed.

4.08.6 University's Adjustment of Contract Time

Even though the Contractor has no right to an extension of time for completion, the University may in the exercise of its sole discretion extend the time at the request of the Contractor if it determines it to be in the best interest of the University.

4.08.7 Adjustment of Contract Time and Cost Due to Reasons Beyond University Control

Should the University be prevented or enjoined from proceeding with Work either before or after the start of construction by reason of any litigation or other reason beyond its control, the Contractor may request an adjustment in the Time of Completion and/or Contract Sum by reason of said delay. The University may make a reasonable adjustment in the Time of Completion and/or Contract Sum for time and costs directly attributable to the delay. It will be the Contractors obligation to demonstrate to the complete satisfaction of the University, that all Time of Completion and Contract Sum adjustments associated with such delays are justified, fair, and reasonable.

4.09 Progress Schedule

4.09.1

The Contractor shall prepare and submit to the University the Contractor’s Construction Schedule utilizing the Critical Path Method within ten (10) days after starting date on the Notice to Proceed. It shall be the Contractor’s responsibility to use its best efforts and to act with due diligence to maintain the progress of the Work in accordance with the schedule. The time for completion may be extended only by a written Change Order executed by the University and the Contractor. The work activities making up the schedule shall be of sufficient detail to assure that adequate planning has been done for proper execution of the
Work and such that, in the sole judgment of the University, it provides an appropriate basis for monitoring and evaluating the progress of the Work. The Construction Schedule shall include the time periods required for utility and service interruptions, including compliance with the notice periods stated in the Utility Disturbance and Disruption Request. The Contractor shall also submit a separate progress schedule listing all submittals required under the Contract and the date by which each submittal will be submitted allowing 10 days for the Design Professional's review (“submittal schedule”).

4.09.4

Float, slack time, or contingency within the schedule at the activity level and total float within the overall schedule, is not for the exclusive use of either the University or the Contractor, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet Contract milestones and the Contract completion date.

4.09.5

The Contractor shall not sequester shared float through such strategies as extending activity duration estimates to consume available float, using preferential logic, or using extensive crew/resource sequencing, etc. Since float time within the construction schedule is jointly owned, it is acknowledged that University caused delays on the Project may be offset by University caused time savings (i.e., critical path submittals returned in less time than allowed by the Contract, approval of substitution requests which result in a savings of time to the Contractor, etc.). In such an event, the Contractor shall not be entitled to receive a time extension until all University caused time savings are exceeded and the Contract completion date is also exceeded.

4.09.6

Regardless of which schedule method the Contractor elects to use in formulating the Contractor's Construction Schedule, an updated construction schedule shall be submitted to the University five (5) days prior to the submittal of the Contractor’s monthly payment request. The submission of the updated construction schedule satisfying the requirements of this Article, accurately reflects the status of the Work, and incorporates all changes into the schedule, including actual dates, shall be a condition precedent to the processing of monthly payment applications. Updated schedules shall also be submitted at such other times as the University may direct. Upon approval of a change order or issuance of a direction to proceed with a change, the approved change shall be reflected in the next schedule update submitted by the Contractor.

4.09.7

If completion of any part of the Work, the delivery of equipment or materials, or issuance of the Contractor submittals is behind the updated Construction Schedule and will cause the end date of the Work to be later than the Contract completion date, the Contractor shall submit in writing a plan acceptable to the University for completing the Work on or before the current Contract completion date.

4.09.8

No time extensions shall be granted unless the delay can be clearly demonstrated by the Contractor on the basis of the updated Construction Schedule current as of the month the change is issued or the delay occurred, and the delay cannot be mitigated, offset, or eliminated through such actions as revising the intended sequence of Work or other means.

4.09.9
As a condition precedent to the release of retained funds, the Contractor shall, after completion of the Work has been achieved, submit a final Construction Schedule which accurately reflects the manner in which the Project was constructed and includes actual start and completion dates for all Work activities on the Project schedule together with a full and unconditional waiver and release of claims for payment in a form acceptable to the University.

4.10 Coordination With Other Work

The University reserves the right to do other Work in connection with the Project or adjacent thereto and the Contractor shall at all times conduct the Work so as to impose no hardship on the University or others engaged in the University’s Work nor to cause any unreasonable delay or hindrance thereto.

Where two or more Contractors are employed on related or adjacent work, each shall conduct their operation in such a manner as not to cause delay or additional expense to the other.

The Contractor shall be responsible to others engaged in the related or adjacent work for all damage to Work, to persons and to property, and for loss caused by failure to complete the Work within the specified time for completion. The Contractor shall coordinate its Work with the Work of others so that no discrepancies shall result in the Project.

4.11 As-built Drawings Reflecting Actual Construction

During the course of construction, the Contractor shall maintain drawings kept up each day to show the Project as it is actually constructed. Every sheet of the plans and specifications which differs from the actual construction shall be marked and sheets so changed shall be noted on the title sheets of the plans and specifications. All change orders shall be shown by reference to sketch drawings, and any supplementary drawings or change order drawings shall be included. The Contractor shall review the “As-built” drawings with the University at least once a month to demonstrate that all changes that have occurred are being fully and accurately recorded. The altered Contract drawings shall be sufficiently detailed so that future Work on the Project or in adjacent areas may be conducted with a minimum of difficulty. Prior to the completion of the Project, and prior to release of the final retention payments, the “As-built” drawings and specifications shall be transmitted in hard copy and electronic format as directed by the University to the University or the Design Professional for further review. A copy of the transmittal shall be sent to the University and included in the formal Close-out documents.

4.12 Cleanup of Project and Site

The Contractor shall, on a daily basis, keep the premises and surrounding area free from accumulation of waste materials, combustibles, or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, combustibles, rubbish, the Contractor’s tools, construction equipment, machinery and surplus materials.

If the Contractor fails to clean up as provided in the Contract Documents, the University may do so and the cost thereof shall be charged to the Contractor. Any additional cleaning requirements are as stated in the Supplementary General Conditions.

Upon completion of the Work, the Contractor shall promptly remove from the premises construction equipment and any waste materials not previously disposed of, leaving the premises thoroughly clean and ready for occupancy.
When two or more Contractors are engaged in work at or near the site, each shall be responsible for cleanup and removal of its own rubbish, equipment, and any waste materials not previously disposed.

In the event the Contractor does not maintain the Project or the site clear of debris and rubbish in a manner acceptable to the Design Professional or University, the University may, at its option, cause the Project or site to be properly cleaned and may withhold the incurred expense from payments due the Contractor or otherwise receive reimbursement from the Contractor.

4.13 [Not used]

4.14 Project Sign, Advertising

If included as a requirement in the project documents, Contractor shall furnish and install a project sign as designed by the Design Professional and accepted by the University as part of the Work under the Contract. As a minimum, the sign shall be four feet by eight feet, made from three-quarter inch plywood. The sign shall identify the Project name, the University including the individual members of the Board of Governors, the Design Professional, and the Contractor. No advertising is permitted on the Project or site without written permission from the University. If the Project is funded by a State of Michigan capital appropriation, the Contractor shall also provide a project sign which satisfies the requirements of the State of Michigan as stipulated in the Department of Technology Management and Budget’s Major Project Design Manual, current edition.
5.00 INTERPRETATION OF AND ADHERENCE TO CONTRACT REQUIREMENTS

5.01 Interpretation of Contract Requirements

5.01.1 Conflicts

In the event of conflict in the Contract Documents, the priorities stated below shall govern:

(1) Addenda shall govern over all other Contract Documents and subsequent addenda shall govern over prior addenda only to the extent that they modify prior addenda. Such addenda shall only govern the scope of Work, Contract Sum, and Time of Completion, and shall not be deemed to amend the Contract, General Conditions of Construction, or Supplementary General Conditions of Construction.

(2) In case of conflict between plans and specifications, the specifications take precedence over drawings for the specific type or quality of materials or the quality of installation; the drawings take precedence over the specifications with regard to quantities, locations or detail of installation.

(3) Conflicts within the plans:
   (a) Schedules, when identified as such, shall govern over all other portions of the plans.
   (b) Specific notes shall govern over all other notes and all other portions of the plans except the schedules described in Article 5.01.1, above.
   (c) Larger scale drawings shall govern over smaller scale drawings.
   (d) Figured or numerical dimensions shall govern over dimensions obtained by scaling. Scaling the drawings is prohibited.

(4) Conflicts within the specifications:
   “General Conditions for Construction” shall govern over all sections of the specifications except for specific modifications thereto that may be stated in Supplementary General Conditions or addenda. No other section of the specifications shall modify the General Conditions for Construction.

(5) In the event provisions of codes, safety orders, Contract Documents, referenced manufacturer’s specifications or industry standards are in conflict, the more restrictive or higher quality shall govern.

5.01.2 Omissions

If the Contract Documents are not complete as to any minor detail of a required construction system or with regard to the manner of combining or installing of parts, materials, or equipment, but there exists an accepted trade standard for good and skillful construction, such detail shall be deemed to be an implied requirement of the Contract Documents in accordance with such standard. “Minor Detail” shall include the concept of substantially identical components, where the price of each such component is small even though the aggregate cost or importance is substantial, and shall include a single component which is incidental, even though its cost or importance may be substantial.
The quality and quantity of the parts or material so supplied shall conform to trade standards and be compatible with the type, composition, strength, size, and profile of the parts of materials otherwise set forth in the Contract Documents.

5.01.3 Miscellaneous

Portions of the Work which can be best illustrated by the Drawings may not be included in the Specifications and portions best described by the Specifications may not be depicted on the Drawings.

If an item or system is either shown or specified, all material and equipment normally furnished with such items and needed to make a complete operating installation shall be provided whether mentioned or not, even though such materials and equipment are not shown on the drawings or described in the specifications, omitting only such parts as are specifically excepted. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

The General Conditions and Supplementary General Conditions are a part of each and every section of the Specifications.

All drawings, Project Plans and Specifications, renderings and models or other documentation, and copies thereof, furnished by the University or any agent, employee or consultant of the University, or Design Professional, are and shall remain the property of the University. They are to be used only with respect to this Project and are not to be used on any other project.

5.01.4 Interpreter of Documents

The University’s Representative shall be the Interpreter, with the advice of the Design Professional, of the Contract Documents and shall be the judge of the performance of the Contractor and subcontractors. Subject to the provisions Article 7, claims, disputes and other matters of controversy relating to the Contract Documents or the Work shall be decided by the University’s Representative. The decision of the University’s Representative shall be final.

5.02 Issuance of Interpretations, Clarifications, Additional Instructions (Requests for Information)

Should the Contractor discover any conflicts, omissions, or errors in the Contract or have any question concerning interpretation or clarification of the Contract Documents, the Contractor shall request in writing an interpretation, clarification, or additional detailed instructions before proceeding with the Work affected. The written request shall be given to the Design Professional and University within 5 days of discovery.

The Design Professional, with review as required by the University, shall, within 10 days or other reasonable time, issue in writing the interpretation, clarification, or additional detailed instructions requested. In the event that the Contractor believes that the progress of the Work is being delayed by a Request for Information or a response to a Request for Information, Contractor shall comply with the procedures stated in section 4.08 of these General Conditions for an extension of time.

Should the Contractor proceed with the Work affected before receipt of the interpretation, clarification, or instructions from the Design Professional, the Contractor shall replace or adjust any Work not in conformance therewith and shall be responsible for any resultant damage or added cost.

Should any interpretation, clarification, or additional detailed instructions, in the opinion of the Contractor, constitute Work beyond the scope of the Contract, the Contractor must submit written notice thereof to the
Design Professional and University within five (5) calendar days following receipt of such interpretation, clarification, or additional detailed instructions and in any event prior to commencement of Work thereon. The Contractor shall submit an explanation of how the interpretation, clarification, or additional detailed instruction constitutes work beyond the scope of the Contract, along with a detailed cost breakdown and an explanation of any delay impacts. The Design Professional shall consider such notice and make a recommendation to the University. If, in the judgment of the University, the notice is justified, the interpretation, clarification or additional detailed instructions shall either be revised or the extra work authorized by Contract change order or by field instruction with a change order to follow. If the University decides that the request is not justified and the Contractor does not agree, the Contractor shall nevertheless perform such Work upon receipt from the University of written authorization to do so. In such case, the Contractor shall have the right to have the Claim later determined only pursuant to the requirements of this Contract. However, any such Claim for additional compensation because of such interpretation, clarification, or additional detailed instruction is waived, unless the Contractor gives written notice to the Design Professional and University within five (5) calendar days as specified above.

5.03 Product and Reference Standards

5.03.1 Product Designation

When descriptive catalog designations, including the manufacturer’s name, product brand name, or model number are referred to in the Contract Documents, such designations shall be considered as being those found in industry publications of current issue at the date of Contract execution.

5.03.2 Reference Standards

When standards of the federal government, trade societies, or trade associations are referred to in the Contract Documents by specific date of issue, these shall be considered a part of this Contract. When such references do not bear a date of issue, the current and most recently published edition at the date of Contract execution shall be considered a part of this Contract.

5.04 Shop Drawings, Samples, Alternatives or Equals, Substitutions

5.04.1 Submittal Procedure

Shop drawings include drawings, diagrams, illustrations, schedules, performance charts, brochures and catalogs and other data prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor, and which illustrate some portion of the Work. In accordance with the submittal schedule, the Contractor shall promptly review and approve all shop drawings and then submit the shop drawings to the Design Professional together with samples as required by the Contract Documents and shall also submit any offers of alternatives or substitutions. The Design Professional shall have 10 days to respond with an acknowledgement of approval, clearly defined exceptions, or rejections. Rejections shall be cause for re-submission and no contract time adjustments will be granted for such requirements. At least six copies of brochures, one copy of shop drawings and one PDF digital file of shop drawings shall be submitted as well as additional copies as required by Design Professional. All such submittals shall be sent to Design Professional at the address given in the instructions to the Contractor at the job start meeting. A letter shall accompany the submitted items which shall contain a list of all matters submitted and shall identify all deviations shown in the shop drawings and samples from the requirements of the Contract Documents. Failure by the Contractor to identify all deviations may render void any action taken by the Design Professional on the materials submitted. Whether to void such action shall be in the discretion of the Design Professional. The letter and all items accompanying it shall be fully identified as to project name and location, the Contractor’s name, and the University’s Project number. By submitting the approved shop drawings and samples, the Contractor warrants and represents that the data contained therein have been
verified with conditions as they actually exist and that the shop drawings and samples have been checked and coordinated with the Contract Documents.

5.04.2 Samples

Samples are physical examples furnished by the Contractor to illustrate materials, equipment, color, texture, or workmanship, and to establish standards by which the Work will be judged. Unless otherwise approved, at least two samples will be submitted for each item requiring samples to be submitted.

The Work shall be in accordance with the samples and reviewed by Design Professional. Samples shall be removed by the Contractor from the site when directed. Samples not removed by the Contractor, will become the property of the University and will be removed or disposed of by the University at the Contractor’s expense.

5.04.2.1 Mock-ups as may be required by the Contract Documents

Mock-ups, models or temporary construction as may be required by the University shall be removed and disposed of by the Contractor at Contractor’s sole cost and expense from the site when directed.

5.04.3

5.04.3 Substitutions

For convenience in designation on the plans or in the specifications, certain materials or equipment may be designated by a brand or trade name or the name of the manufacturer together with catalog designation or other identifying information, hereinafter referred to generically as “designated by brand name.” Alternative material or equipment which is of equal quality and of the required characteristics for the purpose intended may be proposed for use provided the Contractor complies with the requirements stated in this section. If the Contractor proposes a product that is of lesser or greater quality or performance than the specified material or equipment, Contractor must both comply with the provisions of section 5.04 and submit any cost impact. The Contractor shall submit its proposal to University and the Design Professional for an alternative in writing within the time limit designated in the Contract, or if not so designated, then within a period which will cause no delay in the Work. By submitting a substitute, the Contractor waives any rights to claim a delay due to the processing of this substitution.

The Contractor may offer a substitution of a specified or indicated item if it presents complete information concerning the substitution and the benefits thereof to the University by reason of lower cost or improved performance, or both, over the specified or indicated item. However, such submission of a proposed substitution does not relieve the Contractor from its obligations under the Contract. In proposing a substitution, the Contractor warrants that the substitution is, at a minimum, equivalent in performance to the specified or indicated item. A substitution shall not be effective unless accepted in writing by the University.

Any additional costs and changes to the Work (including, but not limited to the Work of other Contractors and additional design costs which may be affected thereby) which may result from the proposed substitution shall be disclosed at the time the substitution is proposed to the University. Changes to the Work and any additional costs therefrom shall be the sole responsibility of the Contractor and shall not increase the Contract Sum.

The Contractor’s substitution proposals shall include written descriptions of the items to be substituted (including drawings and/or specifications) and referenced information of the proposed substitution. The
Design Professional and University’s Representative’s signature on this proposal is required for acceptance. Shop Drawings will not be considered a substitution proposal pursuant to this section. Verbal approvals or approved Shop Drawings will not be considered as acceptance of proposed substitutions.

5.05 Quality of Materials, Articles and Equipment

Materials, articles and equipment furnished by the Contractor for incorporation into the Work shall be new unless otherwise specified in the Contract Documents. When the Contract requires that materials, articles or equipment be furnished, but the quality or kind thereof is not specified, the Contractor shall furnish materials, articles or equipment at least equal to the kind or quality or both of materials, articles or equipment which are specified.

5.06 Testing Materials, Articles, Equipment and Work

Materials, articles, equipment or other Work requiring tests are specified in the Contract Documents. Materials, articles and equipment requiring tests shall be delivered to the site in ample time before intended use to allow for testing and shall not be used prior to testing and receipt of written approval. The Contractor shall be solely responsible for notifying the University where and when materials, articles, equipment and Work are ready for testing. Should any such materials, articles, equipment or Work be covered without testing and approval, if required, they shall be uncovered at the Contractor's expense. The University has the right to order the testing of any other materials, articles, equipment or Work at any time during the progress of the Work. Unless otherwise directed, all samples for testing shall be taken by the University from materials, articles or equipment to be used on the project or from Work performed. All tests will be under the supervision of, and at locations convenient to, the University. The University shall select the laboratories for all tests. Decisions regarding the adequacy of materials, articles, equipment or Work shall be issued to the University in writing. The University may decide to take further samples and tests, and if the results show that the Work was not defective, the University shall bear the costs of such samples and tests. In the event the results show that the Work was not defective, the Contractor shall bear the cost of such samples and tests. Samples that are of value after testing shall remain the property of the Contractor. All retesting and reinspection costs may be back charged to the Contractor by the University.

5.07 Rejection

Should any portion of the Work or any materials, articles or equipment delivered to the Project fail to comply with the requirements of the Contract Documents, such Work, materials, articles or equipment shall be rejected in writing and the Contractor shall immediately correct the deficiency to the satisfaction of the Design Professional and the University at no additional expense to the University. Any Work, materials, articles or equipment which is rejected shall immediately be removed from the premises at the expense of the Contractor. The University may retain one and one-fourth times the cost of the rejected materials, articles, equipment, and Work from any payments due the Contractor until such time as the deficiency is made acceptable to the Design Professional and University.

5.08 Responsibility for Quality

The testing and inspection provided by the University shall not relieve the Contractor of its responsibility for the quality of materials and workmanship provided by the Contractor, and the Contractor shall make good all defective Work discovered during or after completion of the Project.
6.00 CHANGES IN THE WORK

6.01 Change Orders

6.01.1 Generally

The University reserves the right to issue written orders whether through a formal Change Order or Preliminary Project Cost and Schedule Impact Report, directing changes in the Contract at any time prior to the acceptance of the Project without voiding the Contract, and Contractor shall promptly comply with such order or direction. The Contractor may request changes in the Work, but shall not act on the changes until approved in writing by the University. Any change made without authority in writing from the University shall be the responsibility of the Contractor.

Any such changes in the Work that have a cost impact shall only be authorized by Change Orders approved by the University. No action, conduct, omission, prior failure or course of dealing by the University shall act to waive, modify, change or alter the requirement that Change Orders must be in writing and signed by the University and Contractor and that such written Change Orders are the exclusive method for changing or altering the Contract Sum or Contract Time. The University and Contractor understand and agree that the Contract Sum and Contract Time cannot be changed by implication, oral agreements, actions, inactions, course of conduct or Preliminary Project Cost and Schedule Impact Report.

On the basis set forth herein, the Contract Sum may be adjusted for any Change Order requiring a different quantity or quality of labor, materials or equipment from that originally required, and the partial payments to the Contractor, set forth in section 8.01, may be adjusted to reflect the change. Whenever the necessity for a change arises, and when so ordered by the University in writing, the Contractor shall take all necessary steps to mitigate the effect of the ultimate change on the other Work in the area of the change. Changed Work shall be performed in accordance with the original Contract requirements except as modified by the Change Order. Except as herein provided, the Contractor shall have no claim for any other compensation including lost productivity or increased overhead expenses due to changes in the Work.

6.01.2 Proposed Change Orders

The Design Professional, with approval of the University, shall issue to the Contractor a cost request Bulletin for a proposed change order describing the intended change and shall require the Contractor to indicate thereon a proposed amount to be added to or subtracted from the Contract Sum due to the change supported by a detailed estimate of cost. Upon request by the University, the Contractor shall permit inspection of the original Contract estimate, Trade Contract agreements, or purchase orders relating to the change. Any request for adjustment in Contract Time which is directly attributable to the changed Work shall be included with substantiating detailed explanation by the Contractor in its response to the cost request bulletin. Failure by Contractor to request adjustment of Contract Time on the response to the cost request Bulletin shall waive any right to subsequently claim an adjustment of the Contract Time based on the changed Work. The Contractor shall submit the response to the cost request Bulletin with detailed estimates and any time extension request thereon to the Design Professional within ten (10) days after issuance of the cost request Bulletin. Upon its submission, the Design Professional will review it and advise the University who will make the decision regarding the request. The University retains sole discretion to accept, reject, or modify the proposed change. If the Contractor fails to submit the response within the required ten (10) days, and the Contractor has not obtained the Design Professional’s and the University’s permission for a delay in submission, the University may order the Contractor in writing to begin the Work immediately, and the Contract Sum shall be adjusted in accordance with the University’s estimate of cost. In that event, the Contractor, within fifteen days following completion of the changed Work, may present information to the University that the University’s estimate was in error; the University, in its sole discretion,
may adjust the Contract Sum. The Contractor must keep and submit to the University time and materials records verified by the University to substantiate its costs. The University may require the Contractor to proceed immediately with the changed Work in accordance with section 6.01.4, “Failure to Agree as to Cost” or section 6.02 “Emergency Changes.”

When the University and the Contractor agree on the amount to be added to or deducted from the Contract Sum and the time to be added to or deducted from the Contract Time and a Contract Change Order is signed by the University and the Contractor, the Contractor shall proceed with the changed Work. If agreement is reached as to the adjustment in compensation for the performance of changed Work but agreement is not reached as to the time adjustment for such Work, the Contractor shall proceed with the Work at the agreed price, reserving the right to further pursue its Claim for a time adjustment. Any costs incurred to acquire information relative to a proposed Change Order shall not be borne by the University.

6.01.3 Allowable Costs Upon Change Orders

The identification of and manner in which costs will be allowed because of changed Work shall be computed as described by this section.

6.01.3.1 Labor

Costs are allowed for the actual payroll cost to the Contractor for direct labor, engineering or technical services directly required for the performance of the changed Work, (but not site management such as field office estimating, clerical, project engineering, management or supervision) including payments, assessments, or benefits required by lawful labor union collective bargaining agreements, compensation insurance payments, contributions made to the State pursuant to the Unemployment Insurance Code, and for taxes paid to the federal government required by the Social Security Act of 1935, as amended, unless the time of completion adjustments affect the general condition inclusion of the Contract Sum.

No labor cost will be recognized at a rate that deviates from the prevailing wages in the locality of Wayne County, Michigan as provided by the University at the time the Work is performed, or of wage and benefit rates associated with trade union collective bargaining agreements prevailing at the time of the change, and the use of a classification which would increase the labor cost may not be permitted unless the Contractor established to the satisfaction of the University the necessity for payment at a higher rate.

6.01.3.2 Materials

Costs are allowed for the actual cost to the Contractor for the materials directly required for the performance of the changed Work. Such cost of materials may include the costs of transportation, sales tax, and delivery if necessarily incurred. However, overhead costs shall not be included. If a trade discount by the actual supplier is available to the Contractor, it shall be credited to the University. If the materials are obtained from a supply or source owned wholly or in part by the Contractor, payment therefor will not exceed the current wholesale price for such materials.

If, in the opinion of the University, the cost of materials is excessive, or if the Contractor fails to furnish satisfactory evidence of the cost from the actual suppliers thereof, then in either case the cost of the materials shall be deemed to be the lowest wholesale price at which similar materials are available in the quantities required at the time they were needed.

6.01.3.3 Equipment

Costs are allowed for the actual cost to the Contractor for the use of equipment directly required in the performance of the changed Work except that no payment will be made for time while equipment is
inoperative due to breakdowns or for non-working days. The total rental cost shall not exceed seventy-five percent (75%) of the market value of the rented equipment. The rental time shall include the time required to move the equipment to the Project site from the nearest available source for rental of such equipment, and to return it to the source. If such equipment is not moved by its own power, then loading and transportation costs will be paid. However, neither moving time nor loading and transportation costs will be paid if the equipment is used on the Project in any other way than upon the changed Work. Individual pieces of equipment having a replacement value of $500.00 or less shall be considered to be tools or small equipment, and no payment therefor will be made.

For equipment owned or furnished by the Contractor, no cost therefor shall be recognized in excess of the rental rates established by distributors or equipment rental agencies in the locality where the Work is performed. Blue Book rates shall not be used for any purpose.

The amount to be paid to the Contractor for the use of equipment as set forth above shall constitute full compensation to the Contractor for the cost of fuel, power, oil, lubrication, supplies, small tools, small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators who shall be paid for as provided in Article 6.01.3.1) and any and all costs to the Contractor incidental to the use of such equipment.

6.01.3.4 Change Order Mark-up Allowance

For Change Order scope whose cost is derived according to the Cost of Work plus a Fee as defined in 6.01.3.1 through 6.01.3.3, the mark-up allowance shall be as defined in the Contract. Lump-sum conditions shall include the mark-up allowance. When agreement as to cost cannot be reached, the Contractor shall execute the Work according to time and materials with the Contractor and University acknowledging such costs by signature on a daily basis, and as set forth below.

6.01.3.5 Credit for Deleted Work

For proposed change orders which involve both added and deleted Work, the Contractor shall separately estimate the cost of the added Work before mark-ups, and separately estimate the cost of the deleted Work before allowance of a credit. If the difference between the costs results in an increase to the Contract Sum, the mark-up for added Work shall be applied to the difference, and if the difference in the costs results in a decrease, then the mark-up for deleted Work shall be applied to the difference.

6.01.3.6 Market Values

Cost for added Work shall be no more than market values prevailing at the time of the change, unless the Contractor can establish to the satisfaction of the University that it investigated all possible means of obtaining Work at prevailing market values and that the excess cost could not be avoided.

When a change order deletes Work from the Contract, the computation of the cost thereof shall be the values which prevailed at the time bids for the Work were opened or the Contract Sum established.

6.01.4 Failure to Agree as to Cost

6.01.4.1 For Added Work

Notwithstanding the failure of the University and the Contractor to agree as to the cost of the proposed Change Order, the Contractor, upon written order from the University, shall proceed immediately with the changed Work. A Preliminary Project Cost and Schedule Impact Report or letter signed by the University shall be used for this written order. At the start of each day’s Work on the change, the Contractor shall
notify the University in writing as to the size of the labor force to be used for the changed Work and its location. Failure to so notify may result in the non-acceptance of the costs for that day. At the completion of each day’s Work, the Contractor shall furnish to the University a detailed summary of all labor, materials, and equipment employed in the changed Work. The University will compare his/her records with Contractor’s daily summary and may make any necessary adjustments to the summary. After the University and the Contractor agree upon and sign the daily summary, the summary shall become the basis for determining costs for the additional Work. The sum of these costs when added to an appropriate mark-up will constitute the payment for the changed Work. Subsequent adjustments, however, may be made based on later audits by the University. When changed Work is performed at locations away from the job site, the Contractor shall furnish in lieu of the daily summary, a summary submitted at the completion of the Work containing a detailed statement of labor, material, and equipment used in the Work. This latter summary shall be signed by the Contractor who shall certify thereon that the information is true.

The Contractor shall maintain and furnish on demand of the University itemized statements of cost from all vendors and subcontractors who perform changed Work or furnish materials and equipment for such Work. All statements must be signed by the vendors and the subcontractors.

6.01.4.2 For Deleted Work

When a proposed Change Order contains a deletion of any Work, and the University and the Contractor are unable to agree upon the cost thereof, the University’s estimate shall be deducted from the Contract Sum and may be withheld from any payment due the Contractor until the Contractor presents adequate substantial information to the University that the University’s estimate was in error. The amount to be deducted shall be the actual costs to the Contractor for labor, materials, and equipment which would have been used on the deleted Work together with an amount for mark-up as defined in the Contract Documents.

6.01.5 Allowable Time Extensions

For any change in the Work, the Contractor shall only be entitled to such adjustments in Contract Time due solely to performance of the changed Work. The procedure for obtaining an extension of time is set forth in Section 4.08 of these General Conditions. No extension of time shall be granted for a change in the Work unless the Contractor demonstrates to the satisfaction of the University that the Work is on the critical path and submits an updated Critical Path Method schedule showing that an extension of time is required and that the Contractor is making, or has made, every reasonable effort to guarantee completion of the additional Work called for by the change within the time originally allotted for the Contract. Failure by the Contractor to make the required submission or showing constitutes a waiver of any possible adjustment in Contract Time.

Any adjustment in Contract time shall specify the exact impact on the date of Substantial Completion and Final Completion.

6.02 Emergency Changes

Changes in the Work made necessary due to unforeseen site conditions, discovery of errors in plans or specifications requiring immediate clarification in order to avoid a serious Work stoppage, changes of a kind where the extent cannot be determined until completed, or under any circumstances whatsoever when deemed necessary by the University are kinds of emergency changes which may be authorized by the University in writing to the Contractor. The Contractor shall commence performance of the emergency change immediately upon receipt of Preliminary Project Cost and Schedule Impact Report issued by the University.
If agreement is reached as to compensation adjustment for the purpose of any emergency change, then compensation will be as provided in this section relating to ordinary changes. If agreement is not reached as to compensation at the time of commencing the emergency change, then compensation will be as provided in section 6.01.4, that is, time and materials records and summaries shall be witnessed and maintained until either a lump sum payment is agreed upon, or the changed Work is completed.

6.03 Preliminary Project Cost and Schedule Impact Report

The Contractor shall perform Work as directed by the University through a Preliminary Project Cost and Schedule Impact Report. The cost of the changed Work is to be determined as stated in the Preliminary Project Cost and Schedule Impact Report or pursuant to section 6.01.4.
7.00 CLAIMS AND DISPUTES

7.01 Policy of Cooperation

The parties shall endeavor to resolve all of their claims and disputes amicably and informally through open communication and discussion of all issues relating to the Project. To the greatest extent possible, the parties shall avoid invoking the formal dispute resolution procedures contained in the Contract Documents.

7.02 Recommendation of Design Professional

Claims, including those alleging an error or omission by the Design Professional, must be referred initially to the Design Professional for action as provided in paragraph 7.09 as an express condition precedent to proceeding further in resolving any claim.

7.03 Time Limits on Claims

Claims must be made within 5 days after occurrence of the event giving rise to such Claim or within 5 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been resolved by Change Order will not be valid.

7.04 Continuing Contract Performance

Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the University shall continue to make payments in accordance with the Contract Documents subject to the University’s rights relative to payments, withholding of payments, termination, or all other rights afforded it in the Contract Documents.

7.05 Claims for Concealed or Unknown Conditions

If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then written notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 48 hours after first observance of the conditions. The Design Professional will promptly investigate such conditions and, if the conditions differ materially and cause an increase or decrease in the Contractor’s cost of, or time required for, performance of any part of the Work, the Design Professional will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Design Professional determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Professional shall so notify the University and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 10 days after the Design Professional has issued such determination. If the University and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Design Professional for initial determination, subject to further proceedings pursuant to Paragraph 7.09.

7.06 Claims for Additional Cost

Any Claim by the Contractor for an increase in the Contract Sum shall be submitted in writing as required by the Contract Documents before proceeding to execute the Work. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Design
Professional, (2) an order by the University to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Design Professional, (4) failure of payment by the University, (5) termination of the Contract by the University, (6) University’s suspension or (7) changes in the scope of Work, the Contractor’s claim shall be filed in strict accordance with the procedure established herein.

7.07 Claims for Additional Time

Any Claim by Contractor for an increase in the Contract Time shall be submitted in writing as required by the Contract Documents. The Contractor’s Claim shall include an estimate of the probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.

7.08 Injury or Damage to Person or Property

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of any of the other party’s employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 5 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in the Contract Documents.

7.09 Resolution of Claims and Disputes

7.09.1 Review by Design Professional

Design Professional will review all Claims and take one or more of the following preliminary actions within 10 days of receipt of a Claim: (1) request additional supporting data from the Claimant, (2) submit a schedule to the parties indicating when the Design Professional expects action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Design Professional may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

If a Claim has been resolved, the Design Professional will prepare or obtain appropriate documentation. If a Claim has not been resolved, the party making the Claim shall, within 10 days after the Design Professional’s preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Design Professional, (2) modify the initial Claim or (3) notify the Design Professional that the initial Claim stands.

If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Design Professional, the Design Professional will notify the parties in writing that the Design Professional’s opinion will be rendered within 5 days. Upon expiration of such time period, the Design Professional will render to the parties the Design Professional’s determination relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor’s default, the Design Professional may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy. The determination by the
Design Professional shall be subject to the review and approval of the Associate Vice President of Facilities Planning and Management at Wayne State University.

7.09.2 Review by Associate Vice President of Facilities Planning and Management

The determination by the Design Professional shall be subject to the review and approval of the Associate Vice President of Facilities Planning and Management at Wayne State University who may request additional information from the Claimant for review and consideration. The Associate Vice President of Facilities Planning and Management may issue a schedule for further discussions, review or decision. Upon decision by the Associate Vice President of Facilities Planning and Management, if the Claimant seeks further review, the matter shall be submitted to the Vice-President of Finance and Business Operations.

7.09.3 Review Vice-President of Finance and Business Operations

If the determination by the Design Professional and the decision of the Associate Vice President does not resolve the Claim, the Claimant may appeal to the Vice President of Finance and Business Operations who shall review such determination and the supporting information submitted by the parties for the purpose of upholding, modifying, or rejecting the determination. The Vice President of Finance and Business Operations shall render a decision within forty-five days of the completion of any submissions by the parties. The decision of the Vice President of Finance and Business Operations is final unless it is challenged by either party by filing a lawsuit in the Court of Claims of the State of Michigan within one year of the issuance of the decision.

7.09.4 Jurisdiction

Sole and exclusive jurisdiction over all claims, disputes, and other matters in question arising out of or relating to this Contract or the breach thereof, shall rest in the Court of Claims of the State of Michigan. No provision of this agreement may be construed as the University’s consent to submit any claim, dispute or other matter in question for dispute resolution pursuant to any arbitration or mediation process, whether or not provisions for dispute resolution are included in a document which has been incorporated by reference into this agreement.

7.09.5 Condition Precedent

The process and procedures described in Article 7.09 are an express condition precedent to the Contractor filing or pursuing any legal remedy, including litigation. Pursuing litigation by the Contractor prior to exhaustion of the procedures set forth herein shall be premature and a material breach of this Agreement.
8.00 PAYMENT AND COMPLETION

8.01 Progress Payments

To assist in computing partial payments, the Contractor shall submit to the Design Professional and University a detailed "Schedule of Values" for review and approval by the University. The cost breakdowns shall be in sufficient detail for use in estimating the Work to be completed each month and shall be submitted within 10 days after the date of commencement of Work given in the Notice to Proceed.

Once each month during the progress of the Work, the Contractor shall submit to the Design Professional a partial payment request for review and approval. The partial payment request shall be based on the cost of the Work completed plus the acceptable materials delivered to or stored on the site under the control of the Contractor and not yet installed. The Design Professional and University shall review and certify by signature as to the validity of the request, and approving payment. Partial payments shall not be construed as acceptance of any Work which is not in accordance with the requirements of the Contract. Once the partial payment request has been certified by the Design Professional, it shall be submitted to the University for approval and processing.

The Contractor warrants that title to the Work, materials and equipment covered by an Application for Payment shall pass to the University upon the earlier of either incorporation in construction or receipt of payment by Contractor; that Work, materials and equipment covered by previous Applications for Payment are free and clear of liens, claims, security interests or encumbrances; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by Contractor or by any other person performing Work at the Project or furnishing materials or equipment for the Project subject to an agreement under which an interest or encumbrance is retained by the seller or otherwise imposed on the Contractor or buyer.

All Applications for Payment shall be accompanied by sworn statements and waivers executed by Contractor, Subcontractors and suppliers whose work is included in the Application for Payment, as well as other documentation that may be required by the University, stating that all have been paid in full for Work performed through the last or most recent progress payment. The Contractor and each subcontractor shall also provide properly completed certified payroll form WH-347 to the University’s with each application for payment request.

8.02 Format of Application for Payment

In addition to a schedule of values or detailed outline for the Cost of Work that is acceptable to the Contractor and University, other specific requirements for Application for Payment format and calculations include.

- Applications for Payment shall first present the itemized Cost of Work.
  - For any portion of the Work being performed according to unit pricing or time and materials pricing, invoicing and Applications for Payment must be accompanied by acceptable supporting documentation to evidence accurate quantities of actual labor, materials and equipment. Any allowed mark-ups to the actual cost of Work performed will be added to these costs separately and not included in the actual cost.
  - Change Orders executed between the Contractor and University shall be reported as separate line items within the Application for Payment and directly under applicable Subcontractor Cost of Work items. Change Orders affecting multiple Subcontractors’ Cost of Work items shall be similarly numbered to permit ease of tracking. These requirements shall run through Subcontractor Applications for Payment to the
Contractor to permit ease of tracking. Change Orders within a Subcontractor Application for Payment shall be appropriately labeled as being initiated by the Contractor or University to permit ease of tracking.

- The Contractor’s General Conditions, Overhead and Profit shall next be calculated as the balance of the Application for Payment.

8.03 Substantial Completion, Incomplete Construction List and Punchlist

When the Contractor considers that the Work, or a portion thereof which the University agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Design Professional a comprehensive Incomplete Construction List of items to be completed or corrected, in a form agreed by the University and the Design Professional. The Contractor shall proceed promptly to complete and correct items on the Incomplete Construction List. Failure to include an item on such Incomplete Construction List does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the Contractor’s Incomplete Construction List, the Design Professional, with the University’s Representative, will make an observation to determine whether the Work or designated portion thereof is substantially complete and will identify observable items inconsistent with the Contract Documents to be included in the Punchlist. If the Design Professional’s or University Representative’s observation discloses any item, whether or not included on the Contractor’s Incomplete Construction List, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item, upon notification by the Design Professional.

The Contractor shall then submit a request for another observation by the Design Professional to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Design Professional will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the University and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time, generally 45 days, within which the Contractor shall finish all remaining Incomplete Construction List and Punchlist items accompanying the Certificate. 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. The Certificate of Substantial Completion shall be submitted to the University and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

8.03.1 Partial Completion

From time to time, as portions of the Work are completed by the Contractor, the University shall have the right, upon giving the Contractor prior written notice, to accept any portion of the Work that the University desires to use and occupy. Such partial acceptance shall be made in writing and thereafter the Contractor shall have no further obligation with respect to the Work accepted, except to correct the Work subsequently found to have been improperly done, to replace defective materials or equipment, or as defined by Substantial Completion, Incomplete Construction List and Punchlist requirements.

8.04 Completion and Final Payment

Upon the Final Completion of the Work by the Contractor, the acceptance of the Work by the University, and the release of all claims against the University and the Work by the Contractor and its subcontractors and suppliers (which releases shall be evidenced by final waivers and releases or other documents acceptable to the University), the Contractor shall file a request for Final Payment.

8.04.1 Final Application for Payment
Upon the receipt of the Contractor’s Final Application for Payment, including any and all waivers required by the University and the Contractor’s provision of all Close-out Documents, and training requirements, the University shall promptly make a final inspection, and if the University finds the Work acceptable and complete in strict accordance with the Contract Documents, the University shall issue Final Payment. Final Payment shall be made upon Completion of the Work and shall indicate the University’s Final Acceptance of the Work and its acknowledgment that the Work (excluding any further warranty and guaranty obligations) has been completed and is accepted under the terms and conditions of the Contract Documents. If prior to the making of Final Payment the University finds deficiencies in the Work, the University shall promptly notify the Contractor thereof in writing, describing such deficiencies in detail. After the Contractor has remedied any deficiencies noted by the University, the Contractor shall request a final inspection and the University shall make such inspection and follow the procedure set forth in this Paragraph.

8.04.2 Final Payment by the University

The making of Final Payment shall constitute a waiver of all claims by the University except those arising from: (1) unsettled liens; (2) faulty or defective work appearing after completion; (3) failure of the work to comply with the requirements of the Contract Documents; (4) terms of any special or extended warranties required by the Contract Documents; or (5) the obligations of the Contractor under the indemnification provisions of Paragraph 4.06 hereof.

The acceptance of Final Payment shall constitute a waiver of all claims by the Contractor.

8.05 Guarantee

The Contractor unconditionally guarantees the Work under this Contract to be in conformance with the Contract Documents and to be and remain free of defects in workmanship and materials not inherent in the quality required or permitted for a period required by the contract documents beginning from the date of Substantial Completion. The Subcontractors unconditionally guaranty the Work under the subcontracts to be in conformance with the Contract Documents and to be and remain free of defects in workmanship and materials for the same period from the date of Substantial Completion, unless a longer guarantee period is stipulated in the Contract Documents. By this guarantee the Contractor and Subcontractors agree, within their respective guarantee periods, to repair or replace any Work, together with any adjacent Work which may be displaced in so doing which is not in accordance with the requirements of the Contract or which is defective in its workmanship or material, all without any expense whatsoever to the University. The Contractor shall be responsible for the coordination of all such guarantee work performance or repairs.

Special guarantees that are required by the Contract Documents shall be signed by the Contractor or Subcontractor who performs the work.

Within their respective guaranty periods, the Contractor and Subcontractors further agree that within five calendar days after being notified in writing by the University of any Work not in accordance with the requirements of the Contract Documents or of any defects in the Work, it shall commence and prosecute with due diligence all Work necessary to fulfill the terms of this guarantee and to complete the Work in accordance with the requirements of the Contract with sufficient manpower and material to complete the repairs as expeditiously as possible. The Contractor, in the event of failure to so comply, does hereby authorize the University to proceed to have the Work done at the Contractor’s expense, and it agrees to pay the cost thereof upon demand. The University shall be entitled to reimbursement of all costs necessarily incurred upon the Contractor’s or Subcontractor’s refusal to pay the above cost.
Notwithstanding the foregoing paragraph, in the event of an emergency constituting an immediate hazard to health, safety or damage of the University’s employees, property, or licenses, the University may undertake at the Contractor’s or Subcontractor’s respective expense, without prior notice, all Work necessary to correct such hazardous conditions caused by the Work of the Contractor not being in accordance with the requirements of this Contract.

The Contractor and Subcontractor shall require a similar guarantee in all subcontracts, including the requirement that the University be reimbursed for any damage or loss to the Work or to other Work resulting from such defects.
9.00 TERMINATION

9.01 Termination by the University for Cause

9.01.1

The University may terminate the Contract if the Contractor: (a) becomes insolvent; (b) files or has filed against it any Petition in Bankruptcy or makes a general assignment for the benefit of its creditors; (c) fails to pay, when due, for materials, supplies, labor, or other items purchased or used in connection with the Work; (d) refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will ensure the completion of the Work in accordance with the Master Project Schedule; (e) in the University’s opinion, fails, refuses or neglects to supply sufficient labor, material or supervision in the prosecution of the Work; (f) interferes with or disrupts, or threatens to interfere with or disrupt the operations of the University, or any other Contractor, supplier, subcontractor, or other person working on the Project, whether by reason of any labor dispute, picketing, boycotting or by any other reason; or (g) commits any other breach of the Contract Documents.

When any of the above reasons exist, the University may, without prejudice to any other rights or remedies of the University and after giving the Contractor and the Contractor’s surety, if any, three days written notice and a reasonable opportunity to cure, terminate employment of the Contractor and may, subject to any prior rights of the surety: (1) take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; (2) accept assignment of subcontracts; and (3) finish the Work by whatever reasonable method the University may deem expedient.

9.01.2

If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Design Professional’s services and expenses made necessary thereby, the remaining balance shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the University. The amount to be paid to the Contractor or University, as the case may be, shall be certified by the Design Professional, upon application, and this obligation for payment shall survive termination of the Contract. The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or consequential damages arising out of or resulting from such termination. However, the University shall be entitled to retain whatever amount is remaining unpaid to the Contractor in order to correct the cause for termination; such action is in addition to any other right or remedy which the University may have.

9.02 Suspension by the University for Convenience

9.02.1

The University may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the University may determine.

9.02.2

An adjustment shall be made for increases in the Contract Sum and/or Time of Completion of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption.
adjustment shall be made to the extent: (1) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or (2) that an equitable adjustment is made or denied under another provision of this Contract. The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or consequential damages arising out of or resulting from such termination.

Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

9.03 Termination By The University For Convenience

9.03.1

The University, with or without cause, may terminate all or any portion of the services by the Contractor under this Agreement, upon giving the Contractor 30 days written notice of such termination. In the event of termination, the Contractor shall deliver to the University all reports, estimates, schedules, subcontracts, Contract assignments, purchase order assignments, and other documents and data prepared by it, or for it, pursuant to this Agreement.

9.03.2

Unless the termination is for cause, the Contractor shall be entitled to receive only the payments provided for in Article 8, pro-rated to the date of termination (including payment for the period of the 30 day notice) plus reimbursement for approved and actual costs and expenses incurred by the Contractor to the date of termination. Prior to payment, the Contractor shall furnish the University with a release of all claims against the University. The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or consequential damages arising out of or resulting from such termination.

9.04 Termination By The Contractor

9.04.1

The Contractor may terminate the Contract if the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor, sub-subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor, for any of the following reasons: (1) issuance of an order of a court or other public authority having jurisdiction; (2) an act of government, such as a declaration of national emergency, making material unavailable; (3) because the Design Professional has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification, or because the University has not made payment on a Certificate for Payment within forty-five (45) days of the time stated in the Contract Documents; (4) if repeated suspensions, delays or interruptions by the University constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

If one of the above reasons exists, the Contractor may, upon fourteen (14) additional days’ written notice to the University and Design Professional, terminate the Contract and recover from the University payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit.

9.04.2

If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor due to University actions or inaction, the Contractor may, upon fourteen additional days’ written
notice to the University and the Design Professional, terminate the Contract and recover from the University as provided in Subparagraph 9.03.2
10.00 MISCELLANEOUS

10.01

These Contract Documents supersede all previous agreements between the University and the Contractor concerning this Work.

10.02

No action or failure to act by the University shall constitute a waiver of a right afforded it under these General Conditions, nor shall such action or failure to act constitute approval or acquiescence of a breach of these General Conditions, except as may be specifically agreed in writing.

10.03

The invalidity or unenforceability of any provision of these General Conditions shall not affect the validity or enforceability of any other provision.

-End of General Conditions for Construction-
-End of General Conditions for Construction-
SUPPLEMENTARY GENERAL CONDITIONS

OF

CONSTRUCTION

Facilities Planning & Management - Design & Construction Services
Wayne State University

Complete Documents can be downloaded at
http://www.forms.procurement.wayne.edu/RFPs/Supplementary_General_Conditions_General_Contractor_1-3-2017.docx
SUPPLEMENTARY GENERAL CONDITIONS OF CONSTRUCTION (REVISED 7-2018)

Where any article of the General Conditions of the Contract for Construction is supplemented in these Supplementary General Conditions, the original article shall remain in full force and effect and all supplementary provisions shall be considered as added thereto. Where any such article is modified, superseded or deleted here, provisions of such article not so specifically modified, superseded or deleted shall remain in full force and effect.

4.00 RESPONSIBILITIES OF THE PARTIES

Add the following to 4.02.3

.1 Temporary Facilities

.a The Contractor shall be responsible for arranging and providing general services and temporary facilities as specified herein and as required for the Design Professional, the University, all Subcontractors, Separate Contractors and Contractor’s staff for the proper and expeditious prosecution of the Work, including, but not limited to, temporary offices and toilets; temporary storage; temporary electrical lighting and power; temporary voice and data communications, temporary water; temporary enclosures; temporary heating and ventilation; temporary openings; material hoists; temporary ladders, ramps and runways; temporary fire protection, protective coverings; temporary fire protection, protective coverings; and construction sign(s). The Contractor shall, at its own expense but included within the Cost of the Work, make all temporary connections to utilities and services in locations acceptable to the University, Design Professional and local authorities having jurisdiction thereof; furnish all necessary labor and materials, and make all installations in a manner subject to the acceptance of such authorities and the Design Professional; maintain such connections; remove the temporary installation and connections when no longer required; and restore the services and sources of supply to proper operating conditions.

.b The Contractor shall make all arrangements with the University and/or the local electrical utility company for temporary electrical service to the Site, shall provide all equipment necessary for temporary power and lighting, and shall pay all charges for this equipment and installation thereof. The electrical service shall be of adequate capacity for all construction tools and equipment without overloading the temporary facilities and shall be made available to all trades. The Contractor shall furnish, install and maintain a temporary lighting system to satisfy minimum requirements of safety and security.

.c Temporary weathertight enclosures and temporary heating shall be provided by the Contractor as required pursuant to the Construction Schedule or Master Project Schedule to complete the Work on or before the Completion Date, to make the building weathertight and suitable working conditions for the construction operations of all trades. Under no circumstances shall the temperature be allowed to reach a level which will cause damage to any portion of the Work which may be subject to damage by low temperatures. Unless otherwise indicated in the Construction Documents, the Contractor shall pay for all fuel, maintenance and attendance required in connection with the portable unit heaters without additional cost or expense to University. Any surface, interior or exterior, damaged by the use of these space heaters shall be replaced by new materials or be refinished to the satisfaction of the Design Professional and University without additional cost to the University.

.d All temporary equipment and conduits for same shall be in accordance with the applicable provisions of the governing codes. All temporary wiring and power conduits shall be maintained in a safe manner and utilized so as not to constitute a hazard to persons or property. All temporary equipment, wiring and conduits shall be completely removed after they are no longer necessary and
prior to completion. At the conclusion of use or at the conclusion of the project, any materials or products purchased for the temporary facilities and temporary utilities and paid for, either directly or indirectly, by the University shall become the property of the University and shall, at the option of the University, be delivered to the University’s designated location.

.e Where temporary facilities and associated utilities, and for utilities used in performance of this Agreement can be reasonably provided from existing University services, the University shall bear the cost of such utility consumption. However, for conditions that require the Contractor to use electrical generators or equipment fueled by an independent fuel source, the Contractor shall bear all such costs.

Add the following to 4.02.12

.1 Safety and Protection

.a Contractor shall provide fences, pedestrian walks, barriers, etc. to ensure safety of the general public and Contractor’s personnel or as directed by University.

.b Contractor will provide perimeter protection at wall and floor openings, elevator shafts, stairwells, and floor perimeters in accordance with MIOSHA requirements.

.c Combustible rubbish shall be removed daily and shall not be disposed of by burning on site. The entire premises and area adjoining and around the operation shall be kept in a safe and sanitary condition and free of accumulation of trash, rubbish, nuts, bolts, small tools, and other equipment not in use. Contractor is responsible to provide trash containers and fund the removal/disposal of construction debris and general trash.

.d Contractor will regularly ensure that 1) excess material/trash are removed from work sites; 2) passageways (e.g., sidewalks, hallways) are cleared of obstructions; 3) equipment is shut down and secured; and 4) lighted barricades are erected where necessary.

.e All existing means of egress, including stairways, egress doors, panic hardware, aisles, corridors, passageways, and similar means of egress shall, at all times, be maintained in a safe condition and shall be available for immediate use and free of all obstructions.

.f The space under the temporary trailer shall not be used for the storage or placement therein of flammable gases, liquids, or gas and liquid fuel powered equipment. This area shall be kept free of accumulations of any rubbish or trash.

.g In temporary trailers, all exit doors shall be open for egress whenever the unit is occupied. Draw bolts, hooks and other similar locking devices shall be prohibited on all egress doors.

.h On site storage of combustible or flammable liquids shall be limited to one day supply. Indoor storage of propane containers is prohibited.

.i Prior to working in confined spaces on campus, the Contractor must have its written Confined Spaces Program and Permit System reviewed by the University and the documents must meet minimum acceptable standards under the current MIOSHA regulation(s). The Contractor must provide its own atmospheric testing, personal protection, ventilating and rescue equipment as required. The Contractor should seek information from University on any known hazards of the confined spaces to be entered. All manholes and utility tunnels are considered confined spaces.

.j Compressed gas cylinders belonging to Contractor must be properly segregated and secured (with chains or similarly reliable restraining devices) to wall or floor mounted support systems,
cylinder storage racks etc., when not in transit. Protective caps must be in place during transit or when not in use.

.k Contractor must follow all of OSHA's lockout/tagout requirements of 29 CFR 1910.147, provide its own lockout/tagout supplies, and be able to demonstrate that its employees have received formal instruction in "lock-tag-try" procedures. Copies of Contractor's written Lockout/Tagout Program shall be made available to the University upon request.

.l Contractor may not use any University sinks, drains or catch basins for the washing of any equipment, tools or supplies, or the disposal of any liquids, (excluding consumable products and hand-soap/water) without the express permission of University. This restriction applies to all sinks (including water fountains) in laboratories, offices and maintenance areas. Additionally, no polluting or hazardous liquids (such as motor oils, cleaners, solvents, paints, diesel fuels, antifreeze, etc.) may be drained onto roads, parking lots, ditches, wetlands, dirt piles or other soil, or into storm or sanitary sewers.

.m Contractor transporting hazardous materials (e.g. reclaimed materials, chemicals, fuels, oils, concrete) to and from campus must follow all applicable Department of Transportation [State or Federal] regulations. This includes proper shipping papers, placarding, material segregation and weight limits.

.n Contractor is also responsible for the proper collection, labeling, transporting, manifesting and disposal of polluting or hazardous wastes such as solvents, paints, oil or antifreeze (and rags contaminated with any of these materials) which are the result of Contractor’s activities, as required by State and Federal laws and regulations. Copies of all manifests should remain available for University review upon request. Under no circumstances may hazardous wastes be disposed of in University-owned dumpsters, waste containers, drains or sewers, or drained onto roads, parking lots, ditches, wetlands, dirt piles or other soil.

.o Neither the University nor the Design Professional is responsible for conducting safety inspections or observations, but may make recommendations concerning safety to the Contractor.

.p Fire Protection

1) All reasonable precautions shall be taken against fire throughout all the Contractor’s and Trade Contractors’ operations. Flammable material shall be kept at an absolute minimum. Any such materials shall be properly handled and stored.

2) Construction practices, including cutting, welding and grinding, and protection during construction shall be in accordance with the applicable published standards. During such operations the Contractor shall provide a fire watch person. The University requires a “Hot Work” permit for such activities. The Contractor shall provide a sufficient number of approved portable fire extinguishers, distributed about the Project and in cold weather, non-freeze type portable fire extinguishers shall be used.

3) Gasoline and other flammable liquids shall be stored in and dispensed from Underwriter’s Laboratories listed safety containers in conformance with the National Board of Fire Underwriters recommendations and applicable State laws. Storage, however, shall not be within or immediately adjacent to the building. Storage shall be in a lockable, non-combustible, suitably rated cabinet or structure no less than 25 feet distant from any University building.

4) The Contractor shall schedule the Work so that the permanent standpipe system shall be installed and made operable at the earliest possible date.

4) All tarpaulins that may be used for any purpose during construction of the Work shall be made
of material which is water and weather resistant and fire retardant treated. All tarpaulins shall be Underwriters’ Laboratories labeled with flame spread rating of fifteen (15) or less and shall be approved by the University’s Representative prior to use.

Add the following to 4.02.13

Hazard Communication: University requires the Contractor to be in full compliance with all applicable Federal and State of Michigan regulations regarding Material Safety Data Sheets ("MSDS"). Upon request, copies of these MSDS must also be provided to the University no less than two weeks prior to the onset of activities. Failure to submit MSDS may result in suspension of Work activities until the MSDS are obtained. If Contractor is to work with hazardous products, it shall notify and update the Project Manager of a) proposed work schedules, b) what to expect in terms of noises/odors, and c) how to access MSDS. The Contractor must also be able to demonstrate that its employees have received “Haz Com” (i.e. Michigan Right-to-Know), and thereby possess a broad understanding of MSDS language. Contractor-owned chemical containers must be labeled with the product name and hazards.

Hazardous Materials: In addition to complying with the Michigan Right-to-Know Law, the Contractor must use and store hazardous materials in accordance with all local, state and federal regulations. Special attention must be paid to the segregation of incompatible materials and the handling/storage of flammable and/or volatile materials. At the end of each work day, hazardous materials must be properly secured, stored in MIOSHA approved containers, and placed in locations authorized by the University or removed from University’s property.

Add the following to 4.02.21

.1 Excavation Policy

The policy prescribed herein shall be adhered to for all earth excavation, manual or power, on the University campus that penetrates the surface of the soil by a depth of 6 inches or greater.

.a Non-emergency Situation

(1) In non-emergency situations (i.e., scheduled maintenance or construction) the Contractor shall contact the University a minimum of seven days in advance of the scheduled excavation.

(2) The Contractor shall contact Miss Dig, as defined by Public Act 174 of 2013, being MCL 460.721 – MCL 460.733, at least three full business days prior to the scheduled excavation, to ascertain and stake the actual location for all utilities within 50 feet of the limits of the proposed excavation. Actual staking shall be performed not more than three (3) days prior to the excavation.

(3) Excavation shall commence only with the approval of the University Representative after a complete examination of the site utility drawings and a field observation of the staked site.

.b Emergency Situation

1. In an emergency situation (i.e., loss of services on campus or to a building), the Contractor shall immediately contact the University Representative, examine the site utility drawings to determine the potential interferences, and contact Miss Dig and private stakers, if appropriate, to ascertain and stake the actual location of all utilities within 50 feet of the limits of the proposed excavation. The Contractor shall also immediately contact the local natural gas supplier in addition to Miss Dig, upon a natural gas line failure.

2. Contact the University’s Police Department at the emergency number: (313) 577-2222.
3. Excavation shall recommence only with the approval of the University’s Representative who will grant approval only after a complete examination of the site utility drawings and a field observation of the staked site and clearance from the utility and University Police Department.

c  Pumping and Draining

The Contractor shall provide and maintain a temporary drainage system and pumping equipment as required to keep all excavation areas within the Site free from water from any source. As the Work progresses, all water shall be removed from basement areas, tunnels, pits, trenches and similar areas as required for proper performance of the Work and to prevent damage to any part of the construction utility. Permanent sump pumps shall not be used for this purpose; however, the Contractor may install temporary pumps in the sump pits until the permanent pumps are installed, providing that it cleans sump pits and drain lines satisfactorily after temporary use. The Contractor shall provide and maintain all pumping and draining equipment as required for the installation of all underground piping and utility conduit systems. Pumping and draining shall be performed in a manner to avoid endangering concrete footings or any adjacent construction or property. Such methods shall be subject to the review of the Design Professional.

d  Post-Excavation

(1) Provide appropriate pipe protection (wraps, and/or cathodic protection) as originally installed.

(2) Provide backfill material and compaction in 12-inch lifts to a minimum 95% Maximum Dry Density or higher as required by the Specifications.

(3) Backfill material shall be as specified; or engineered fill free of all deleterious materials and rubbish of any type. Reuse of excavated material, unless otherwise specifically noted on the drawings, is unacceptable.

(4) Provide plastic tape trace 24" (12" for shallow trenches) above all utilities indicating utility type by Miss Dig color code and name defined as follows:

<table>
<thead>
<tr>
<th>Utility</th>
<th>Color</th>
<th>Lettering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>Red</td>
<td>Elect</td>
</tr>
<tr>
<td>Oil/Natural Gas</td>
<td>Yellow</td>
<td>Gas</td>
</tr>
<tr>
<td>Telephone &amp; Fiber optic</td>
<td>Orange</td>
<td>Tele</td>
</tr>
<tr>
<td>Cable TV</td>
<td>Brown</td>
<td>TV</td>
</tr>
<tr>
<td>Water</td>
<td>Blue</td>
<td>Water</td>
</tr>
<tr>
<td>Steam</td>
<td>Yellow</td>
<td>Steam</td>
</tr>
<tr>
<td>Sewer</td>
<td>Green</td>
<td>Sewer</td>
</tr>
</tbody>
</table>

(5) Return grade to pre-excavation condition.

Add the following to 4.05.1

The insurance furnished by the Contractor under this Article 4.05.1 shall provide coverage not less than the following:

.1 Workers’ Compensation with Employers’ Liability & Alternate Employers Endorsement:
  (a) Statutory Limits & Employer’s Liability $1,000,000

.2 Commercial General Liability
  (a) $1,000,000 per occurrence and $2,000,000 aggregate
  (b) University added as additionally insured on
.3 Contractors’ Pollution Liability:
   (a) $1,000,000 per claim

.4 Professional Liability:
   (a) $2,000,000 per claim and $4,000,000 aggregate

.5 Auto Liability with Pollution & Legal Liability
   (a) $1,000,000
   (b) University added as additionally insured on

.6 Excess Liability (Umbrella):
   (a) $2,000,000

.7 Builder's Risk Insurance in the amount equal to the Contract Sum.

Any deductible or self-insured reserve shall not be refunded to the Contractor from project contingency or other project funds.

Add the following to 4.12

Elevator shafts, electrical closets, pipe and duct shafts, chases, furred spaces and similar spaces which are generally unfinished, shall be cleaned by the Contractor and left free from rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt and dust before preliminary inspection of the Work.

All areas of the Project in which painting and finishing work is to be performed shall be cleaned throughout just prior to the start of this work, and these areas shall be maintained in satisfactory condition for painting and finishing. This cleaning shall include the removal of trash and rubbish from these areas; broom cleaning of floors; the removal of any plaster, mortar, dust and other extraneous materials from all finished surfaces, including but not limited to, all exposed structural steel, miscellaneous metal, woodwork, plaster, masonry, concrete, mechanical and electrical equipment, piping, duct work, conduit, and also all surfaces visible after all permanent fixtures, induction unit covers, convector covers, covers for finned tube radiation, grilles, registers, and other such fixtures or devices are in place.

In addition to all cleaning specified above and the more specific cleaning which may be required, the Project shall be prepared for occupancy by a thorough final cleaning throughout including washing or cleaning of all surfaces on which dirt or dust has collected. Glass and curtain wall shall be washed and cleaned on both sides by a window cleaning subcontractor specializing in such work. Contractor shall, at University’s request, delay such washing of exterior surfaces to such time as requested by University. Recleaning will not be required after the Work has been inspected and accepted unless later operations of the Contractor, in the opinion of the University, make re-cleaning of certain portions necessary.

5.00 INTERPRETATION OF AND ADHERENCE TO CONTRACT REQUIREMENTS

Add the following to 5.04.1

.1 Contractor Requirements

   .a Signature: Each item submitted shall be thoroughly reviewed by the Contractor and have a stamp or note describing the Contractor’s action, signed by the person authorized by the Contractor to do the checking with that person’s name clearly printed.
.b Contractor Responsibility: Contractor shall review each submittal for completeness, conformance to the Contract Documents and coordination with other parts of the Work and the Construction Schedule. By providing and submitting to the Design Professional shop drawings, product data, warranties and samples, the Contractor is representing that he or his Subcontractor, has determined and verified (a) the availability of all materials, and (b) field measurements and field construction criteria related thereto, and (c) that he has checked and coordinated the information contained within such submittals with the requirements of the Work, the Contract Documents and the Construction Schedule and that such shop drawings, samples, warranties and data conform to the Contract Documents.

c Limited Acceptance by University and Design Professional: Acceptance is for general design only. Quantities, size, field dimensions and locations are some of the required characteristics which are not part of the acceptance and will not be checked. Accordingly, the limited acceptance shall in no way relieve the Contractor from his obligation to conform his work to required characteristics and to the requirements of the Contract Documents.

d Delays: The Design Professional may return incomplete submittals with no action taken. The Contractor shall have no claim for any damages or for an extension of time due to delay in the Work resulting from the rejection of materials or from the rejection, correction, and resubmittal of Shop Drawings, samples and other data, or from the untimely submission thereof.

.2 Approvals

The Design Professional’s approval shall not indicate approval of dimensions, quantities or fabrication processes unless specific notations are made by the Design Professional regarding same. The Design Professional will check one of the following notations on the Shop Drawing and Sample Review Stamp:

.a "REVIEWED-NO EXCEPTIONS NOTED", indicating final action by the Design Professional. When reviewing resubmitted shop drawings the Design Professional assumes that there are no revisions from the previous submittal, except as provided by 5.04.1 and his review of resubmittals is only for the corrections requested with the approval of the balance of the shop drawing being based on the original submission. Where the Contractor directs specific action to revisions, as provided by 5.04.1 the approval includes these also.

.b "REVIEWED WITH CORRECTIONS NOTED", indicating final action by the Design Professional with the same conditions as "REVIEWED-NO EXCEPTIONS NOTED". Unless he takes exception to the corrections noted, the Contractor may begin that portion of the Work for which the shop drawing was required.

.c "REVISE AND SEND RECORD COPY", requiring that the Design Professional be sent a copy of the revised shop drawing in accordance with the noted corrections, at the same time it is issued for the Work.

.d "NOT APPROVED-RESUBMIT", indicating that the Contractor shall not begin that portion of the Work until the reason indicated for disapproval has been corrected and the revised shop drawing submitted, reviewed and approved by the Design Professional.

.e "NO ACTION REQUIRED", indicating that Contract Documents do not require the Design Professional to review or take any action with this submittal.

.f Where more than one action has been checked, each shall apply to that portion of the shop drawing for which the action is indicated.
8.00 PAYMENT AND COMPLETION

Add the following to 8.01

8.01.1 Monthly Payment Applications

At a meeting mutually agreed upon between the University’s Representative and the Contractor, but no less than monthly, the Contractor shall distribute, in triplicate, draft copies of the proposed Payment Application for review and comment. The review, comment and mutual concurrence will be an agenda item at that meeting. The Contractor will prepare the formal Application for submission from the comments made on the Draft and will present the formal application as provided for herein, including all required back-up materials, such as waivers of claim, release of claim on bond, sworn statement, documentation for stored materials, certified payroll reports and other documents required by the University Representative.

8.01.2 Offsite Materials

If an Application for Payment is made for materials not installed in the Work, but suitably stored off-site at a location acceptable to the University’s Representative, such application shall be accompanied by legally acceptable paid invoices or conditional bills of sale and copies of delivery tickets, signed by the Contractor, indicating the Contractor verified that the materials shown on the delivery tickets are at the location accepted by the University and are adequately insured. Failure of the Contractor to furnish paid invoices, conditional bills of sale and proof of insurance shall be cause for withholding such amounts from payment until such paid invoices or bills of sale have been received by the University. The University reserves the right to examine the stored items prior to payment.

Add the following to subparagraph 8.03

The following submittals shall be bound in three (3) sets, plus one electronic file of all materials:

.1 Project Closeout Documents

.a The Contractor shall submit to the Design Professional, a written guarantee, which shall be in accordance with Section 8.04 and such additional guarantees, in writing, as are required by the Specifications.

.b The Contractor shall submit complete instruction for the care and maintenance of all finish materials under the contract, including, but not limited to floor finishes and coverings, wainscot and wall finishes, acoustical treatment, metal finishes, painted surfaces, flooring, hardware, and finishes on mechanical and electrical equipment. Instructions shall contain the manufacturer’s or supplier’s recommendations with respect to cleaning agents, preservative treatment and such other instructions as may be beneficial to the maintenance, usage, appearance and durability of the product. The recommendations shall further contain cautions on the use of certain cleaners and coatings which may be detrimental to the product.

.c The Contractor shall prepare and submit operating and maintenance instructions, coordination drawings, and shop drawings for all mechanical and electrical equipment, and other special items, as called for in the specifications.

.d All of the above described documents shall be checked by Contractor for conformance with the specifications and shall be submitted in uniform size, bound and indexed for cross-reference.

.e The Contractor shall also submit "As-Built" drawings as specified in Section 4.11.
.f Copies of all "Attic Stock" transmittals signed by appropriate University personnel accepting the attic stock material.

.2 Project Closeout Training

a. The University and the Contractor will coordinate, schedule and present formal training for University personnel for all equipment, systems, devices, and building features.

b. Training shall be scripted to include all important aspects of the equipment and its installation and maintenance. Trainers shall be suitably prepared and experienced in the features of the equipment and the equipment’s installation within the project.

c. The Contractor, all product vendors, subcontractors, suppliers and materialmen shall consent to and participate in the recording of the training as determined by the University and the Contractor.

d. The University may supplement training with outside providers to meet the training requirements of the project should a vendor, subcontractor, or supplier fail to provide the required training. The University shall be reimbursed by the Contractor for any such costs for supplemental training.
The Technical Specifications and Drawings dated 08/21/2018 represent the scope of work as defined in the Contract Documents from Article 4.
GENERAL REQUIREMENTS

GENERAL

A. CONTRACTOR’S RESPONSIBILITY

It is not the responsibility of the Architect/Engineer or Owner's Representative to notify the Contractor or subcontractors when to commence, to cease, or to resume work; nor in any way to superintend so as to relieve the Contractor of responsibility or of any consequences of neglect or carelessness by him or his subordinates. All material and labor shall be furnished at times best suited for all Contractors and subcontractors concerned, so that the combined work of all shall be properly and fully completed on the date fixed by the Contract.

The Contractor shall be responsible for all items contained in both the specifications and on the drawings for all trades. He shall be responsible for the proper division of labor according to current labor union agreements regardless of the division of responsibility implied in the contract documents.

B. CODES AND STANDARDS

Reference to standard specifications for workmanship, apparatus, equipment and materials shall conform to the requirements of latest specifications of the organization referenced, i.e., American Society for Testing Materials (ASTM), Underwriters Laboratories, Inc. (UL), American National Standards Institute, Inc. (ANSI), and others so listed in the Technical Specifications.

C. PERMITS, FEES AND NOTICES

See General Conditions, Article 4.02.18

D. MEASUREMENTS

Before proceeding with each Work Item, Contractor shall locate, mark and measure any quantity or each item and report quantities to Engineer. If measured quantities exceed Engineer’s estimate, Contractor shall obtain written authorization to proceed from Owner before executing Work required for that Work Item.

Measurement of quantities for individual Work Items will be performed by Contractor and reviewed by Engineer. Coordinate measurements with inspection as required in Section “Coordination.”

Cost of Work included in Work Item for quantities as indicated in Contract Documents shall be included in Base Bid.

1. Additions to or deductions from lump sum price for quantities of each Work Item added to or deducted from Work respectively shall be at unit prices indicated in Bid Form and shall constitute payment or deductions in full for all material, equipment, labor, supervision and incidentals necessary to complete Work.

E. CONTRACTOR’S MEASUREMENTS

Before ordering material, preparing Shop Drawings, or doing any work, each Contractor shall verify, at the building, all dimensions which may affect his work. He assumes full responsibility for the accuracy of his figures. No allowance for additional compensation will be considered for minor discrepancies between dimensions on the drawings and actual field dimensions.

F. CONTINUITY OF SERVICE (Revised 3-26-2012)

Continuity of all existing services in the building shall be maintained throughout the construction period. Where it is necessary to tie into the existing electrical service, water or waste systems, it shall be done as directed by the Architect/Engineer. This Contract shall also provide temporary lines or bypasses that may be required to maintain continuous service in the building. All utility shutdowns must be approved by the Owners Representative / Project Manager, not less than 7 business days prior to the event, so that proper notification can be posted.

G. SUBMITTALS
All submittals (except Shop Drawings) and samples required by the Specifications shall be submitted in triplicate unless otherwise specified for a particular item under an individual Specification Section.

Each sample shall be clearly identified on a tag attached, showing the name of the Project Consultant, the project number and title, the names of the Contractor, manufacturer (and supplier if same is not the manufacturer), the brand name or number identification, pattern, color, or finish designation and the location in the work.

Each submittal shall be covered by a transmittal letter, properly identified with the project title and number and a brief description of the item being submitted.

Contractor shall be responsible for all costs of packing, shipping and incidental expenses connected with delivery of the samples to the Project Consultant or other designated address.

If the initial sample is not approved, prepare and submit additional sets until approval is obtained.

Materials supplied or installed which do not conform to the appearance, quality, profile, texture or other determinant of the approval samples will be rejected, and shall be replaced with satisfactory materials at the Contractor's expense.

**H. GENERAL/STANDARD ELECTRONIC EQUIPMENT AND INFRASTRUCTURE REQUIREMENTS (Revised 11-2008)**

1. **Compliance with WSU Standards for Communications Infrastructure**
   
   A. All applicable work, products, materials and methods shall comply with the latest version of the “WSU Standards for Communications Infrastructure” except as where noted.
   
   B. This document is available at the following website/URL: https://computing.wayne.edu/docs/wsu-communications-standards.pdf

2. **Automation System Program Code**

   A. All automation system uncompiled and compiled program codes, source codes, custom modules, graphical user interface screen shots and any other automation system programming data and material (Program Code) shall be provided to the UNIVERSITY in hard copy and on CD Rom in an unencrypted format acceptable to the UNIVERSITY.

   B. Copyright for the Program Code shall be assigned to the UNIVERSITY for purposes of system maintenance.

**PROTECTION OF OCCUPANCY (Revised 3-2006)**

**A. FIRE PRECAUTIONS**

Take necessary actions to eliminate possible fire hazards and to prevent damage to construction work, building materials, equipment, temporary field offices, storage sheds, and other property. During the construction, provide the type and quantity of fire extinguishers and fire hose to meet safety and fire prevention practices by National Fire Protection Association (NFPA) Codes and Standards (available at http://www.nfpa.org/)

In the event that construction includes "hot work", the contractor shall provide the Owner's Representative with a copy of their hot work policy, procedures, or permit program. No hot work activity (temporary maintenance, renovation, or construction by operation of a gas or electrically powered equipment which produces flames, sparks or heat that is sufficient to start a fire or ignite combustible materials) shall be performed until such documents are provided. During such operations, all highly combustible or flammable materials shall be removed from the immediate working area, and if removal is impossible, same shall be protected with flame retardant shield.

Not more than one-half day's supply of flammable liquids such as gasoline, spray paint and paint solvent shall be brought into the building at any one time. Flammable liquids having a flash point of 100 degrees F, or below which must be brought into the building shall be confined in an Underwriters Laboratories (UL) labeled safety cans. The bulk supply of flammables shall be stored at least 75 feet from the building and other combustible materials. Spigots on drums containing flammable liquids are prohibited on the project site. Drums shall be equipped with approved vented pumps, and be grounded and bonded.
Only a reasonable working supply of combustible building materials shall be located inside the building.

All oil-soaked rags, papers, and other similar combustible materials shall be removed from the building at the close of each day's work, or more often if necessary, and placed in metal containers, with self-closing lids.

Materials and equipment stored in cardboard cartons, wood crates or other combustible containers shall be stored in an orderly manner and accessibly located, fire-fighting equipment of approved types shall be placed in the immediate vicinity of any materials or equipment stored in this type of crate or carton.

No gasoline, benzene, or like flammable materials shall be poured into sewers, manholes, or traps.

All rubbish shall be removed from the site and legally disposed of. Burning of rubbish, waste materials or trash on the site shall not be permitted.

The contractor shall be responsible for the conduct of employees relative to smoking and all smoking shall be in the area designated by the Architect/Engineer.

B. GENERAL SAFETY AND BUILDING PRECAUTIONS

Provide and maintain in good repair barricades, railings, etc., as required by law for the protection of the Public. All exposed material shall be smoothly dressed.

At dangerous points throughout the work environment provide and maintain colored lights or flags in addition to above guardrails.

Isolate Owner's occupied areas from areas where demolition and alteration work will be done, with temporary, dustproof, weatherproof, and fireproof enclosures as conditions may require and as directed by the Architect/Engineer.

Cover and protect furniture, equipment and fixtures to remain from soiling, dust, dirt, or damage when demolition work is performed in rooms or areas from which such items have not been removed.

Protect openings made in the existing roofs, floors, and other construction with weatherproof coverings, barricades, and temporary fire rated partitions to prevent accidents.

Repair any damage done to existing work caused by the construction and removal of temporary partitions, coverings, and barricades.

The Contractor will be held responsible for all breakage or other damage to glass up to the time the work is completed.

Provide protection for existing buildings, interior and exterior, finishes, walls, drives, landscaping, lawns (see below), etc. All damages shall be restored to match existing conditions to the satisfaction of the Architect/Engineer.

The Contractor and Owner will define the anticipated area of lawn damage at the project Pre-Construction Meeting. Whether the lawn is sparse or fully developed, any lawn damaged due to the Contractor's work will be replaced with sod by the University. The University's unit cost of $10.00 per square yard and landscaping at a rate of 1.5 times the cost of the sod repairs, the full cost of which will be assessed against the Contractor. At the completion of the project, a deductive Change Order reflecting this cost will be issued. The Contractor is to include an allowance in his bid for this corrective work.

C. INTERFERENCE WITH OWNER'S OPERATIONS

The Owner will be utilizing the Building Facilities to carry on his normal business operation during construction. The Contractor shall schedule performance of the work necessary to complete the project in such a way as to interfere as little as possible with the operation during construction. The Contractor shall schedule performance of the work necessary to complete the project in such a way as to interfere as little as possible with the operation of the Owner.

Work which will interfere with the Owner's occupancy, including interruptions to the Owner's mechanical and electrical services, and essentially noisy operations (such as jackhammering) shall be scheduled in advance. The schedule of alterations shall be approved by the Architect/Engineer and the work shall be done in accordance with the approved schedule.
It is understood that the work is to be carried through to completion with the utmost speed consistent with good workmanship and to meet the construction schedule.

The Contractor shall begin work under the Contract without delay upon receipt of the fully-executed contract and shall substantially complete the project ready for unobstructed occupancy and use of the Owner for the purposes intended within the completion time stated in the contract.

The Contractor shall, immediately upon award of contract, schedule his work and expedite deliveries of materials and performance of subcontractors to maintain the necessary pace to meet the construction schedule.

**CONTRACTOR'S REPRESENTATION AND COORDINATION**

**A. FIELD SUPERINTENDENT**

Contractor shall assign a full time project manager/superintendent for the duration of the project. This person shall be experienced and qualified in all phases of the work and shall be present at the site during Contractor's working hours. The project manager shall have Contractor's full authority to represent Contractor in all routine operations including payment, changes to the work, and scheduling. Contractor shall not re-assign this individual without prior written permission of the Owner.

**B. MEETINGS**

When directed by the Architect/Engineer, meetings shall be held for the purpose of coordinating and expediting the work. The invited contractors or subcontractors will be required to have qualified representatives at these meetings, empowered to act in their behalf.

**C. COORDINATION**

The Contractor shall also provide a staff adequate to coordinate and expedite the work properly and shall at all times maintain competent supervision of its own work and that of its subcontractors to insure compliance with contract requirements.

The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the Contractor.

**D. CONSTRUCTION SCHEDULE**

The Construction Schedule shall be prepared after the award of contract. Soon after, a pre-construction meeting is held with the Owner and the Architect/Engineer to determine the areas to which the Contractor will be allowed access at any one time.

The Contractor is alerted to the fact that areas in which he will be working will be occupied by students and employees of the University as well as the general public. The Contractor's access, to and from the project site, will be confined to limited areas so as not to unduly disrupt the normal activities of the University.

**TEMPORARY FACILITIES**

**A. GENERAL**

The following temporary facilities descriptions represent standard conditions. Verify accuracy with Architect/Engineer at time of bids.

**B. CONTRACTOR’S OFFICE**

Provide field offices as required. Locate temporary field offices on site where directed by Architect/Engineer.

Appearance and location of field offices shall be approved by the Architect/Engineer.

Provide for all other administrative facilities and storage off the Owner’s property.

**C. STORAGE OF MATERIALS**
All materials shall be stored in areas designated by the Architect/Engineer. All stored materials shall be arranged for the minimum disruption to occupants and to allow full access to and throughout the building. Materials stored outdoors shall be neat and orderly and covered to prevent damage or vandalism.

D. PARKING

1. GENERAL

   University parking regulations will be strictly enforced.

   Maintain Owner's parking areas free of dirt and debris resulting from operations under the contract.

2. STANDING AND UNLOADING/LOADING VEHICLES

   All Contractors are to call Wayne State University Public Safety at 577-2222, and give at least 24 hours advance notice that they have vehicles that must be at the job site.

   Vehicles will be permitted at the project site only as long as the vehicles are needed for loading/unloading, and must be immediately moved upon completion.

   All unauthorized and/or unattended standing vehicles will be subject to ticketing and removal by University Police. Towed vehicles may be reclaimed by calling 577-2222, and paying any assessed charges.

3. COMPLIMENTARY PARKING

   There is no complimentary parking for Contractor's employee vehicles.

4. WAYNE STATE UNIVERSITY PUBLIC/STUDENT PARKING AREAS

   Public Parking, on a first-come first-served basis is available. Contact the office of the One Card System, at 313.577.9513 for information on availability of parking on a contractual basis.

E. TOILET FACILITIES

   The Owner's designated existing toilet facilities may be used by workers on the project. Contractor shall maintain such facilities in a neat and sanitary condition.

F. TELEPHONE USE

   If required, the Contractor shall provide and pay for a temporary telephone within the building for his use and that of his subcontractors.

   No use of the Owner's telephone (except pay telephones) will be permitted.

G. ACCESS DEVICES

   The Contractor shall furnish and maintain temporary hoists, ladders, railings, scaffolds, runways, and the like as required for safe, normal access to the permanent construction until the permanent facilities are complete. Each trade shall furnish such additional means of access as may be required for the progress and completion of the work. Such temporary access devices shall meet all applicable local, state, and federal codes and regulations.

H. HEAT AND VENTILATION

   Provide cold weather protection and temporary heat and ventilation as required during construction to protect the work from freezing and frost damage.

   Provide adequate ventilation as required to maintain reasonable interior building air conditions and temperatures, to prevent accumulation of excess moisture, and to remove construction fumes.

   Tarpaulins and other materials used for temporary enclosures. Coverings and protection shall be flameproofed.

I. WATER SERVICE
Sources of water are available at the site. The Owner will pay for reasonable amounts of water used for construction purposes.

The Contractor shall provide, at the earliest possible date, temporary connections to the water supply sources and maintain adequate distribution for all construction requirements. The Contractor shall protect sources against damage.

Methods of conveying this water shall be approved by the Architect/Engineer and shall not interfere with the Owner's operations.

**J. ELECTRICAL SERVICES**

All charges for reasonable amounts of electrical power energy used for temporary lighting and power required for this work will be paid by the Owner.

The Contractor shall provide and maintain any temporary electrical lighting and power required for this work. At the completion of the work, all such temporary electrical facilities shall be removed and disposed of by the Contractor.

Temporary lighting and power shall comply with the regulations and requirements of the National Electrical Code.

**INSPECTIONS AND TESTS**

The Architect/Engineer shall at all times have access to the work wherever it is in preparation or in progress and the Contractor shall provide proper facilities for such access and for observation.

No failure of the Architect/Engineer, during the progress of the work, to discover or reject materials or work not in accordance with the Contract Specifications and Drawings shall be deemed an acceptance thereof nor a waiver of defects therein. Likewise, no acceptance or waiver shall be inferred or implied due to payments made to contractor or by partial or entire occupancy of the work, or installation of materials that are not strictly in accordance with the Contract Specifications and Drawings.

Where tests are specifically called for in the Specifications, the Owner shall pay all costs of such tests and engineering services unless otherwise stated in the contract.

Where tests are not specifically called for in the Specifications, but are required by the Architect/Engineer or Consultant, the Owner shall pay all costs of such tests and engineering services unless the tests reveal that the workmanship or materials used by the Contractor are not in conformity with the Drawings, Specifications, and/or approved shop drawings. In such event, the Contractor shall pay for the tests, shall remove all work and materials so failing to conform and replace with work and materials that are in full conformity.

**CLEAN-UP**

The Contractor shall at all times keep the Owner’s premises and the adjoining premises, driveways and streets clean of rubbish caused by the Contractor’s operations and at the completion of the work shall remove all the rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the contractor does not attend to such cleaning immediately upon request, the Architect/Engineer may cause such cleaning to be done by others and charge the cost of same to the Contractor.

The Contractor will be responsible for all damage from fire that originates in, or is propagated by, accumulations of rubbish or debris.

All rubbish and debris shall be disposed of off the Owner’s property in an approved sanitary landfill site. No open burning of debris or rubbish will be permitted. Job site shall be left neat and clean at the completion of each day’s operation.

**PROJECT CLOSE-OUT**

**A. RECORD DRAWINGS**

At beginning of job, provide one copy of Working Drawings, and record changes, between Working Drawings and "As Built", including changes made by Addenda, Change Orders, Shop Drawings, etc. These shall be kept up to date. Update to indicate make of all mechanical and electrical equipment and fixtures installed. Keep these Record Prints in good condition and available for inspection by the Architect/Engineer.
Upon completion of the job, turn over to the Architect/Engineer Record Prints of Working Drawings showing all job changes.

B. OPERATING AND MAINTENANCE DATA

Prepare and furnish to the Architect/Engineer three (3) bound copies of "Operating and Maintenance Manual" on all equipment installed under this Contract.

Manual shall include copies of all Manufacturers’ "Operating and Service Instructions", including Parts List, Control Diagrams, Description of Control Systems, Operating, Electrical Wiring, and any other information needed to understand, operate and maintain the equipment. The names and addresses of all subcontractors shall be included. These instructions shall be custom-prepared for this job -- catalog cuts will not be accepted. Equipment shall be cross-referenced to Section of Specifications and to location shown and scheduled on drawings.


C. FINAL INSPECTION

Secure final inspections from the State of Michigan as soon as the work is completed and immediately submit such Certificates to the Architect/Engineer.

D. GUARANTEES (See Sections 00510 and 01781)

Guarantees on material and labor from the General Contractor and his subcontractors shall be as required in Sections 00510 and 01781.

E. SWORN STATEMENT AND WAIVER OF LIENS (revised 4-11-2012)

Prior to final payment, the General Contractor shall provide a Contractor's Sworn Statement and Full Unconditional Waivers of Liens from all subcontractors for material and labor and from all suppliers who provide materials exceeding $1,000. Sworn Statements and signed waivers from all Subcontractors must accompany Pay Applications or they will be returned for such documentation prior to approval.

ASBESTOS HAZARD

A. The contractor shall not start any work in any area that has not been inspected for asbestos by the Owner's Industrial Hygiene Department, or a qualified representative of the Owner and approval is given for work to be done. If asbestos is found, safety measures as recommended by the Owner's Industrial Hygiene Department, or a qualified representative of the Owner, shall be completed, or approval given for work to be done before work is started. The contractor shall not perform any asbestos removal or containment work under the contract.

KEYS

A. The Owner shall provide the contractor keys on loan to have access to the various spaces in order to complete the contract. Contractor will sign for and be responsible for each key on loan, returnable to Owner upon completion of the contract. In case of any lost keys, the Owner will backcharge the contract $250.00 for each core change. In the event that a Contractor wants access to a secured area, he shall give the Owner a minimum 48-hour notice.
SUMMARY OF WORK

PROJECT: Elliman Fume Hood Relocation

WSU PROJECT NO.: 629-304592

PROJECT MANAGER: T. Allen Gigliotti

1. EXAMINATION

   The Contractor shall visit the site and become familiar with conditions under which he will be working. Also meet with the project manager and review site access, storage areas, etc.

2. Description of Work – Project includes Prepare one room on the Lower Lever of the Elliman Research Building for use of a fluoroscopy unit. Prepare a second room and relocate fume hoods from the 1st Floor to the Lower Level.

3. The building is located at

   Wayne State University
   421 E. Canfield
   Detroit, Michigan
Wayne State University
Elliman Research Building
RI Fume Hood Relocation

Owner
Wayne State University
Facilities Planning and Management
5454 Cass Avenue
Detroit, Michigan 48202

LAS Project # 10905-00
WSU Project # 629-304592

August 21, 2018
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  23 0500 - Common Work Results for HVAC  
  23 0593 - Testing, Adjusting, and Balancing  
  23 0911 - Laboratory Airflow Controls  
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WSU Project No. 629-304592

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END OF SECTION
SECTION 01 1000 - SUMMARY

PART 1  GENERAL

1.01 REMOVALS
   A. Owner will remove the following items before start of work:
      1. Laboratory Equipment.
      2. Furnishings.

1.02 OWNER OCCUPANCY
   A. Owner intends to continue to occupy adjacent portions of the existing building during the entire
      construction period.
   B. Owner intends to occupy the Project upon Substantial Completion.
   C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
   D. Schedule the Work to accommodate Owner occupancy.

1.03 CONTRACTOR USE OF SITE
   A. Construction Operations: Limited to areas noted on Drawings.
   B. Arrange use of site to allow:
      1. Owner occupancy.
   C. Provide access to and from site as required by law and by Owner.
   D. Do not obstruct roadways, sidewalks, or other public ways without permit.
   E. Utility Outages and Shutdown:
      1. Limit disruption of utility services to hours when the building is unoccupied and when
         approved by the Owner.
      2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers
         and fire alarm system, without notice to and approval from the Owner. Secure the
         approval of authorities having jurisdiction when required.
      3. Prevent accidental disruption of utility services to other facilities.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION - NOT USED

END OF SECTION
SECTION 01 2300 - ALTERNATES

PART 1 GENERAL

1.01 ACCEPTANCE OF ALTERNATIVES

A. Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternatives will be identified in the Owner-Contractor Agreement.

1.02 SCHEDULE OF ALTERNATIVES

A. Alternate No. 1 -- Removal of additional abandoned ductwork.
   1. Complete removal of 18x12 exhaust ductwork to be abandoned on basement level as indicated on Drawing MD103 and DEMOLITION KEY NOTE ‘G’.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION
SECTIONS 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.
B. Progress meetings.
C. Construction progress schedule.
D. Progress photographs.

1.02 SUBMITTALS

A. Construction progress schedule.

1.03 ELECTRONIC DELIVERY OF PROJECT CORRESPONDENCE

A. Where electronic delivery of documents is required or permitted, deliver electronic documents to the Architect via "NewForma Info Exchange" provided by the Architect at no cost to the Contractor.

B. Where pdf format is required, create pdf documents using standard text/graphic conversion software such as Adobe or Bluebeam and employ bookmarks throughout the document for ease of navigation; manually scanned documents are not acceptable.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Contractor shall schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor’s Superintendent.

C. Agenda:
      a. Bonds, insurance certificates, and other preliminary contract compliance submittals.
      b. Notice to proceed.
      c. Schedule of values.
      d. Construction progress schedule.
      e. Submittal schedule.
      f. List of subcontractors.
      g. List of products.
      h. Posted construction documents (including addenda).
      i. Mobilization.
      j. Use of premises by Owner.

   2. Project Correspondence.
      a. Meeting notes.
      b. Architect’s Field Reports.
      c. Requests for Information.
      d. Submittals (product data, shop drawings, test reports, etc.).
      e. Product substitutions.
f. Procedures for processing of ASI, PR, CCD, Bulletins, CO.
g. Substantiation of proposed cost of contract modifications and substitution requests.
h. Applications for Payment.

3. Site.
a. Temporary Utilities.
b. Temporary facilities and services.
c. Staging/storage.
d. Contractor parking.
e. Owner Requirements (Badging, Housekeeping).
f. Testing Procedures.
g. Severe Weather Rules.
h. Security and housekeeping.
i. Waste removal and disposal.

4. Post Construction.
a. Owner’s requirements and occupancy prior to completion.
b. Project close out procedures.
c. Start-up, training, and O&M manuals.
d. Inspection and acceptance of equipment put into service during construction period.
e. Maintaining record documents.
f. Releases (surety, waivers, etc.).
g. Reducing retainage.
h. Inspection for Substantial Completion, Date of Substantial Completion, Final Completion, Final Payment.
i. 12-Month Warranty Review.

D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Progress meetings will be held at weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Change Order Log.
      a. Effect of proposed changes on progress schedule and coordination.
   3. Condemnation Log.
      a. Field observations, problems, and decisions.
   5. Review of Work progress.
   6. RFI Log.
   8. Review construction progress schedule.
      a. Planned progress during succeeding work period.
      b. Review of off-site fabrication and delivery schedules.
      c. Time Extension Requests (if any).
d. Corrective measures to regain projected schedules.

9. Payment or Claim Issues.
10. Subcontractor Issues.
11. Contractor Application for Payment.
12. Identification of problems which impede planned progress.
13. Other issues Affecting the Work.
   a. Owner-Provided items (FFE); especially submittal or coordination data.
14. Scheduled pre-installation meetings.
15. Scheduled mock-ups.
16. Scheduled tests.
17. Any other items for discussion.
18. Is the Contractor being delayed because of any action or non-action by the Architect or Owner.
19. Next Meeting Date.
20. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE
A. Within 10 days after date of the Agreement, submit preliminary schedule.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 15 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
D. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS
A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
B. Photography Type: Digital; electronic files.
C. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

3.05 REQUESTS FOR INFORMATION (RFI)
A. When additional information concerning the Contract Documents is desired, the Contractor shall make a request to the Architect in the form of an RFI and shall include a detailed written statement that indicates the specific Drawing number or Specification paragraph number in need of clarification and the nature of the clarification requested.
B. The Architect will review and respond to requests for information about the Contract Documents. The Architect’s response to such requests will be made in writing within any time limits agreed to by the Architect or, in the absence of agreement, with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

3.06 FOR REQUESTS FOR SUBSTITUTION, SEE:
A. Invitation to Bid.
B. General Conditions of the Contract for Construction.
C. Section 01 6201 - Pre-Bid Substitution Request.
D. Section 01 6202 - Post-Bid Substitution Request.
3.07 FOR SUBMITTAL PROCEDUREs, SEE:
   A. Section 01 3300 - Submittals.

   END OF SECTION
SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1  GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for submittals for review, information, and project closeout.
B. Timing and packaging of submittals.
C. Delivery of submittals.

1.02 SUBMITTALS

A. List of proposed major products.

1.03 ELECTRONIC DELIVERY OF PROJECT CORRESPONDENCE

A. Where electronic delivery of documents is required or permitted, deliver electronic documents to the Architect via "NewForma Info Exchange" provided by the Architect at no cost to the Contractor.
B. Where pdf format is required, create pdf documents using standard text/graphic conversion software such as Adobe or Bluebeam and employ bookmarks throughout the document for ease of navigation; manually scanned documents are not acceptable.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION

3.01 SUBMITTALS FOR REVIEW

A. Product Data Submittals: Submit manufacturer's standard published data necessary to demonstrate compliance with specified requirements. Mark each copy to identify applicable products, models, options, and other data. If necessary, supplement manufacturer's standard data with information specific to this Project.
B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
D. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
   5. Other types indicated in respective specification sections.
E. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents. Architect's review is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.
F. Contractor is responsible for determining and verifying materials, field measurements and field construction criteria related thereto, and checking and coordinating the information contained within the submittal with the requirements of the Work and of the Contract Documents.

G. Samples will be reviewed only for aesthetic attributes such as color and texture.

3.02 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated in respective specification sections.

B. Submit for Architect's delivery to Owner.

C. Action taken by the Architect (whether "approval" or other action) indicates only that the item has been received in the form required by the contract documents and that the Architect will transmit the item to the Owner for the Owner's records, but does not indicate that the Architect has verified the accuracy or adequacy of the contents of the submittal.

3.03 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

C. Action taken by the Architect (whether "approval" or other action) indicates only that the item has been received in the form required by the contract documents and that the Architect will transmit the item to the Owner for the Owner's records, but does not indicate that the Architect has verified the accuracy or adequacy of the contents of the submittal.

3.04 TIMING AND PACKAGING OF SUBMITTALS

A. Submit complete, coordinated data. Partial submittals are not acceptable unless specifically exempted. For complex assemblies comprising components from two or more Specifications Sections, submit data for all components of the assembly as a single, coordinated package.

B. Initial Product Information: Submit the initial product information listed below for each Section of the Specifications as a single package.
   1. Product data.
   2. Samples.
   3. Installer and manufacturer qualifications.
   4. Manufacturer's instructions.
   5. Certificates, test reports, and inspection reports of standard plant runs that demonstrate compliance of proposed products with specified quality.
   6. Similar submittals demonstrating quality of proposed products.

C. Shop Drawings and Design Data:
1. Submit Shop Drawings and Design Data for each Section of the Specifications as a single package.
   a. Exception: When approved by the Architect especially large quantities of drawings on large projects may be divided into individual submissions, such as package 1, 2, 3, etc.

2. Submit the following prior to placing final order for fabrication:
   a. Detailed drawings prepared specifically for the project, for example drawings of concrete reinforcing, structural steel, curtain wall, equipment, doors, frames.
   b. Calculations or other designs prepared specifically for the project.

D. In-Progress Reports: Multiple submittals permitted. Submit the following in a timely manner as the work progresses.
1. Certificates, test reports, and inspection reports of actual plant runs for this project (where required) or of tests and inspections made at the project site (earthwork, concrete, steel, etc.).
2. Similar submittals recording actual quality installed on-site.

E. Closeout Submittals: Submit the following for each Section of the Specifications as a single package:
1. Final certificates, test reports, and inspection reports of completed work.
2. Project record documents.
3. Operation and maintenance data.
4. Warranties and bonds.
5. Similar submittals attesting to completed work.

3.05 DELIVERY OF SUBMITTALS
A. Initial Product Information, Shop Drawings, Design Data, and In-Progress Reports:
1. Deliver documents electronically in pdf format.
2. Small Size Documents:
   a. Sheet size either 8-1/2 x 11 or 11 x 17 inches; do not submit 8-1/2 x 14.
3. Documents Larger than 11 x 17 Inches:
   a. Sheet size as necessary.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect. If not specified in individual specification sections, submit two.
1. Retained samples will not be returned to Contractor unless specifically so stated.

C. Documents for Information:
1. Deliver documents electronically in pdf format.

D. Documents for Project Closeout:
1. Warranties, Bonds, and Executed Forms: Submit original (paper) executed documents plus two photocopies.
2. Testing, Balancing, Start-Up, and Operations and Maintenance Manuals:
   a. Submit number of paper copies as specified in respective specification sections. If quantity is not so indicated, submit two copies.
   b. Submit two copies of CD or DVD-ROM format disks containing pdf files that are indexed and organized by specification section.

E. Submittal Procedures:
1. Transmit each submittal with approved form.
2. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
3. Identify Project, Contractor, Subcontractor or supplier. Identify Specification Section number and pertinent drawing and detail number.

4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

5. Text of the Contractor's stamp shall not be effective to limit or reduce the Contractor's responsibilities for review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information in accordance with the requirements of the Work and Contract Documents.

6. Schedule submittals to expedite the Project, and coordinate submission of related items.

7. Schedule submittals for orderly review by the Architect. For each submittal for review, allow 15 days plus delivery time to and from the Contractor, unless Architect notifies Contractor that additional time is necessary for review on account of Contractor's scheduling of simultaneous submittals.

8. Identify variations from the Contract Documents.

9. Identify product or system limitations that in Contractor's view may be detrimental to successful performance of the completed Work.

10. When revised for resubmission, identify all changes made since previous submission.

11. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

12. Submittals not requested will not be processed.

3.06 FOR REQUESTS FOR SUBSTITUTION, SEE:
A. Invitation to Bid.
B. General Conditions of the Contract for Construction.
C. Section 01 6201 - Pre-Bid Substitution Request.
D. Section 01 6202 - Post-Bid Substitution Request.

END OF SECTION
SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.
B. Mock-ups.
C. Control of installation.
D. Tolerances.
E. Testing and inspection services.
F. Manufacturer's field services.

1.02 SUBMITTALS

A. Testing Agency Qualifications:
   1. Prior to start of Work, submit agency name, address, and telephone number, and names of
      full time registered engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction
      Materials Reference Laboratory during most recent inspection, with memorandum of
      remedies of any deficiencies reported by the inspection.

B. Test Reports:  After each test/inspection, promptly submit report directly to Architect and to
   Contractor.  Include:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.
   6. Location in the Project.
   7. Type of test/inspection.
   8. Date of test/inspection.
   9. Results of test/inspection.
  11. When requested by Architect, provide interpretation of results.

C. Manufacturer's Field Reports:  Submit reports for Architect's information and benefit as
   contract administrator.
   1. Submit reports within 7 days of observation to Architect.

1.03 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included
   in the Project Manual, also referred to as reference standards, comply with requirements of the
   standard, except when more rigid requirements are specified or are required by applicable
   codes.

B. Conform to reference standard of date of issue specified in individual specification sections or,
   if none, the date current on the date of issue of the Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification
   from Architect before proceeding.

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor
   those of Architect shall be altered from the Contract Documents by mention or inference
   otherwise in any reference document.
1.04 TESTING AND INSPECTION AGENCIES

A. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

B. Contractor Employed Agency:
   2. Maintain a full time registered engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Testing may be performed under provisions identified in the respective product specification sections and as otherwise directed by the Architect.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Approved mock-ups (in conjunction with the other requirements of the Contract Documents) shall be a standard of quality for judging the Work.

D. If mock-up is specified to be removed, remove and dispose of the mock-up only after mock-up has been approved by Architect and when directed to do so.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.
3.04 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Provide reasonable notice to Architect and laboratory of expected time for operations requiring testing/inspection services to permit Architect and testing laboratory to schedule their activities.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections or when requested by the Architect, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, and testing, adjusting, and balancing of equipment, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION
SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

A. PART 1  GENERAL

1.01 SECTION INCLUDES
A. Temporary utilities.
B. Temporary sanitary facilities.
C. Temporary vehicular access and parking.
D. Project waste removal.

1.02 TEMPORARY UTILITIES
A. Provide all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
B. Existing facilities may be used.

1.03 TEMPORARY SANITARY FACILITIES
A. Provide and maintain temporary toilets. Provide at time of project mobilization.
B. Use of existing facilities located at ________ is permitted.
C. Maintain daily in clean and sanitary condition.
D. At end of construction, return facilities to same or better condition as originally found.

1.04 BARRIERS
A. Provide barriers to prevent unauthorized entry to construction areas, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
C. Protect the vehicles of others, stored materials, site, and structures from damage.

1.05 FENCING
A. Construction: Commercial grade chain link fence.

1.06 VEHICULAR ACCESS AND PARKING
A. Coordinate access and haul routes with governing authorities and Owner.
B. Provide and maintain access to fire hydrants, free of obstructions.
C. Provide means of removing mud from vehicle wheels before entering streets.
D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.07 WASTE REMOVAL
A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.08 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED

END OF SECTION
SECTION 01 6201 - PRE-BID SUBSTITUTION REQUEST

TO: LORD, AECK & SARGENT, INC.,
213 S. Ashley Street, Suite 200, Ann Arbor, MI 48104

Substitution of the following is hereby requested in accordance with the Instructions to Bidders and the General Conditions of the contract.

SPECIFIED PRODUCT:

SECTION NO.: PAGE NO.: PARA. NO.: 

REASON FOR REQUESTING SUBSTITUTION; CHECK ONE OR MORE:

[ ] Contractor cannot provide the specified product, assembly, or method of construction within the Contract Time;

[ ] The request directly relates to an “or-equal” clause or similar language in the Contract Documents;

[ ] The request directly relates to a “product design standard” or “performance standard” clause in the Contract Documents;

[ ] The requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations after deducting additional responsibilities Owner must assume;

[ ] The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and Owner can approve the requested substitution;

[ ] Contractor cannot provide the specified product, assembly, or method of construction in a manner that is compatible with other materials and Contractor certifies that the substitution will overcome the incompatibility;

[ ] Contractor cannot coordinate the specified product, assembly, or method of construction with other materials and Contractor certifies they can coordinate the proposed substitution; or

[ ] The specified product, assembly, or method of construction cannot provide a warranty required by the Contract Documents and Contractor certifies that the proposed substitution provides the required warranty.

[ ] Other (explain):

PROPOSED PRODUCT INFORMATION:

Manufacturer:
Address:
Product trade name, model number, other characteristics:

Name of fabricator or supplier:
Address:

LAS 10905-00 August 21, 2018
CHECK ONE:

[ ] The proposed product complies with the contract documents in every respect except for the specified manufacturer name or brand name or model number.

[ ] The proposed product material complies with the contract documents in every respect except for deviations which are as follows:

CHECK ONE:

[ ] No changes are required in other work or products if the substitute product is approved.

[ ] Changes will be required in other work or products if the substitute product is approved, as follows:

MAINTENANCE SERVICES AND REPLACEMENT MATERIAL AVAILABILITY (IF APPLICABLE):

CONTRACTOR'S CERTIFICATION

To the Owner, to the Architect, to other bidders and sub-bidders (of any tier), and to the Contractor(s) and subcontractors and suppliers (of any tier) to whom contracts are eventually awarded in connection with the project, the undersigned warrants that the undersigned:

- has examined the bidding documents for the project,
- has investigated the proposed product and has found it to be equal or superior in all significant respects to the specified product,
- will provide the same warranty for the proposed product as for the specified product,
- will coordinate the installation and make other changes which may be required for the work to be complete in all respects, including, redesign, additional components, and additional capacity required by other work affected by the change, and
- waives all claims for additional costs and time extensions which subsequently may be come apparent and which are caused by the change.

ENCLOSURES:

Complete product data, as specified in the Contract Documents, is enclosed with this request.

Other enclosures:
THIS REQUEST IS SUBMITTED IN THE NAME OF:

Company name: 
Address: 
Telephone: 
By: 

Authorized Signature: 
Date: 
Typed Name: 
Title: 

END OF SECTION
LAS 10905-00 August 21, 2018
SECTION 01 6202 - POST-BID SUBSTITUTION REQUEST

TO: LORD, AECK & SARGENT, INC.,
    213 S. Ashley Street, Suite 200, Ann Arbor, MI 48104

Substitution of the following is hereby requested in accordance with the Instructions to Bidders and the General Conditions of the contract.

SPECIFIED PRODUCT:

SECTION NO.: PAGE NO.: PARA. NO.: 

REASON FOR REQUESTING SUBSTITUTION; CHECK ONE OR MORE:

[ ] Contractor cannot provide the specified product, assembly, or method of construction within the Contract Time;
[ ] The request directly relates to an “or-equal” clause or similar language in the Contract Documents;
[ ] The request directly relates to a “product design standard” or “performance standard” clause in the Contract Documents;
[ ] The requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume;
[ ] The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and Owner can approve the requested substitution;
[ ] Contractor cannot provide the specified product, assembly, or method of construction in a manner that is compatible with other materials and Contractor certifies that the substitution will overcome the incompatibility;
[ ] Contractor cannot coordinate the specified product, assembly, or method of construction with other materials and Contractor certifies they can coordinate the proposed substitution; or
[ ] The specified product, assembly, or method of construction cannot provide a warranty required by the Contract Documents and Contractor certifies that the proposed substitution provides the required warranty.
[ ] Other (explain):

PROPOSED PRODUCT INFORMATION:

Manufacturer:
Address:
Product trade name, model number, other characteristics:
Name of fabricator or supplier:
Address:

LAS 10905-00 August 21, 2018
CHECK ONE:

[ ] The proposed product complies with the contract documents in every respect except for the specified manufacturer name or brand name or model number.
[ ] The proposed product material complies with the contract documents in every respect except for deviations which are as follows:

CHECK ONE:

[ ] No changes are required in other work or products if the substitute product is approved.
[ ] Changes will be required in other work or products, if the substitute product is approved, as follows:

MAINTENANCE SERVICES AND REPLACEMENT MATERIAL AVAILABILITY (IF APPLICABLE):

CHECK ONE:

[ ] No change in the Contract Sum is proposed.
[ ] Modification of the Contract Sum by adding $ is hereby requested.
[ ] Modification of the Contract Sum by subtracting $ is hereby requested.

CHECK ONE:

[ ] No change in the Contract Time is proposed.
[ ] Modification of the Contract Time by adding calendar days is hereby requested.
[ ] Modification of the Contract Time by subtracting calendar days is hereby requested.

CONTRACTOR’S CERTIFICATION:

To the Owner, to the Architect, and to other contractors and their subcontractors (if any), the undersigned warrants that the undersigned:

- has examined the Contract Documents for the project,
- has investigated the proposed product and has found it to be equal or superior in all significant respects to the specified product,
- will provide the same warranty for the proposed product as for the specified product,
- will coordinate the installation and make other changes which may be required for the work to be complete in all respects, including, redesign, additional components, and additional capacity required by other work affected by the change, and
- waives all claims for additional costs and time extensions which subsequently may become apparent and which are caused by the change.
- Will reimburse Owner for review or redesign services, when request is made after the award of contract.

ENCLOSURES:

The following complete information is enclosed for evaluation:
1. Product data on the proposed substitution.
2. Detailed cost breakdown itemizing each of the following:
   a. Quantities of materials and the cost thereof.
   b. Shipping to the site.
   c. Manhours of labor and hourly cost including payroll taxes, insurance, and benefits for each skill or labor classification.
   d. Quantities and costs of equipment, tools, and other material not incorporated into the work.
   e. Overhead and profit.
   f. Credit for deletions from Contract, similarly documented.
4. Other information requested by the Architect.

Other enclosures:

THIS REQUEST IS SUBMITTED IN THE NAME OF:

Company name:
Address:
Telephone:

BY:

Authorized Signature:
Date:
Typed Name:
Title:

END OF SECTION
SECTION 01 7000 - EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Pre-installation meetings.
D. Cutting and patching.
E. Cleaning and protection.
F. Starting of systems and equipment.
G. Demonstration and instruction of Owner personnel.

1.02 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
C. Rodent and Pest Control: Provide methods, means, and facilities to prevent rodents and pests and insects from accessing or invading premises.
D. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.03 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
B. Notify affected utility companies and comply with their requirements.
C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
D. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
E. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
F. Coordinate completion and clean-up of work of separate sections.
G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. Notify Architect sufficiently in advance of meeting date to allow for coordination with Architect's schedule.

B. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

C. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are not record documents or precise surveys of actual conditions.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Separate areas in which alterations are being conducted from other areas that are still occupied; provide, erect, and maintain temporary dustproof partitions of construction.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

G. Adapt existing work to fit new work.

H. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
I. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

J. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

K. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
   3. Patch as specified for patching new work.

L. Clean existing systems and equipment.

M. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

N. Do not begin new construction in alterations areas before demolition is complete.

3.06 CUTTING AND PATCHING

A. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

C. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

E. Restore work with new products in accordance with requirements of Contract Documents.

F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

I. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

J. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate to Owner's personnel the start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season near the onset of the other season.

C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.
3.12 FINAL CLEANING

A. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces, dust and mop hard flooring.
D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
E. Clean permanent washable filters and replace disposable filters of operating equipment.
F. Clean debris from roofs, gutters, downspouts, and drainage systems.
G. Clean site; sweep paved areas, rake clean landscaped surfaces.
H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

END OF SECTION
SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Project Record Documents.
   B. Operation and Maintenance Data.
   C. Warranties and bonds.

1.02 SUBMITTALS
   A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
   B. Operation and Maintenance Data:
      1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
      2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
      3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
      4. Submit two sets of revised final documents in final form within 10 days after final inspection.
   C. Warranties and Bonds:
      1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
      2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
      3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS
   A. Maintain on site one set of the following record documents; record actual revisions to the Work:
      1. Drawings.
      2. Specifications.
      3. Addenda.
      4. Change Orders and other modifications to the Contract.
      5. Reviewed shop drawings, product data, and samples.
   B. Ensure entries are complete and accurate, enabling future reference by Owner.
   C. Store record documents separate from documents used for construction.
   D. Record information concurrent with construction progress.
   E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
      1. Changes made by Addenda and modifications.
F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA
A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS
A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.04 WARRANTIES AND BONDS
A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
B. Verify that documents are in proper form, contain full information, and are notarized.
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.

END OF SECTION
SECTION 02 4100 - DEMOLITION

PART 3 EXECUTION

1.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
   6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

1.02 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. See Section 01 1000 for other limitations on outages and required notifications.
4. Verify that abandoned services serve only abandoned facilities before removal.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

1.03 DEBRIS AND WASTE REMOVAL
A. Remove debris, junk, and trash from site.
B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.
C. Leave site in clean condition, ready for subsequent work.
D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION
SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud interior wall framing.
B. Formed steel joist and purlin framing and bridging.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.
B. Section 07 9200 - Joint Sealants.
C. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system 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.
B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
B. Design Requirements: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
   2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   3. Design Loads: As follows:
      a. Lab 0133 Ceiling:
         1) Live load of positive or negative 9.5 psf, uniformly distributed.
2) Dead load: Wallboard, framing, lighting fixtures, and any other items supported by ceiling framing.

4. Live load deflection meeting the following, unless otherwise indicated:

5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.02 FRAMING MATERIALS
   A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.

2.03 WALL SHEATHING
   A. Gypsum Board Wall Sheathing: See Section 09 2116.

PART 3 EXECUTION

3.01 INSTALLATION OF STUDS
   A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

3.02 INSTALLATION OF JOISTS AND PURLINS
   A. Install framing components in accordance with manufacturer's instructions.
   B. Make provisions for erection stresses. Provide temporary alignment and bracing.
   C. Place joists at 12 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.
   D. Set ceiling joists parallel and level, with lateral bracing and bridging.

END OF SECTION
SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCES

B. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.
C. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; 2002.
E. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.03 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials.

1.04 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
   1. Acceptable Lumber Inspection Agencies: Any agency with rules approved by American Lumber Standards Committee.
   2. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
   3. Grade Stamps for Concealed Lumber: Each piece of lumber, applied by inspection agency and showing compliance with each specified requirement.
B. Marking of Treated Wood: Each piece of lumber or plywood, applied by inspection agency, and showing compliance with specified standards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect wood products against moisture and dimensional changes. Support stacks at several uniformly spaced points to prevent deformation. Store stacks raised above ground. Cover to protect from rain and snow. Select and arrange cover to allow air circulation under and all around stacks to prevent condensation. Maintain and restore displaced coverings. Remove from the site any wood products that have been subjected to moisture or that do not comply with the specified moisture requirements.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01 6000 - Product Requirements.

2.02 DIMENSION LUMBER

A. Size: Provide nominal sizes indicated, complying with PS 20 except where actual sizes are specifically required.
B. Miscellaneous Lumber: Provide dimension lumber and boards necessary for the support of work specified in other sections, whether or not specifically indicated, and including but not limited to blocking, nailers, etc.
   1. Moisture content: 15 percent maximum (kiln-dry).
   2. Lumber: S4S, No. 2 or standard grade.
3. Boards: Construction, 2 common, or No. 2 grade.

2.03 FASTENERS

A. Material:
   1. Interior untreated wood: Steel.
   2. Provide ASTM A 153 hot-dip dipped galvanized steel fasteners for the following:
      a. Interior fire-retardant treated wood.
      b. Coated or electro-plated fasteners are not acceptable.
   3. Provide Type 304 stainless steel fasteners.
      a. Exterior fire-retardant treated wood.
   4. In contact with copper: Provide silicone bronze or copper material as specified in respective specification section.

B. Provide fasteners as required by applicable codes and as specified in this section unless other types and spacings are indicated for specific uses.

2.04 WOOD TREATMENT

A. Treat all lumber and all construction panels used in building construction unless untreated material is explicitly specified by the use of the words "fire retardant or preservative treatment is not required" or similar language.
   1. Except where required to be untreated, all lumber and all construction panels used in building construction shall be fire retardant treated, except pressure preservative treated lumber and construction panels are not required to be fire retardant treated.
   2. Furniture, furnishings, finish carpentry, and architectural woodwork is not specified in this section and is subject to treatment requirements, if any, specified in the respective specification sections.

B. Fire Retardant Treatment:
   2. Fire retardant treated plywood: AWPA C27.
   3. Provide product with factory-applied colored dye to readily identify the material on site.
   4. Interior Type A, Low Hygroscopic, and meeting AWPA Standard U1 Commodity Specifications A (lumber) and F (plywood) for preservative qualities in above-ground, weather-protected locations. “Dricon Fire-Retardant Treated Wood”. Treat lumber and panels used for the following:
      a. Interior uses.
      b. Exterior walls (protected from direct weather exposure by other materials).
   5. Exterior Type: "FRX Fire-Retardant-Treated Wood". Treat lumber and panels used for the following:
      a. Wherever direct exposure to wetting will occur.

PART 3 EXECUTION

3.01 INSTALLATION

A. Arrange work to use full length pieces except where lengths would exceed commercially available lengths. Discard pieces with defects that would lower the required strength or appearance of the work.

B. Cut and fit members accurately. Install plumb and true to line and level.

C. Fasten carpentry in accordance with applicable codes and recognized standards.

D. Where exposed, countersink nails and fill flush with suitable wood filler.
E. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.02 MISCELLANEOUS CARPENTRY

A. Provide miscellaneous blocking, nailers, grounds, furring, and framing as shown and as required for support of facing materials, fixtures, specialty items, and trim. Cut and shape to the required size.

1. Provide dimension lumber and boards necessary for the support of work specified in other sections or required for the support of work of other contracts, whether or not specifically indicated, and including but not limited to blocking, nailers, etc.

2. Do not space blocking or nailers; install continuous lengths with butt joints not exceeding 1/8-inch per 8 foot.

END OF SECTION
SECTION 07 5010 - CUTTING AND PATCHING OF EXISTING ROOF COVERING

PART 1  GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Modification of existing roof coverings.
   2. Patching of penetrations in roof coverings after removal of existing items.
   4. Patching and repair of existing roof coverings.

1.02 PERFORMANCE REQUIREMENTS

A. Factory Mutual System Classification: Comply with FM Global requirements for modifications to the roofing assembly.

1.03 SUBMITTALS

A. Product Data: Submit technical product information, installation instructions, and recommendations for each type of roofing material. Furnish additional information as necessary to demonstrate products comply with project criteria.

1.04 PRODUCT HANDLING

A. Deliver materials to project site in manufacturer's unopened, sealed containers or packages, with manufacturer's labels intact.

B. Store materials in weather-protected environment, clear of ground and moisture, in strict accordance with manufacturer’s and NRCA recommendations.

PART 2  PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01 6000 - Product Requirements.

2.02 ASSEMBLIES AND DETAILS

A. For cutting and patching back, employ only materials, assemblies, and details that would qualify for manufacturer's 20-year NDL warranty for new work. Where a manufacturer's warranty is currently in force for the existing roof, provide notice to manufacturer and maintain existing warranty in force.

B. Where a manufacturer's warranty is not currently in force, this specification does not require that a manufacturer's warranty be provided.

2.03 INSULATION

A. Roof Insulation: Match existing insulation type, number of layers, and thickness.

B. Crickets, Saddles, and Tapered Edge Strips: Tapered insulation.

C. Cants:
   1. Against wood curbs or parapets: Pressure preservative treated wood.
   2. Elsewhere: Tapered insulation.

PART 3  EXECUTION

3.01 EXISTING CONDITIONS

A. Correct substrates that are unacceptable to the installer or the roof membrane manufacturer before starting roofing application.
3.02 GENERAL
   A. No roofing operations shall occur without the presence of the installer’s supervisor on site, whether:
      1. Demolition.
      2. Installation of insulation and roof covering.
      3. Installation of base flashings.
      4. Installation of wood nailers and blocking specified elsewhere.
      5. Installation of sheet metal flashings specified elsewhere.

3.03 SUBSTRATE PREPARATION
   A. General: Remove trash, debris, grease, oil, water, and contaminants from surface.
   B. Removal Of Existing Roofing: Remove existing roofing, insulation, blocking, etc., as indicated and as necessary to accommodate project requirements.
   C. Penetrations: Ensure that roof curbs, equipment supports, columns, posts, piping, etc., which will penetrate roof are installed in correct locations, and permanently secured.

3.04 VAPOR BARRIER AND INSULATION
   A. Vapor Barrier: Preserve, repair, and restore vapor barrier where encountered prior to installing insulation.
   B. Insulation:
      1. Install insulation of total thickness to match existing insulation and to fill voids around penetrations and where patching occurs.
      2. Butt insulation units tightly together and trim to fit penetrations and interruptions so that gaps between units and between insulation and adjacent construction do not exceed 1/4 inch.
      3. Provide preformed units at drains to ensure positive drainage.
      4. Provide crickets on high side of roof curbs and other obstructions.
      5. Provide crickets, saddles, and tapered areas where necessary to conform to deck, penetrations, and existing irregularities and to avoid localized areas of ponding.
   C. Installation of Roofing Sheets:
      1. Follow manufacturer's recommendations for installation to ensure proper installation of sheet without irregularities such as fishmouths or wrinkles.
      2. Place and press sheets during installation to ensure proper adhesion to substrate and adjacent roofing sheet.
      3. Comply with manufacturer's recommendations to ensure that joints are solidly adhered and weather-tight.

END OF SECTION
SECTION 07 7210 - ROOF PENETRATION ACCESSORIES

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Manufactured curbs.

1.02 REFERENCES
F. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; 2003.

1.03 SUBMITTALS
A. Product Data:
   1. Provide manufacturer's specifications, standard details, and installation recommendations.
   2. Indicate size and spacing of fasteners.
B. Design Data: Submit schedule indicating each piece of equipment, weight of equipment, and capacity of curb or equipment support.

PART 2  PRODUCTS

2.01 SUBSTITUTIONS
A. Refer to Section 01 6000 - Product Requirements.

2.02 MATERIALS
A. Steel Sheet for Curbs: Galvanized Steel Sheet: ASTM A 653/A 653M, minimum G90 coating.
B. Steel for Structural Supports and Reinforcements: ASTM A 36, hot-dip galvanized after fabrication in accordance with ASTM A 123.
C. Flashings, Counterflashings, and Receivers: Stainless Steel Sheet: ASTM A 167, Type 302 or 304. 28 gage (0.0156 inch; 0.4 mm).
D. Fasteners:
   1. For attachment of roof accessories to supporting structure: Hot-dip galvanized, zinc plated or cadmium plated steel, or stainless steel.
   2. Concealed fasteners for flashings and receivers: Hot-dip galvanized steel or stainless steel.

E. Hot-Dip Galvanizing for fabricated products and hardware: ASTM A 123.

F. Solder: ASTM B 32, 50/50 tin-lead, rosin flux unless recommended otherwise by sheet metal manufacturer.

G. Pourable Sealer: 2-part pourable urethane sealant.

H. Bituminous Coating: Asphaltic mastic ASTM D4479, Type I.

I. Insulation: Mineral (Rock or Slag) Fiber Insulation Board; ASTM C 612; composed of thermosetting resin binders and semirefractory mineral fibers derived from slag.

2.03 MANUFACTURED CURBS

A. General: Provide curbs and supports for mechanical equipment and appurtenances.

1. Fabricate from galvanized steel sheet, minimum 18 gage, with seams fully welded, ground smooth, and painted with zinc-rich primer.

2. Engineer units to support superimposed gravity and wind uplift loads.


4. Slope bottom edges to match slope of roof deck so that top is level when installed.

5. Height of curb to extend not less than 10 inches (254 mm) above roof membrane surface.

6. Nailers: Provide 4 inch (102 mm) high nailers on top of curb units, fabricated from softwood lumber preservative-treated by the pressure process in accordance with AWPA C-2.

7. Factory-install insulation, minimum 1-1/2 inches thick, on interior of curb; provide galvanized sheet steel liner on inside face of insulation.

8. Flashing:
   a. Install flashing receiver and counterflashing as indicated in NRCA Detail MB-14/14S.
   b. Flashing Material: Stainless steel.

B. Curbs Around Air Handling Units, Exhaust Fans, and Similar Units:

1. Provide 4 inch (102 mm) high wood nailer and polyisobutylene seal strip as indicated in NRCA Detail MB-14/14S. Acceptable products:
   c. Curb manufacturer’s standard polyisobutylene seal tape.

2.04 OTHER PENETRATIONS AND CONDITIONS

A. At conditions not scheduled or otherwise indicated, provide roofing membrane manufacturer's standard prefabricated thermoplastic or elastomeric boot or liquid flashing or provide curbs and flashings in accordance with SMACNA standard details and recommendations, and fabricated of the materials specified herein.

2.05 SCHEDULE OF VERTICAL CLEARANCES

A. Fabricate equipment supports and pipe supports to provide not less than the following distances. W=width of equipment. H=height measured from roof membrane surface to underside of equipment.

1. W less than 25 inches (620 mm): H=14 inches (356 mm).
2. W 25 inches (620 mm) to less than 37 inches (940 mm): H=18 inches (457 mm).
3. W 37 (940 mm) to less than 49 inches (1245 mm): H=24 inches (610 mm).
4. W 49 inches (1245 mm) or greater: H=48 inches (1219 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and openings are rigidly set, at proper lines and elevation, properly sized, and ready to receive units.

B. Do not proceed with installation until conditions detrimental to proper installation have been corrected.

C. Coordinate installation with roofing work and other adjacent elements of building envelope to ensure watertight construction.

3.02 DISTANCE BETWEEN PENETRATIONS

A. Coordinate and layout mechanical, electrical, and structural work to provide clearance between penetrations as follows:

1. Distance between curb and adjacent curb: Not less than 20 inches (508 mm).
2. Distance between curb and adjacent wall or equipment extending more than 36 inches (914 mm) above roof: Not less than 36 inches (914 mm).
3. Distance between stripped-in roof jacks and adjacent curbs, parapets, or walls: Not less than 18 inches (457 mm).
4. Distance between stripped-in jacks: Not less than 12 inches (305 mm).

B. If the Contract Documents appear to indicate clearances less than above, obtain instructions from the Architect before proceeding with layout and coordination. Do not construct clearances less than above without the approval of the Architect. If clearances less than above have been constructed without the express approval of the Architect, reconstruct clearances without change in Contract Time or Price.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Install products in correct location, plumb and true, without warp or twist.

C. Secure curbs and equipment supports to structure, and equipment to curbs, in accordance with manufacturer's instructions to prevent wind uplift forces specified. Do not install curbs or equipment supports on top of roofing insulation or nailers unless specifically approved.

D. Isolate dissimilar metals by means of a heavy bituminous coating, approved paint coating, adhered polyethylene sheet, or other means approved by the Architect.

3.04 SEALING OF ENVELOPE

A. General: Install sealant to form a water-tight and air-tight seal between penetrating elements and building envelope.

B. Where roof deck is indicated to be a fire-resistance-rated assembly, install firestopping between penetrating elements and deck. Firestopping is specified elsewhere in Division 7.

C. Where roof deck is not indicated to be a fire resistance rated assembly:

1. Fill void between penetration and deck with mineral wool insulation and install pourable sealant to seal between penetrating element and deck.
2. Where curbs are not used, install pourable sealant up to top of sheet metal flashing.
3. Exception: Where prohibited by flue or stack clearance requirements.
3.05 CLEANING AND PROTECTION
   A. Touch up marred or abraded areas of finished elements. If satisfactory touch-up cannot be accomplished, remove and replace element.

3.06 SMACNA FIGURES
   A. See the SMACNA "Architectural Sheet Metal Manual" for additional material, fabrication, and joining requirements.

END OF SECTION
SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protection of new and existing fire-resistance-rated construction and smoke barriers as required by the building code, and using materials subject to the limitations of this specification.
   1. Protection of new penetrations and construction.
   2. Inspection of existing penetrations and construction uncovered during the course of construction.
   3. Repair/renewal of non-compliant existing penetrations and construction where encountered.

B. The location and extent of fire-resistance-rated construction and smoke barriers are indicated on the Drawings.
   1. Protect every penetration into or through such construction.
   2. Protect every joint in such construction or between elements of such construction and adjacent construction.

C. Work Not Included: Repairing penetrations made in error and repairing penetrations which are too large to be sealed by the methods indicated; these are to be repaired using the original material of the construction.

1.02 PRICE AND PAYMENT

A. Include the cost of firestopping new penetrations and construction in the base bid.

B. Include the cost of firestopping of existing penetrations and construction in the base bid where shown on the drawings, schedules, or specifications.

C. The cost of repair or renewal of non-compliant existing firestopping penetrations and construction encountered during construction will be paid for in accordance with the General Conditions that govern changes in the Work.

1.03 DEFINITIONS

A. Fire Wall, Fire Barrier, Smoke Barrier, Fire Partition: As defined by the building code.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance ratings, limitations, and tested assembly details including preparation and installation instructions.

B. Shop Drawings - Schedule: Submit a single, integrated, and complete list of joints and penetrations to be sealed including penetrations caused by mechanical, electrical, plumbing, and other work. Do not submit separate schedules prepared by the various subcontractors. Identify the following:
   1. Type of penetration (floor, wall, other).
   2. Fire rating of penetrated assembly.
   3. Material of penetrated assembly (e.g., cast-in-place concrete wall, CMU wall, composite floor deck, etc.).
   4. Size and material of the penetrating object (e.g. 4"-8" C.I.P, EMT up to 2" dia., etc.).
   5. Testing laboratory design number.
   6. Manufacturer’s design number.

C. Preinstallation Inspection Report.

D. Final Inspection Report.
1.05 QUALITY ASSURANCE
   A. Manufacturer's technical representative shall be available for initial job start-up and trouble-
   shooting as needed, and to assist with inspections.
   B. Coordination Meeting: Prior to the start of work which involves cutting penetrations, conduct a
      meeting with installers of such work to identify fire barriers and required configurations of
      penetrations and to discuss the proper procedures and time schedule for cutting, patching, and
      sealing penetrations in such assemblies, with emphasis on avoiding unnecessary cutting and
      patching.

1.06 REGULATORY REQUIREMENTS
   A. Protect fire rated construction and smoke barriers as required by the building code, and using
      materials subject to the limitations of this specification. Construction to be protected includes:
      1. Penetrations into or through fire walls, fire barriers, smoke barriers, and fire partitions.
      2. Penetrations into or through fire-resistance-rated floors, floor/ceiling assemblies, and the
         ceiling membrane of roof/ceiling assemblies.
      3. Penetrations in smoke barriers.
      4. Joints in or between fire-resistance-rated walls, floors, floor/ceiling assemblies, roofs, and
         roof/ceiling assemblies.
      5. Joints between fire-resistance-rated floor or floor/ceiling assemblies and exterior curtain
         wall assemblies (where a curtain wall is formed by wall materials that bypass the floor
         slab edge such as aluminum framing and glass, studs and other cladding, or other wall
         materials).
      7. Joints at the intersection of horizontal smoke barriers and exterior curtain wall assemblies.
      8. Penetrations into or through non-fire-resistance-rated floors, floor/ceiling assemblies, and
         the ceiling membrane floor/ceiling assemblies.

1.07 MOCK-UP
   A. Install one mock-up of each major type of firestop assembly using proposed materials and
      illustrating workmanship to be expected in the completed work.
   B. Obtain approval of the manufacturer's technical representative before proceeding with
      firestopping work.
   C. Disassembly or removal may be required during inspection.

1.08 PROJECT CONDITIONS
   A. Comply with firestopping manufacturer's recommendations for temperature and conditions
      during and after installation.
   B. Provide ventilation in areas where solvent-cured materials are being installed.

1.09 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to project site in original unopened containers bearing the name of the
      manufacturer, product name, type, and testing agency's identification mark.
   B. Store products in accordance with manufacturer's instructions.

1.10 SEQUENCING AND SCHEDULING
   A. Perform firestopping work after completion of work which penetrates fire barriers, but prior to
      covering up or eliminating access to the penetration. Coordinate with installers of such other
      work.
PART 2 PRODUCTS

2.01 SUBSTITUTIONS
   A. Refer to Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS
   A. Fire Testing of Assemblies: Provide materials and designs that have been tested by approved agencies, as follows:
      1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
      2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   B. Provide products complying with requirements of the contract documents and made by a single manufacturer to the greatest extent practicable, unless otherwise indicated and approved by the Architect.

2.03 MATERIALS
   A. Firestopping Materials: Provide assemblies whose fire-resistance ratings have been determined by testing in the configurations required and which have fire-resistance ratings at least as high as that of the fire-rated assembly in which they are to be installed.
      1. If a tested assembly is not available for a particular penetration or joint configuration, modify the penetration or joint configuration to suit available assemblies; do not modify assembly configuration except as specifically stated in the test report or as approved by the authority having jurisdiction.
      2. Provide products that:
         a. Allow normal expansion and contraction movement of the assembly without failure of the seal.
         b. Emit no hazardous, combustible, or irritating by-products during installation or curing period.
         c. Do not require special tools for installation.
      3. Provide products that allow for differential movement unless otherwise approved.
      4. For products used in horizontal assemblies, provide products that are impervious to water when fully cured.
      5. For materials used in expansion joints, provide sealant with at least 40% movement capability in compression or extension. For other joints provide at least 25% movement capability in compression or extension.
      6. Select assemblies and products so as to minimize the number of different assemblies and different products used.
   B. Penetration Assembly Labels: Permanent, red marking with black lettering.
      1. For marking firestopping assemblies, use self-adhesive tape or wired-on labels.
      2. Legend:
         a. Fire-Rated Assembly - Do not disturb - See maintenance instructions".
         b. Product manufacturer’s name.
         c. U.L. Des. No. ____________
         d. F rating: _______________
         e. T rating: _______________
         f. Installer’s name.
   C. Partition Labels:
1. Permanent, red lettering with legend "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS".
2. Use letters at least 3 inches (77 mm) high.

2.04 ASSEMBLIES
A. Protect fire rated construction and smoke barriers as required by the building code, and using materials subject to the limitations of this specification.
   1. Exceptions: Certain materials, locations, and assemblies are exempt where permitted by the building code and approved by the authorities having jurisdiction.
B. Penetrations into or through fire walls, fire barriers, smoke barriers, and fire partitions: Provide through-penetration firestop systems tested per ASTM E 814 or UL 1479, minimum positive pressure differential of 0.01 inch of water, F rating not less than that of the wall.
C. Penetrations into or through fire-resistance-rated floors, floor/ceiling assemblies, and the ceiling membrane of roof/ceiling assemblies: Provide through-penetration firestop systems tested per ASTM E 814 or UL 1479, minimum positive pressure differential of 0.01 inch of water, F rating and T rating not less than that of the floor nor less than 1 hour whichever is greater.
D. Penetrations in smoke barriers: Provide through-penetration firestop systems tested per UL 1479 for air leakage. The L rating measured at 0.30 inch of water in ambient and elevated temperature tests: Not greater than 5.0 CFM/SF of penetration opening for each penetration or a total leakage of 50 CFM for any 100 SF of wall area or floor area.
E. Joints in or between fire-resistance-rated walls, floors, floor/ceiling assemblies, roofs, and roof/ceiling assemblies: Provide fire-resistant joint systems tested per ASTM E 1966 or UL 2079.
F. Joints between fire-resistance-rated floor or floor/ceiling assemblies and exterior curtain wall assemblies (where a curtain wall is formed by wall materials that bypass the floor slab edge such as aluminum framing and glass, studs and other cladding, or of other wall materials): Provide an approved system tested per ASTM E 2307, F rating not less than that of the floor.
G. Joints in smoke barriers: Provide fire-resistant joint systems tested per UL 2079 for air leakage. The L rating measured at 0.30 inch of water in ambient and elevated temperature tests: Not greater than 5 CFM/LF.
H. Joints at the intersection of horizontal smoke barriers and exterior curtain wall assemblies.

2.05 ACCESSORIES
A. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION
3.01 EXAMINATION
A. Preinstallation Inspection:
   1. Inspect for penetrations of any type; mark or otherwise identify all penetrations indicating action required: "Repair" or "Firestop".
   2. Conduct inspection prior to covering up or enclosing walls or ceilings.
   3. Conduct inspection jointly with authorized representative of authority having jurisdiction, unless the authority waives the inspection.
   4. Submit a report detailing findings of inspection to the Architect.
B. Include existing penetrations uncovered during the course of construction in the preinstallation inspection.
C. If the configuration of a particular penetration does not conform to the configuration necessary for the required firestopping assembly, modify the construction to suit the firestopping assembly design.

3.02 PREPARATION
A. Prepare penetrations in accordance with material manufacturer's instructions.
B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
C. Remove incompatible materials which may affect bond.

3.03 INSTALLATION
A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings. Provide all accessory materials required.
B. Produce a smooth, uniform, neat appearing finish.
C. Remove combustible forming materials, unless they are a required component of the tested assembly.
D. Do not cover installed firestopping until inspected by authority having jurisdiction, unless such inspection is waived by the authority.

3.04 PERMANENT IDENTIFICATION
A. Affix penetration assembly labels to each fire-stop penetration assembly.
B. Install partition labels on fire rated partitions above lay-in ceilings at intervals not exceeding 12 feet.

3.05 FIELD QUALITY CONTROL
A. Special inspections are required by the building code or by the authority having jurisdiction. Inspections shall be conducted in accordance with ASTM E 2174 and ASTM E 2393 by an approved inspection agency acceptable to the authority having jurisdiction.
B. Special Inspections: Coordinate and schedule special inspections by the approved inspection agency.
C. Inspect completed installations for completeness and correct installation.
   1. Arrange for the firestopping material manufacturer's representative to conduct an inspection of completed work.
   2. If installed work is to be covered in completed work, inspect and obtain approval prior to covering.
D. Submit report of inspection to the Architect.
E. Notify the Architect of completed firestopping work prior to covering with subsequent work.

3.06 CLEANING AND PROTECTION
A. Clean adjacent surfaces of excess firestopping materials promptly. Use methods and materials approved by the manufacturers of the penetration seals and of surfaces to be cleaned.
B. Protect adjacent surfaces from damage by material installation.
C. Protect installed work during curing period.
D. Protect installed work from damage from construction operations using substantial barriers, if necessary.
E. Repair damaged firestopping and adjacent materials in accordance with manufacturer's instructions.

END OF SECTION
SECTION 07 9000 - JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section Includes:
   1. Sealants and joint backing.

B. Work of this section includes:
   1. Sealing of joints indicated in the schedule at the end of this section and in other locations required by the Contract Document.
   2. Seal joints on the interior of the building to prevent the passage of water or air from space to space or between adjacent building materials and assemblies.
   3. Joints of a nature similar to that of joints indicated shall be sealed with same sealer, whether or not specifically indicated on the drawings and schedules to be sealed.

1.02 REFERENCES


1.03 DEFINITIONS

A. M Type Substrates: Cast-in-place concrete, concrete masonry units, clay brick, masonry mortar, natural stone.
B. G Type Substrates: Glass and transparent plastic glazing sheets.
C. A Type Substrates: Metals, porcelain, glazed tile, and smooth plastics.
D. O Type Substrates: Wood, unglazed tile; substrates not included under other categories.
E. Use T: Surfaces bearing pedestrian or vehicular traffic.
F. Use NT: Non-traffic-bearing surfaces.

1.04 SUBMITTALS

A. Product Data:
   1. Provide manufacturer's data on each joint sealer indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, color availability, and installation instructions.
   2. Provide manufacturer's technical guide containing recommendations for primers for each exterior sealant/substrate combination.

B. Samples: Submit two cured samples for each product exposed to view, illustrating full range of sealant colors available for selection.

C. Installer's Preconstruction Inspection Report: List all conditions detrimental to performance of joint sealer work.

1.05 MOCK-UP

A. Before beginning installation, install sealers in joints in actual construction as directed by the Architect, to show color, materials, and installation.
B. Locate where directed.
C. Keep mock-ups intact as the standard for evaluating the completed joint sealer work.
D. Mock-up may remain as part of the Work.
1.06 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials in original containers or bundles with labels showing manufacturer, product
      name or designation, color, shelf life, and installation instructions.

1.07 PROJECT SITE CONDITIONS
   A. Environmental Limitations: Do not install sealers if any of the following conditions exist:
      1. Air or substrate temperature exceeds the range recommended by sealer manufacturer or is
         below 40 degrees F (4.4 degrees C) or is above 100 degrees F (38 degrees C).
      2. Substrate is wet, damp, or covered with snow, ice, or frost.
      3. Substrate is dusty, oily, or otherwise contaminated.
   B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater
      than that recommended by sealer manufacturer; notify the Architect and get joint sealer
      manufacturer's recommendations for alternative procedures.
   C. Maintain temperature and humidity recommended by the sealant manufacturer during and after
      installation.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS
   A. Refer to Section 01 6000 - Product Requirements.

2.02 SEALANTS
   A. One-Part Nonsag Urethane Sealant: ASTM C 920, Type S, Grade NS, Class 25, Use NT.
      1. Products:
         a. Master Builders / BASF; MasterSeal NP 1: www.master-builders-solutions.basf.com. (35 g/l)
         b. Pecora Corporation; Dynatrol I-XL: www.pecora.com. (68 g/l)
         c. Sika Corporation; Sikaflex 1a: www.sika.com. (47.6 g/l)
   B. Non-Curing Sealers:
      1. Butyl Polyisobutylene Tape Sealer: Solvent-free, 100 percent solids; complying with
         804.3, as described in AAMA 800; nonstaining and nonmigrating; provide in rolls with
         release paper.
         a. Integral shimming spacer.

2.03 ACCESSORIES
   A. Primer for Silicone Sealants: Nonstaining type, as recommended by joint sealant
      manufacturer for specific substrates encountered on the project and as verified by testing.
   B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; not
      damaging to substrates, and compatible with joint forming materials.
   C. Backer Rods: Flexible, nonabsorbent, compressible polyethylene foam, either open cell or
      nongassing closed cell, unless otherwise restricted by sealant manufacturer; preformed to
      appropriate size and shape.
   D. Bond-Breaker Tape: Self-adhesive, polyethylene or other plastic tape, unless otherwise
      restricted by sealant manufacturer; suitable for preventing sealant adhesion.
   E. Masking Tape: Nonabsorbent, nonstaining.
   F. Tooling Agents: Approved by sealant manufacturer; nonstaining to sealant and substrate.
2.04 SEALANT COLORS
   A. The Architect will select sealant colors from manufacturer's full range of available colors for each respective sealant and adjacent substrate.
   B. Obtain approval of mock-up color before ordering job quantities of sealant.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Examine joints for characteristics that may affect sealer performance, including configuration and dimensions.
   B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION
   A. Cleaning: Just before starting sealer installation, clean out joints as follows:
      1. Remove loose materials and foreign matter which might impair adhesion of sealant including, but not limited to, dust, dirt, coatings, paint, oil, and grease.
      2. Dry out damp and wet substrates thoroughly.
      3. Clean A-type and G-type substrates by chemical or other methods that will not damage the substrate.
      4. Remove loose particles by brushing and by blowing with oil-free compressed air.
      5. Concrete: Remove laitance and form-release coatings.
      6. Use methods which will not leave residues that will impair adhesion.
   B. Prime joint substrates where required by this specification, manufacturer's recommendations, or adhesion tests.
   C. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces which would be damaged by contact or by cleanup. Remove tape at the end of each day.
   D. Protect elements surrounding the work of this section from damage or disfigurement.
   E. Install fillers where needed to provide proper joint depth or support for sealant backers.
   F. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

3.03 INSTALLATION
   A. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
   B. Comply with sealer manufacturer's installation instructions and recommendations, except where more restrictive requirements are specified.
   C. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C 1193.
   D. Backers:
      1. Install backers at depth required to result in shape and depth of installed sealant which allows the most joint movement without failure.
         a. Make backers continuous, without gaps, tears, or punctures.
         b. Do not stretch or twist backers.
      2. Use bond-breaker tape wherever it is necessary to keep sealant from adhering to back or third side of joint.
      3. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.
   E. Shape and Depth: Use methods recommended by manufacturer; completely fill the joint; make full contact with bond surfaces; tool nonsag sealants to smooth surface eliminating air pockets.
1. Use concave joint shape shown in Figure 8 in ASTM C 1193, where not otherwise indicated.

2. Depth of sealant at center of joint, unless otherwise required by the Contract Documents or recommended by manufacturer:
   a. For joints up to 1/4 inch (6.4 mm) wide: Depth equal to width.
   b. For joints 1/4 inch to 1/2 inch (13 mm) wide: Depth equal to 1/4 inch.
   c. For joints over 1/2 inch (13 mm) wide: Depth equal to 1/2 the width but not deeper than 1/2 inch.

3. Contact depth: Twice the depth of sealant at center of joint, unless otherwise required.

3.04 CLEANING
   A. Clean adjacent soiled surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.

3.05 PROTECTION OF FINISHED WORK
   A. Protect sealants from contamination and damage until cured.
   B. Remove and replace damaged sealers.

3.06 SCHEDULE
   A. General:
      1. Seal joints on the interior of the building to prevent the passage of water or air from space to space or between adjacent building materials and assemblies.
      2. Joints of a nature similar to that of joints indicated shall be sealed with same sealer, whether specifically indicated on the drawings and schedules to be sealed or not.
   B. Between Roof Curbs and Mechanical Units: Use butyl polyisobutylene tape sealer.
   C. Typical Interior Joints:
      1. Including, but not limited to:
         a. Interior joints for which no other sealer is indicated.
      2. Use the following sealant:
         a. One part, nonsag urethane sealant.

END OF SECTION
SECTION 08 1100 - STEEL  DOORS AND FRAMES

PART 1  GENERAL

1.01 SECTION INCLUDES

A. Work Included in this Section:
   1. Steel Doors:
      a. Lead-lined steel doors.
   2. Steel Frames:
      a. Lead-lined steel frames.

1.02 REFERENCES


1.03 SYSTEM DESCRIPTION

A. Radiation Protection: Contain, without leakage, emitted radiation of less than 2 millirem RAD units, measured at door and frame surface with radiation measuring device simulating the emitting equipment.

1.04 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
B. Shop Drawings: Details of each opening showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2  PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01600 - Product Requirements.

2.02 GENERAL

A. Requirements for All Units:
   1. Door Top Closures: Flush with top of faces and edges.
   2. Door Edge Profile: Beveled on both edges.
   4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
B. Hardware Preparation: In accordance with DHI A115 Series, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Thickness: 1-3/4 inches unless indicated otherwise.

B. Interior Doors, Lead-Lined:
   1. Grade: ANSI A250.8 Level 2, 18 ga., physical performance Level B, Model 1, full flush.
   2. Sheet Lead: ASTM B 749, Type 14, 1/8" thick for room 0133, 1/32" thick for room 0312. inch thick.
   3. Core: Vertical steel stiffeners.
      a. Steel channel grid: 20 ga. steel stiffeners welded to face sheets 4 inches (102 mm) o.c. Fill voids with mineral wool.

2.04 STEEL FRAMES

A. General:
   1. Comply with the requirements of grade specified for corresponding door.
   2. Finish: Same as for door.

B. Lead-Lined Door Frames:

C. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 ACCESSORY MATERIALS

A. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
   1. Lead-lined Doors: Provide lead of equivalent thickness to lead in door, at inside of stop.
      Install continuously, without gaps at joints and corners.
   2. Lead-lined Frames: Provides lead of equivalent thickness to lead in the door frame, at inside of frame.
      Install continuously, without gaps at joints and corners.

B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard.

B. Coordinate frame anchor placement with wall construction.

C. Coordinate installation of hardware.
3.03 ERECTION TOLERANCES
   A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 ADJUSTING
   A. Adjust for smooth and balanced door movement.

END OF SECTION
SECTION 083449 - RADIATION SHIELDING DOOR AND FRAMES

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. Radiation shielding swinging doors and frames.
   2. Radiation shielding sidelight, borrowed lite and transom panels and frames.

B. Related Sections:
   1. Division 04 Section "Unit Masonry" for embedding anchors for radiation shielding hollow metal work into masonry construction.
   2. Division 08 Section "Glazing" for glass view panels in radiation shielding doors.
   3. Division 08 Sections "Door Hardware" and "Access Control Hardware" for door hardware for radiation shielding doors and frames.
   4. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
   5. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
   6. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access system.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

   1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
   6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of preparations for power, signal, and control systems.

D. Samples for Verification:
   1. Samples are only required by request of the architect and for manufactures that are not current members of the Steel Door Institute.

E. Informational Submittals:
   1. Certificates of Compliance: Submit any information necessary to indicate compliance with this specification section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain radiation shielding doors and frames through one source from a single manufacturer wherever possible.
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 positive pressure according to NFPA 252 (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: 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. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105.

E. Pre-Installation Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing radiation shielding doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver radiation shielding work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store radiation shielding work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
1.7 COORDINATION

A. Coordinate installation of anchorages for radiation shielding 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.

1.8 WARRANTY

A. Provide manufacturer's written 5 year warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products (C).
2. Curries Company (CU).

B. Substitutions: Material from alternate radiation shielding door and frame fabricators will not be accepted on jobsite without prior written and sample approval in accordance with requirements specified in Division 01.

2.2 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

B. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Lead Glazing: Comply with requirements in Division 08 Section, "Glazing."

2.3 RADIATION SHIELDING DOORS

A. General: Provide 1-3/4 inch doors of type and design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2.4 RADIATION SHIELDING FRAMES

A. General: Provide frames of the type and profile indicated, not less than thickness indicated; to comply with ANSI/SDI A250.8.

1. Fabricate frames with mitered corners.
2. Fabricate frames with "closed and tight" mitered, full depth continuously welded seams, finished smooth with no visible seam unless otherwise indicated. Knock down type frames are not permitted.
3. Minimum 16 gage (0.053-inch -1.3-mm) thick steel sheet
4. Lead-lining: Rolled pure sheet lead conforming to ASTM B749, matching sheet thickness specified for lead door cores.

B. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

C. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.
1. Masonry Type: Adjustable strap-and-stirrup anchors to suit frame size, not less than 16 (0.8 mm) gage thickness, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.

2. Stud Wall Type: Designed to engage stud and not less than 16 gage (0.8 mm) thickness.

B. Floor Anchors: Floor anchors to be provided at each jamb. Formed from same material as frames, not less than 14 gage (0.067-inch -1.7-mm) thick.

C. Mortar Guards: Provide minimum 26 gage mortar guards welded to the back of each hardware cutout.

2.6 STOPS AND GLAZED LITES

A. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Factory installed, minimum 16 gauge (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

2.7 FABRICATION

A. Fabricate radiation shielding 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. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate radiation shielding work to tolerances indicated in ANSI/SDI A250.8.

C. Radiation Shielding Doors:

1. Glazed Lites: Factory cut openings in doors with applied flush trim kit to fit.
2. Astragals: Provide lead-lined overlapping astragals on one leaf of pairs of doors where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
3. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".

D. Radiation Shielding Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Full depth continuously weld frame seams; grind, fill, dress, and make smooth and flush.
   a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
2. Sidelight 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 butt welding.

3. High Frequency Hinge Reinforcement: Provide 12 gage angle reinforcements for butt type hinges on every door and frame assembly.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gage straps for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".

5. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; this includes but not limited to electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as noted in door hardware sets in Division 08 Section, "Door Hardware".

   a. Provide electrical knock out boxes as required for Project.
   b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
   c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section, "Door Hardware".
   d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.

6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

7. Jamb Anchors: Provide number and spacing of anchors as follows:

   a. Masonry and Stud Wall Types: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

      1) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 84 inches (2137 mm) high.

E. Surface Hardware Preparation: Factory prepare radiation shielding work to receive template mortised hardware; include cutouts, reinforcement, 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 indicated, or if not indicated, according to ANSI/SDIA250.8.
   2. Reinforce doors and frames to receive non-template, mortised and surface-mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDIA250.6 and ANSI/DHIA115 Series specifications for preparation of radiation shielding work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

F. Stops and Moldings: Provide factory installed stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop.
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RADIATION SHIELDING DOORS AND FRAMES
WSU Project No. 629-304592

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of radiation shielding work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so glazed lites are capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

2.8 STEEL FINISHES

A. Prime Finish: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded radiation shielding frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
3.3 INSTALLATION

A. General: Install radiation shielding work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Radiation Shielding Frames: Install radiation shielding frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with appropriate mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Radiation Shielding Doors: Fit radiation shielding doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section, "Glazing" and with door manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including radiation shielding work that is warped, bowed, or otherwise unacceptable.
B. Remove grout and other bonding material from radiation shielding work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 083449
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 08 Section “Radiation Shielding Doors and Frames”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies
1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

   3. Content: Include the following information:

      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
      h. Warranty information for each product.

   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

   1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

      a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.

c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".
1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
   1. Twenty five years for manual surface door closer bodies.
   2. Five years for motorized electric latch retraction exit devices.
   3. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. 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 door hardware.
PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-
door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:
   a. Stanley Best (BE).

B. Cylinders: Original manufacturer cylinders complying with the following:
   1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
   2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
   4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

C. Key Registration List (Bitting List):
   1. Furnish a list of opening numbers with locking devices, showing cylinder types and quantities required when cylinders or cores are to be owner furnished.

2.5 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.
1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ML20900 Series.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.7 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
   2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
   4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use.
Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - DC8000 Series.

2.8 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
2.9 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.10 ELECTRONIC ACCESSORIES

A. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:
   a. Securitron (SU) - BPS Series.

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 9
Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating 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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with
corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer’s Abbreviations:
1. MR - Markar
2. RU - Corbin Russwin
3. BE - Best Access Systems
4. RO - Rockwood
5. SU - Securitron
6. MK - McKinney

Hardware Sets

Set: 1.0

<table>
<thead>
<tr>
<th>Doors: 0133, 0312A, 0312B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
</tr>
<tr>
<td>1 Electrified Mortise Lock</td>
</tr>
<tr>
<td>1 SFIC Core</td>
</tr>
<tr>
<td>1 Surface Closer</td>
</tr>
<tr>
<td>1 Armor Plate</td>
</tr>
<tr>
<td>1 Wall Stop</td>
</tr>
<tr>
<td>1 Silencer</td>
</tr>
<tr>
<td>1 Electric Power Transfer</td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
</tr>
<tr>
<td>1 ElectroLynx Harness</td>
</tr>
<tr>
<td>1 Power Supply</td>
</tr>
<tr>
<td>1 Card Reader</td>
</tr>
</tbody>
</table>

Notes:

Entrance by presentation of valid credential at card reader, or by key at cylinder. Free egress at all times.
## SECTION 087100 – DOOR HARDWARE

**Set: 2.0**

**Doors:** 0312A, 0312B

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Set</th>
<th>Finish</th>
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</thead>
<tbody>
<tr>
<td>Continuous Hinge</td>
<td>HG315 x CTP x AS</td>
<td>630</td>
<td>MR</td>
</tr>
<tr>
<td>Classroom Lock</td>
<td>ML2055 NSA M29 CT7SD</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td>SFIC Core</td>
<td>Best Cores by owner</td>
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<td></td>
</tr>
<tr>
<td>Surface Closer</td>
<td>DC8210 A10 M73 M108 - pull side mount</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td>Armor Plate</td>
<td>K1050 36&quot; high x 2&quot; LDW 4BE CSK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall Stop</td>
<td>406</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silencer</td>
<td>608 / 609</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

Latch bolt by lever either side unless outside lever is locked by key outside. Outside lever remains locked unless unlocked by key. Inside lever always free for egress.

END OF SECTION 087100

END OF SECTION 087100
SECTION 08 8000 - GLAZING

PART 1  GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCES

H. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 1990.

1.03 SUBMITTALS

A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
B. Samples: Submit two samples 12 x 12 inch in size of glass and plastic units, showing coloration and design.

1.04 QUALITY ASSURANCE


1.05 MOCK-UP

A. Provide mockup of ________ including glass and air barrier and vapor retarder seal.
B. Locate where directed.

1.06 WARRANTY

A. Provide a ten year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2  PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01 6000 - Product Requirements.

2.02 FLAT GLASS MATERIALS

   1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Comply with ASTM C 1048. Provide Type HS (heat strengthened) glass except where Type FT (fully tempered) is required.
B. Tempered Safety Glass (08 8000.TS): Clear; fully tempered with horizontal tempering.
1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C 1048.
2. Comply with ANSI Z97.1.

C. Lead Glass: (08 8000.LG):
1. Lead barium glass, high quality optical grade, polished both surfaces, over 60% heavy metal oxide with at least 55% PbO.
2. Thickness: as required to provide the lead equivalent radiation shielding of sheet lead specified in Division 13.
3. Multilayer laminate safety glazing complying with ASNI Z97.1 and 16 DFR1201 (Cat I and II).

2.03 FIRE RATED GLAZING PRODUCTS
2. Fire Rating: 20 minutes, 45 minutes, 60 minutes, 90 minutes, 3 hour with hose stream test.
3. Thickness: 5/16 inch, (8 mm) overall.
4. STC Rating: 35dB.
5. Products:
   b. Pyran Platinum L; Schott North America, Inc.

2.04 SEALED INSULATING GLASS MATERIALS
A. General Requirements:
1. Comply with ASTM E 774 and E 773, Class CBA.
2. Purge interpane space with dry hermetic air.
B. Clear Insulating Low-E Glass Units (08 8000.ICE): Double pane with glass to elastomer edge seal.
1. Outer pane of clear glass, inner pane of clear glass.
2. Low-E Coating: Place low-e coating on No. 2 surface within the unit.
3. Maximum Summer U-Value of unit: 0.027.
4. Maximum Winter U-Value of unit: 0.29.
5. Maximum SHGC of 0.29.
7. Maximum Reflectivity, exterior: 12%.
8. Maximum Reflectivity, interior: 13%
9. Total unit thickness of 1 inch minimum.
10. Provide tempered units where indicated on drawings.
11. Products:
   a. , by Viracon.
   c. Vitro Solarban 70XL, by PPG certified fabricator.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that openings for glazing are correctly sized and within tolerance.
B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.
3.02 INSTALLATION
   A. Install glazing in accordance with GANA Glazing Manual and system manufacturer's instructions.

3.03 CLEANING
   A. Remove glazing materials from finish surfaces.
   B. Remove labels after Work is complete.
   C. Clean glass and adjacent surfaces.

END OF SECTION
SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1    GENERAL

1.01 SECTION INCLUDES
   A. Gypsum wallboard.
   B. Lead-lined gypsum board and installation accessories.
   C. Gypsum wallboard (GWB) with setting-type joint compound to receive high performance coatings specified in Section 09 9600.
   D. Joint treatment and accessories.

1.02 REFERENCES

1.03 SUBMITTALS
   A. Product Data: Provide manufacturer's product data for systems required. Include installation instructions and data sufficient to show compliance with requirements.
   B. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 x 12 inch in size, illustrating finish color and texture.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Deliver materials in original and unopened packages, containers, or bundles, with brand names and manufacturer's labels intact and legible.
   B. Store materials in dry location, fully protected from weather and direct exposure to sunlight.
   C. Stack gypsum board products flat and level, properly supported to prevent sagging or damage to ends and edges.
   D. Store corner bead and other metal and plastic accessories to prevent bending, sagging, distortion, or other mechanical damage.

1.05 PROJECT CONDITIONS
   A. Do not store or install products until building is fully enclosed and temperature and humidity controlled.
   B. Temperature: Maintain temperature in areas of installation between 50 and 80 degrees F for at least 48 hours before installation begins and continuously thereafter.
   C. Ventilation: Provide controlled ventilation and dehumidification.
   D. Do not allow excessive variations in humidity or temperature.
   E. Coordinate installation of lead-lined gypsum board with the installation of other x-ray protection materials. Make installed work available for inspection by other x-ray protection installers.
PART 2  PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01 6000 - Product Requirements.

B. For substitutions of the basis of design products to receive high performance coatings, submit complete data demonstrating compatibility of wallboard and finishing products with coatings and bond of coatings.

2.02 WALL AND CEILING BOARD MATERIALS AND ACCESSORIES FOR SURFACES TO RECEIVE HIGH PERFORMANCE COATINGS

A. Where surfaces will receive high performance coatings specified in Section 09 9600 - High Performance Coatings, provide board materials and accessories as specified herein.

B. Ordinary GWB plus Setting Type Joint Compound:
   1. Panels as specified below for "all other surfaces".
   2. Joint Compound:  High strength, high density setting type.
   3. Joint Tape:  Paper or alkali-resistant mesh type, as recommended for use with setting type joint compound by compound manufacturer.
   4. Other accessories as specified below for "all other surfaces".

2.03 GYPSUM BOARD MATERIALS - ALL OTHER SURFACES

A. Gypsum Wallboard:  ASTM C1396; sizes to minimize joints in place; ends square cut.
   1. Thickness:  5/8 inch, all locations.  1/2 inch not acceptable.
   2. Edges: Tapered; beveled or rounded.
   3. Type X: Fire resistant, UL or Intertek rated.

B. Lead-lined Gypsum Board:  ASTM C 1396; type X, UL or Intertek rated; with a single lead sheet, complying with ASTM B749, Type L51120 (chemical lead) laminated to back of board; of width and length required for support spacing and to prevent cracking during handling.
   1. Thickness:  5/8 inch, all locations.  1/2 inch not acceptable.
   2. Lead Thickness:  As specified in Division 13.
   4. Joint Strips and Discs:  Sheet lead complying with FS QQ-L-201, Grade C, or ASTM B749, Type L51120 (chemical lead), same thickness as lead lining.
      a. Strips:  1-1/2 inch wide minimum; where indicated to cover points of screws, twice as wide as face of support plus depth of face flange.
      b. Discs:  1/2 to 1 inch diameter.

2.04 ACCESSORIES - ALL OTHER SURFACES

A. Except as otherwise specifically indicated, provide trim and accessories by manufacturer of gypsum board materials, made of galvanized steel or zinc alloy and configured for concealment in joint compound.
   1. Include corner beads, edge trim, and other trim units necessary for project conditions.  Provide accessories as required in order to achieve details indicated, whether or not specific accessories are shown on the drawings.
   2. Exposed trim:  At locations indicated, provide manufacturer's standard metal units designed to be left exposed or semi-exposed.

B. Corner Beads:  Galvanized steel.

C. Edge Trim:  Bead types as detailed.

D. Control Joints:  At locations indicated, provide manufacturer's standard one-piece control joints of zinc alloy.
E. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
   1. Joint Compound:
      a. General Interior Use: Ready-mixed vinyl-based joint compound. All-purpose taping and topping compound: type specifically formulated for embedding tape and accessories, for prefilling, and for finishing drywall.
   2. Joint Tape:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions and substrates are appropriate for work of this section to commence.

B. Coordinate installation of anchorage devices for suspended ceilings/soffits, verifying that spacing and rated strength are correct for anticipated load conditions.

3.02 NOISE, AIR, AND DUST CONTROL

A. General: Every partition dividing two spaces is a noise, air, and dust control partition.
   1. Seal noise, air, and dust control partitions in accordance with the requirements listed below.
   2. Seal gypsum panels used on the interior face of exterior walls in the same manner.

B. Seal perimeter of partition with acoustical sealant, complying with recommendations and details in USG Corporation's "Gypsum Construction Handbook" and ASTM C 919. Do not install sealant under metal runners. Install 1/4-inch or larger round bead of sealant to in-place runners and adjacent substrate including those used at partition intersections. Immediately place gypsum panel so as to compress bead, leaving 1/8 inch of perimeter relief (or other dimension where indicated) between gypsum panel and adjacent construction. Locate the sealant bead so that the bead seals between the gypsum wallboard, the runner, and the adjacent floor, wall, structure, or other substrate.
   1. Relief Joints: Install sealant between metal edge trim and adjacent construction. Joint size 1/4 inch unless otherwise indicated.
   2. Install sealant beneath control joints.
   3. Install sealant at metal door frames just before inserting face panel.
   4. Carefully seal around penetrations such as electrical boxes, plumbing, cabinets, ducts, and other openings.

3.03 GYPSUM BOARD INSTALLATION

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Install wallboards in a manner which will minimize butt end joints in center of wall area. Stagger vertical joints on opposite sides of walls.

C. Butt all joints loosely, with maximum of 1/16 inch between boards.

D. Size panels to provide perimeter relief and install over sealant as specified under noise control, above. Do not install panels unless and until sealant is properly installed.

E. Place wrapped edges adjacent to one another; do not place cut edges or butt ends adjacent to wrapped edges.
F. Support all edges and ends of each board on framing or by solid substrate, except that long edges at right angles to framing members in non-fire-rated construction may be left unsupported.

G. Single-Layer: Install gypsum board vertically, with ends and edges occurring over firm bearing.

H. Lead-Lined Gypsum Board: Install board over supports as indicated; make all lead-linings continuous or adequately lapped or covered, to prevent leakage of x-rays.
   1. Install board with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.
   2. Secure lead strips to face of supports and blocking where joints occur.
   3. Provide shims equivalent to lead strip thickness at intermediate supports.
   4. At control and expansion joints, install lead strip on face of framing extending across joint, lapped with lead lining of gypsum board.
   5. Extend gypsum board into frames of openings, lapping lead lining with lead frames or frame linings. Arrange board around openings so that neither horizontal nor vertical joints occur at corners of openings.
   6. Fasten to metal supports using drywall screws spaced as recommended by gypsum board manufacturer, with penetrations covered by the following methods, in locations indicated on drawings:
      a. Cover heads of screws with lead discs recessed flush into surface of board.
      b. Wrap lead joint strip around flange to cover points of screws.
   7. Double-layer systems: Apply face sheet of gypsum board over the base sheet using the manufacturer's recommended bonding adhesive. To ensure a positive bond maintain pressure on the finish panel until the adhesive has set.
   8. At penetrations of lead lining, provide lead shields as specified in Division 13.
   9. After x-ray equipment has been installed and placed in operating condition, the Owner will arrange and pay for testing of the x-ray protection for leakage at joints and through penetrations.
  10. Make all corrections required, including repair or replacement of defective work, including other work affected thereby. Pay for additional testing, until no more corrections are required.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Comply with manufacturer's recommendations for installation of trim items. Except for items intended by manufacturer to be left exposed or semi-exposed, install trim units for concealment in joint finishing compound. Wherever possible, fasten metal trim items to substrate with same fasteners used to install gypsum board products.

B. Control Joints: Where control joints are indicated on the drawings, place control joints as shown on the drawings. Where control joints are not indicated on the drawings, place control joints consistent with lines of building spaces and as follows:
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. Install one-piece control joints at required locations. Do not remove tape until finishing operations are complete.

C. Corner Beads: Install at external corners, unless details clearly indicate its omission at specific locations. Use longest practical lengths.

D. Isolation Joints: Where gypsum board construction abuts cabinetry, windows, structural components, and other dissimilar materials, provide isolation by stopping board a minimum of 1/4 inch from structure, for finishing by means of exposed or semi-exposed trim.
3.05 JOINT TREATMENT AND FINISHING OF SURFACES TO RECEIVE HIGH PERFORMANCE COATINGS
   A. Ordinary GWB plus Setting Type Joint Compound:
      1. Provide joint treatment using setting type compound, mesh or paper joint tape recommended by joint compound manufacturer, and Finish Level 4 as specified below for "all other surfaces".

3.06 JOINT TREATMENT - ALL OTHER SURFACES
   A. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840.
   B. Do not mix joint compounds except as specifically recommended by manufacturer.
   C. Penetrations in Wallboard: Fill cutouts and openings around fixtures and penetrations with joint compound.

3.07 CLEANING
   A. Promptly remove any residual gypsum drywall materials from adjacent or adjoining surfaces, leaving spaces ready for subsequent finishing operations and decorating.

3.08 FINISH LEVEL SCHEDULE - ALL OTHER SURFACES
   A. Level 1: Above finished ceilings concealed from view; from 8 inches (203 mm) above suspended ceilings to top of partition.
      1. Embed tape in joint compound at all joints and interior angles; provide accessories only as detailed.
      2. Provide surfaces free of excess joint compound; tool marks and ridges are acceptable.
   B. Level 2: Walls scheduled to receive the following:
      1. Utility areas; areas behind cabinetry.
      2. Application:
         a. Embed tape in joint compound at all joints and interior angles.
         b. Provide one separate coat of compound at all joints, angles, fastener heads, and accessories.
         c. Provide surfaces free of excess joint compound; tool marks and ridges are acceptable.
   C. Level 4: Surfaces scheduled to receive the following:
      1. Flat or eggshell paint finish specified in Section 09 9100 - Paints and Coatings.
      2. All surfaces not otherwise indicated.
      3. Application:
         a. Embed tape in joint compound at all joints and interior angles.
         b. Provide three separate coats of compound at all joints, angles, fastener heads, and accessories.
         c. Provide smooth surfaces free of tool marks and ridges.

A. no high or low air pressure framing
B. no substrates for catalyzed epoxy coatings

END OF SECTION
SECTION 09 9100 - PAINTS AND COATINGS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Surface preparation.
B. Field application of paints.
C. See Schedules at end of this Section.

1.02 SUBMITTALS
A. Product Data:  Provide data on all finishing products including:
   1. Manufacturer name.
   2. Product Type.
   3. Product Name.
   4. Product Number.
   5. Color.

1.03 DELIVERY, STORAGE, AND PROTECTION
A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label:  Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing. Information shall be legible.
C. Use of off-brand containers or mixing buckets will not be allowed on the site.
D. Paint Materials:  Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.  Protect from freezing.

1.04 PROJECT CONDITIONS
A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Application Temperatures for Waterborne Paints:  Minimum 45 degrees F for interiors; minimum 50 degrees F for exterior; maximum 90 degrees F (32 degrees C), unless required otherwise by manufacturer's instructions.  Maintain interior temperatures until paint is completely dry and cured.
C. Application Temperatures for Solvent Thinned Paints:  Minimum 50 degrees F (10 degrees C) for interiors and exterior; maximum 95 degrees F (35 degrees C), unless required otherwise by manufacturer's instructions.  Maintain interior temperatures until paint is completely dry and cured.
D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
E. Ventilation:  Ventilate affected areas during paint application.  Exhaust solvent vapors outdoors, away from air intakes and people.

PART 2  PRODUCTS

2.01 SUBSTITUTIONS
A. Refer to Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS - PAINTS

2.03 PAINTS AND COATINGS - GENERAL
A. Do not use insecticides in paint materials

2.04 ACCESSORY MATERIALS
A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 PREPARATION
A. General:
1. Start of the surface preparation or paint materials application will be construed as applicator's acceptance of the surfaces as satisfactory for application of materials.
2. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
3. Surfaces: Correct defects and clean surfaces of substances which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
4. Marks: Seal with sealer compatible with primer and finish coats marks which may bleed through surface finishes.
5. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
6. Reduce the gloss of glossy surfaces to be painted.
7. Fill nail holes, cracks, chips, spalls, and similar damaged areas to match adjacent undamaged areas.

3.03 APPLICATION
A. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

B. Thinning:
1. When thinning is required to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions.
2. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds.
C. Do not mix paint materials of different manufacturers.
D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
G. Minimum Coating Thickness:
   1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness as recommended by manufacturer. Provide total dry film thickness of the entire system as recommended by manufacturer.
   2. Strip paint to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.
   3. Apply each coat of paint so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. If application thickness or color and opacity of the paint do not achieve complete hiding, apply additional coat(s) to achieve complete hiding without change in contract price.

3.04 REPAIR AND RESTORATION
A. Reinstall electrical plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to preparing surfaces or finishing.
B. Restore to original condition surfaces damaged or marred by painting materials application.
C. Remove, refinish, or repaint work not complying with approved samples and other specified requirements.

3.05 PROTECTION AND CLEANING
A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 SCHEDULE - SURFACES TO BE FINISHED
A. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted.
   2. UL, FMG, or other code required labels; fire rating labels; and equipment name, identification, performance rating, serial number and capacity labels.
   3. Stainless steel items.
B. Paint the surfaces described in Schedules at the end of this Section and as follows:
   1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of permanently fixed equipment or furniture, paint surfaces behind permanently fixed equipment or furniture with primer only.
   2. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
   3. Finish exterior field-finished doors on tops, bottoms, and side edges the same as exterior faces.
   4. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
   5. Paint both sides and edges of plywood panel backers for electrical and telephone equipment before installing equipment.
3.07 PRIMER, INTERMEDIATE, AND TOP COAT COLORS

A. Except where coating materials cannot be tinted, tint each successive (primer, intermediate, top) coat of paint a sufficiently contrasting color to facilitate identification of complete coating coverage. The preceding coat may be in the same color family, but shall be noticeably different. Provide additional top coats without change in Contract Price if necessary to achieve complete hiding and uniform sheen.

B. Top coat colors are indicated on the drawings and schedules. For approval of actual colors, see sample and mock-up requirements specified above.

C. Top coat colors of manufacturers listed on the Finish Schedule (or elsewhere) indicate the required color, only, and do not indicate the required brand name product, which shall be as specified in above.

D. Top Coat Colors:
   1. Before submitting samples for approval and before purchasing project quantities of material, confirm with the Architect that colors have not changed based on awarded flooring, tile, and countertop finishes.

END OF SECTION
SECTION 09 9600 - HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   2. Application of primers, intermediate coats, and top coats for each coating system.

B. Coating Systems Include:

   09 9600.LE Low Gloss Epoxy

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets for each coating.
   1. Material analysis including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.
   2. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods.

B. Color and Texture Samples:
   1. Provide for each coating system, color, and texture and applied to representative substrate samples.
   2. Label each sample with coating name and color.
   3. Prepare samples to show bare, prepared surface and each successive coat.

1.03 QUALITY ASSURANCE

A. Installer: A company skilled in the application of special coatings whose installations have performed in a satisfactory manner under comparable conditions.

B. Coordination with Work Specified in Other Sections: Where primers will be applied in the shop, apply the primers listed in the schedule at the end of this section.
   1. Exception: Shop primed steel doors and frames shall receive fabricator's standard shop primer, followed by one full field coat of the primer specified in the schedule at the end of this section.

C. Mock-up:
   1. Apply coatings to mock-ups in the presence of the coating manufacturer's technical representative.
   2. Rooms: Mock up one room of each coating system including walls, ceilings, doors, and other elements.
   3. Apply full coating systems, including required textures and colors, to mock-up. In interior spaces, provide completed lighting, or similar, for viewing of mock-up.
   4. Over CMU: apply filler, only, to one wall of space; apply filler and intermediate coat to one wall of the space; apply filler, intermediate coat, and finish coat to remaining walls.
   5. Demonstrate coating of control and expansion joints and joints to receive elastomeric joint fillers.
   6. Remove and reapply coatings until texture, color, and gloss are approved by the Architect.
   7. Final approval of colors will be based on mock-up; obtain full job quantities of tinted materials only after obtaining final approval.
   8. Apply coatings to mock-ups in locations as directed by the Architect.
1.04 DELIVERY, STORAGE AND HANDLING
   A. Deliver materials in manufacturer's original containers bearing coating name and color, material composition data, date of manufacture, legal notices if applicable, and mixing, thinning, and application instructions.
   B. Storage:
      1. Store materials in an orderly fashion and in clean, well-closed containers with labels intact.
      2. Maintain above 40 degrees F. Do not allow materials to freeze.

1.05 PROJECT CONDITIONS
   A. Apply coatings only under the following environmental conditions:
      1. Air and surface temperatures are between 50 and 120 degrees F, or more restrictive when recommended by coatings manufacturer.
      2. Surface temperature is at least 5 degrees F above dew point, or more restrictive when recommended by coatings manufacturer.
      3. Relative humidity is less than 85 percent, or more restrictive when recommended by coatings manufacturer.
   B. Provide temporary lighting to achieve a well-lit surface with a level of not less than 80 footcandles measured mid-height.
   C. Provide continuous ventilation and heating to prevent accumulation of hazardous fumes, and maintain surface and ambient temperatures as specified above for 24 hours before, during, and for 48 hours after application of finishes (or longer if required to obtain full cure as indicated by manufacturer's instructions).

1.06 MAINTENANCE STOCK
   A. At time of completing application, deliver stock of maintenance material to the Owner.
   B. Furnish not less than one properly labeled and sealed gallon can of each type of finish coat of each color, taken from batch mix furnished for the work.

PART 2 PRODUCTS
2.01 SUBSTITUTIONS
   A. Refer to Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS
   A. Provide all products of this section from a single manufacturer.
   B. The brand-name products listed in the schedule at the end of this section and made by the following are the basis of the contract documents.
      1. Tnemec Company, Inc.
      2. Carboline.
      3. PPG Architectural Finishes.
   C. Provide the products listed.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that surfaces and conditions are ready for work in accordance with the contract documents and coating manufacturer's recommendations.
   B. Prior to commencement of work, examine surfaces scheduled to be finished.
      1. Report any unsatisfactory conditions in writing.
2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the applicator.

3. Beginning work on an area will be deemed acceptance of surfaces in that area.

3.02 PREPARATION

A. Do not apply coatings to labels that identify equipment, fire-resistance ratings, etc.

B. Remove hardware, switch and outlet plates, lighting fixtures, etc., before applying coatings. After application of coatings, reinstall removed items. Employ only skilled workmen for removal and replacement of such items.

C. Provide protection for non-removable items not scheduled for coating.

D. Protect surfaces not scheduled for coating. Clean, repair, or replace to the satisfaction of the Architect any surfaces inadvertently spattered or coated.

3.03 SURFACE PREPARATION

A. General: Clean and prepare surfaces as specified. Achieve the surface profile recommended by the coating manufacturer for optimum adhesion and proper appearance.

B. All Surfaces: Ensure surfaces are clean, dry and free of oil, grease and other contaminants.


D. Concrete Masonry Units: Ensure that mortar joints are filled full of mortar and properly struck or tooled as required - no voids, gaps, or open joints allowed. Allow mortar to cure 28 days.
   1. Previously painted CMU: Remove existing coating by blast cleaning or other method of mechanical abrasion.

E. Nonferrous Metal: Solvent clean new surfaces in accordance with SSPC-SP 1 Solvent Cleaning specifications. If recommended by coating manufacturer to ensure adhesion, brush off blast clean in accordance with SSPC-SP 7. Prepare and prime any rusted existing surfaces in accordance with coating manufacturer's instructions.
   1. Previously painted metal: Remove coating in its entirety using methods that will not damage the underlying zinc substrate.

3.04 MIXING AND THINNING

A. Remove and discard any skin formed on surface of coatings in containers. Discard any containers where skin comprises 2 percent or more of the remaining material.

B. Combine multi-component paints in quantities needed for use within the manufacturer's recommended pot life at the anticipated application temperatures. Discard remaining mixed material after pot life has expired.

C. Do not add thinner except as specifically recommended (not merely permitted) by the coating manufacturer for proper coating application under the circumstances prevailing at the project site when application equipment recommended by the coating manufacturer is employed. Use only the quantities and the types of thinner recommended.

D. Mix materials using mechanical mixers in accordance with coating manufacturer's instructions. Agitate mixed materials during application if recommended by manufacturer.

E. Strain pigmented coatings after mixing except where mechanical application equipment is provided with effective strainers.

3.05 APPLICATION

A. General:
1. Metal Surfaces Exposed to View: Apply coatings using brush or spray, only. Roller application not permitted.
2. Full, uniform coverage is required.
3. Employ only application equipment that is clean, properly adjusted, in good working order, and of the type recommended by the coating manufacturer.
4. Apply successive coats after adequate cure of the preceding coat and within the recommended recoating time.

B. Film Thickness: Apply each coat to achieve the dry film mil (DFM) thickness per coat indicated in the schedule at the end of this section. Application rates of excess thickness and fewer numbers of coats than specified will not be accepted.

1. The dry film mil thicknesses shown in the schedule are per each coat.
2. Where a thickness range is specified, the dry film thickness actually applied shall fall within the specified range when measured at any point, and the average dry film thickness actually applied to the entire surface shall be equal to the midpoint of the range specified plus or minus 10 percent.
3. Where a single thickness value is specified, the dry film thickness actually applied, when measured at any point, shall be equal to the specified value plus or minus 10 percent.

C. Prime, First, or Bottom Coats:

1. Concrete masonry units:
   a. A pinhole-free surface is required.
   b. Inspect the filled surface for pinholes and holidays and obtain approval before applying intermediate or top coats.
2. Either before or after applying prime coat but before applying successive coats, stripe paint edges, corners, mechanical fasteners, and welds using specified primer.
3. Before applying successive coats, touch-up connections, fasteners, and damaged areas using specified primer.
4. Where first coat shows signs of suction spots or poorly sealed areas, reapply first coat material to adequately seal surface before proceeding with intermediate and top coats.

D. Miscellaneous:

1. Completed coatings shall be free of defects such as runs, sags, lap or brush marks, holidays, and skips.
2. Apply coatings according to the schedule at the end of this section and as otherwise indicated. Coat all similar surfaces not specifically mentioned unless specifically exempted.
3. Coat front and back of miscellaneous items such as covers, access panels, and grilles.
4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of permanently fixed equipment or furniture, paint surfaces behind permanently fixed equipment or furniture with primer only.

E. Apply coatings to match approved mock-ups.

F. Remove coatings not in compliance with this specification, reclean and re-prepare surfaces as specified, and apply coatings to comply with the contract documents.

3.06 JOINTS

A. Control and Expansion Joints in Floors, Walls, and Ceilings: Before installing backer rod and joint sealant specified in Division 7, apply coating to the joint face, approximately 1/2 inch deep, and allow to cure.
3.07 FIELD QUALITY CONTROL

A. Monitor coating thickness to ensure proper dry film thickness, complete coverage without skips, holidays, or pinholes and to obtain complete hiding of undercoats.

B. Inspect CMU after application of filler (before applying intermediate or finish coats) to ensure a pinhole-free surface. Inspect the entire surface. Notify the Architect when inspection is complete and surface is pinhole free, using the certification form provided at the end of this Specification. Obtain the approval of the Architect before applying intermediate and finish coats.

C. At the Contractor's option and for the Contractor's convenience on account of the size of the Project or the construction schedule, for the purposes of certification the Contractor may subdivide the Project into several parts, each part covered by one certificate. The certificates, in sum, shall represent the entire project.

D. The Architect or the designated representative of the Architect or Owner will inspect the filled CMU surface in whole or in part and to the extent deemed necessary at the Architect's sole discretion, one time without charge.
1. If the surface is found not to be free of pinholes or other defects, charges to the Owner for subsequent time (including travel and other expenses) of the Architect or designated representative will be deducted from the Contract Price.
2. If the Contractor elects to subdivide the Project into several parts for the purposes of certification, charges to the Owner for time (including travel and other expenses) of the Architect or designated representative for certifying each of the several parts (after the first) will be deducted from the Contract Price.

3.08 CLEANING

A. Clean work area on a daily basis; dispose of spent materials and empty containers. If requested, turn over to the Architect all empty coatings containers used during the course of each day.

B. Remove all trace of coatings inadvertently applied to adjacent surfaces not scheduled to be coated. Remove by appropriate methods that do not damage surfaces.

3.09 DEMONSTRATION AND INSTRUCTION

A. Instruct Owner's personnel in methods of touch up painting of interior epoxy coatings.

3.10 PROTECTION

A. Protect work against damage until fully cured. Provide signs identifying wet surfaces until surfaces are adequately cured.

B. Shortly before final completion of the project, examine surfaces for damage to coatings and restore coatings to new, undamaged condition.
1. Touch-up of minor damage will be acceptable where, in the opinion of the Architect, the result is not visibly different from surrounding surfaces. Recoat entire surface where result is different either in color, sheen, or texture.

3.11 PRIMER, INTERMEDIATE, AND TOP COAT COLORS

A. Except where coating materials cannot be tinted, tint each successive (primer, intermediate, top) coat of paint a sufficiently contrasting color to facilitate identification of complete coating coverage. The preceding coat may be in the same color family, but shall be noticeably
different. Provide additional top coats without change in Contract Price if necessary to achieve complete hiding and uniform sheen.

B. Top coat colors are indicated on the drawings and schedules. For approval of actual colors, see sample and mock-up requirements specified above.

C. Top Coat Colors:
1. Before submitting samples for approval and before purchasing project quantities of material, confirm with the Architect that colors have not changed based on awarded flooring, tile, and countertop finishes. Match the following colors:
   2. High Performance Coating 1 (HPC1); Match [_________].
   3. High Performance Coating 2 (HPC2); Match [_________].
   4. High Performance Coating 3 (HPC3); Match [_________].
   5. High Performance Coating 4 (HPC4); Match [_________].

D. Top coat colors of manufacturers listed on the Finish Schedule (or elsewhere) indicate the required color, only, and do not indicate the required brand name product, which shall be as specified below.

3.12 SCHEDULE

A. COATINGS ON INTERIOR WALLS AND CEILINGS.
1. Apply coatings indicated for walls to all vertical surfaces in the space (e.g. columns, other vertical surfaces, etc.).
2. Apply coatings indicated to ceilings to all overhead surfaces (e.g. soffits, fascia, beams, etc.).
3. Apply coatings to miscellaneous surfaces in the space (e.g. steel doors and frames, steel piping and conduit, non-ferrous piping and conduit, PVC piping, ductwork, etc.).
4. In the case of steel doors and frames, apply coatings to the "room-side" and to the "opposite-side" of the door and frame.
5. System(s):
   a. Gypsum Board Walls:
      1) Primer.
      2) Intermediate coat.
      3) Top coat.
   b. CMU Walls:
      1) Block filler pin-hole-free.
      2) Intermediate coat.
      3) Two top coats
   c. Gypsum Board Ceilings:
      1) Primer.
      2) Two top coats.
   d. Steel Doors And Frames:
      1) Universal primer (apply 1 coat over manufacturer's standard shop primer).
      2) Top coat.
   e. Non-Ferrous Metals:
      1) Wash primer.
      2) Steel primer.
      3) Top coat.
   f. Other Miscellaneous Substrates:
      1) Surface preparation and primer as recommended by coatings manufacturer.
      2) Intermediate coat.
3) Two top coats.

6. Tnemec:
   a. Primers:
      1) Gypsum Wallboard Primer:
         (a) Series 151 Elasto-Grip FC, DFT 1.0 to 2.0 mils. (170 g/l)
      2) CMU Block Filler:
         (a) Apply not less than 2 coats Series 130, not to exceed 70 sf/gallon per coat,
             so as to achieve a pin-hole-free surface. (75 g/l)
   b. Intermediate Coat:
      1) Series 280 Tnemeglaze DFT 4.0 to 8.0 mils. (25 g/l)
   c. Top Coats:
      1) Low Gloss (Satin) Epoxy: LE material designation on Finish Schedule.
         (a) Series N69 Hi-Build Epoxoline II, DFT 2.0 to 3.0 mils. (285 g/l)

7. Carboline:
   a. Primers:
      1) Gypsum Wallboard Primer:
         (a) Carbocrylic 120, DFT 1.0 to 2.0 mils. (98 g/l)
      2) CMU Block Filler:
         (a) Apply not less than 2 coats Sanitile 600, not to exceed 78 sf/gallon per coat,
             so as to achieve a pin-hole-free surface. (216 g/l)
      3) Universal Primer:
         (a) One full field coat of Carboguard 890VOC, DFT 4.0 to 6.0 mils. (100 g/l)
      4) Wash Primer for Non-Ferrous Metals:
         (a) Galoseal WB Wash Primer, DFT 0.5 to 1.0 mils. (98 g/l)
      5) Steel Primer:
         (a) Carboguard 890, DFT 4.0 to 6.0 mils. (214 g/l)
   b. Intermediate Coat:
      1) Carboguard 890, DFT 4.0 to 6.0 mils. (214 g/l)
   c. Top Coats:
      1) Low Gloss (Satin) Epoxy: LE material designation on Finish Schedule.
         (a) Series N69 Hi-Build Epoxoline II, DFT 2.0 to 3.0 mils. (285 g/l)

8. PPG:
   a. Primers:
      1) Gypsum Wallboard Primer:
         (a) Seal Grip 100% Acrylic Universal Primer 17-921, DFT 1.2 to 1.5 mils.
             (84 g/l)
      2) CMU Block Filler:
         (a) Apply not less than 2 coats Cementitious Epoxy Block Filler 95-217 Series,
             not to exceed 60 sf/gallon per coat, so as to achieve a pin-hole-free surface.
             (337 g/l)
      3) Universal Primer:
(a) One full field coat of PittGuard DTR Epoxy Coating 97-145, DFT 4.0 to 7.0 mils. (128 g/l)

4) Wash Primer for Non Ferrous Metals:
   (a) Poly Clutch Wash Primer 97-687. (728 g/l)

5) Steel Primer:
   (a) PittGuard DTR Epoxy Coating 97-145, DFT 2.0 to 3.0 mils. (128 g/l)

b. Intermediate Coat:
   1) Pittguard DTR Epoxy Coating 97-145, DFT 5.0 to 7.0 mils. (128 g/l)

c. Top Coats:
   1) Low Gloss (Satin) Epoxy: LE material designation on Finish Schedule.
      (a) Aquapon HG Epoxy Semi-Gloss 97-130 Series, DFT 4.0 to 6.0 mils. (325 g/l)

NOTICE TO THE ARCHITECT OF CONTRACTOR'S INSPECTION OF FILLED CMU PRIOR TO APPLICATION OF SUBSEQUENT COATINGS

I certify that I have inspected CMU prior to application of filler and have found no defects in the CMU or joint work that remain uncorrected. I further certify that I have inspected the filled CMU on this project and have found no pinholes, skips, holidays, gaps, or other defects in the filler. This work is complete and correct and in compliance with the requirements of the Contract Documents and is ready for application of intermediate coatings.

The filler has not been covered by subsequent coatings or other covering.

This certificate applies to the entire Project unless otherwise indicated, as follows:

________________________________________________________________

I request the Architect's approval of this Work.

Certified this ________ day of ______________, 20___, by

________________________________________(signature)

______________________________(printed name) on behalf of

__________________________________________________(Contractor).

ARCHITECT'S CERTIFICATE OF APPROVAL OF FILLER

In accordance with the Contract Documents, based on on-site observations and the Contractor's certification above, the Architect certifies to the Owner that to the best of the Architect's knowledge, information, and belief this Work has progressed as indicated and the quality of this Work is in accordance with the Contract Documents, and the Architect's approval is given to the Contractor to proceed with application of subsequent coatings or covering to this portion of the Work.

Neither this certificate nor the approval contained herein waives the provisions of the General Conditions regarding subsequent discovery of defective work or of latent defects.

Certified this ________ day of ______________, 20___, by

________________________________________(signature)

______________________________(printed name) on behalf of

LAS 10905-00 August 21, 2018
__________________________________________________(Architect).

END OF SECTION
SECTION 10 4400 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 SUBMITTALS

A. Product Data.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION
SECTION 12 3553 - LABORATORY CASEWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Metal laboratory casework.
   2. Laboratory work surfaces.
   3. Water services fittings.
   4. General laboratory accessories.

1.02 REFERENCES

A. ANSI Z535.2 - Environmental and Facility Safety Signs; 2011.
D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
E. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. SEFA 2.3 - Installation of Scientific Laboratory Furniture and Equipment recommended Practices; 2010.
L. SEFA 7 - Laboratory and Hospital Fixtures Recommended Practices; 2010.
M. SEFA 8M - Laboratory Grade Metal Casework; 2010.
P. UL 3101-1 - Electrical Equipment for Laboratory Use; Part 1: General Requirements; Current Edition, Including All Revisions.

1.03 DEFINITIONS

A. Abbreviations:
   1. CFM: Cubic feet per minute.
   2. PSI: Pound per square inch.

B. Broom clean: A condition in an interior area in which surface debris has been removed by dry methods.

C. Service fittings and fixtures: Service fittings include gas, air, vacuum, and special gas valves including factory piped turrets when mounted on work surfaces; hot, cold, reagent grade water faucets; remote control valves for fume hoods; and vacuum breakers.
D. Service lines: Conduit, junction boxes, conduit fittings, wire disconnect switches and fuse or circuit breakers necessary to carry electrical services from building roughing-in outlets in floors or walls through equipment to service fixtures.

E. Rough-in point: Individual or common supply of mechanical, electrical, and heating, ventilating and air conditioning (HVAC) through wall, floor, or ceiling, generally located within the utility umbilical, equipment chase, or service space behind cabinets.

F. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, tops of cabinets less than 72 inches above floor, and visible surfaces in open cabinets or behind glazed doors.
   1. Ends of cabinets visible when the full installation is completed, shall be considered exposed.

G. Semi-exposed Surfaces of Casework: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interiors faces of doors. Tops of cabinets 72 inches or more above floor, back panel in knee spaces, the three non-visible edges of adjustable shelves, holes and openings including notches at shelving and grommets shall be considered semi-exposed. Toe space shall be considered semi-exposed.

H. Concealed Surfaces of Casework: Includes sleepers, web frames, dust panels, and other surfaces not visible after installation.
   1. Ends of cabinets installed directly against and completely concealed by walls or other cabinets after installation shall be considered concealed.

1.04 SUBMITTALS

A. Submit all of the following on the same date. Submit complete, coordinated data. Partial submittals are not acceptable unless specifically approved by the Architect.
   1. Product data.
   2. Samples for initial selection.
   3. Shop drawings.

B. Product Data: Provide manufacturer's data and installation instructions for each type of laboratory casework unit, service fixtures, and accessories.
   1. Certification by an independent testing laboratory indicating that applied finish complies with specified chemical and physical resistance requirements.
   2. Certification by an independent testing laboratory that the casework complies with the specified requirements.

C. Samples for Initial Selection:
   1. Factory-applied finishes and other materials requiring color selection.

D. Shop Drawings: Large scale plans, elevations, cross sections, and details indicating layouts, dimensions, service run spaces, and attachment to other works.
   1. Indicate locations of hardware.
   2. Indicate locations and type of service fittings.
   3. Indicate locations of blocking and reinforcements required for installing casework.
   4. Include details of utility spaces showing supports for conduits and pipings.
   5. Include details of support framing system.
   6. Include coordinated dimensions for existing to be relocated owner-furnished contractor relocated and installed Fume Hood and Laminar Flow Hood.

E. Contract Closeout Submittals:
   1. Project Record Documents:
a. Provide 1 set of record documents including plans, elevations, cross sections, and details indicating layouts, dimensions, service run spaces, and locations and types of service fixtures.
b. Marked up shop drawings and documents will not be acceptable.

2. Cleaning Data: Manufacturer's instructions for cleaning casework finishes and work surfaces

3. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Provide laboratory casework with tops, service fixtures, and accessories, manufactured or furnished by a single laboratory casework company.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Storage:
1. If installation cannot commence in a timely manner after delivery, casework and equipment may be placed in storage. Additional costs for handling, shipping, and storage shall be borne by the Contractor.
2. In the case of items, such as service fittings, that may be shipped to the job site on larger projects and used over the course of several months installation, provide a secure, locked storage area for use to safeguard this equipment at the job site prior to installation.

B. Protection:
1. Protect finished surfaces from soiling and damage during delivery, storage, and handling. Cover with polyethylene film or other protective covering.
2. Laboratory casework and counters are not to be used as workbenches, work platforms, and scaffolding for any portion of the work by any trade. Furniture and casework, as installed, is considered to be finished equipment and shall be protected from damage by all trades.
3. The Contractor shall protect installed laboratory casework and equipment, especially the laboratory work surface, from debris, paint, and damage in the course of the construction sequence.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:
1. Interior spaces where casework, service fittings, and accessories are to be installed shall be conditioned to final design temperature and humidity level for minimum 24 hours prior to and continuously after installation, and in accordance with SEFA 2.3.
2. Do not deliver or install casework, tops, service fittings, and accessories until the following conditions have been met:
   a. Windows and doors are installed and the building is permanently closed in and weathertight.
   b. Ceiling, overhead ductwork and lighting are installed.
   c. All painting is completed and floor tile is installed.

1.08 WARRANTY

A. Metal Casework: Provide written warranty signed by the manufacturer guaranteeing to correct failures in products which occur within one year commencing on the Date of Substantial
Completion, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Correction may include repair or replacement.

B. Warranties shall commence on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Refer to Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS

A. Source Limitations: Provide laboratory casework through the same source from a single manufacturer.

B. Metal Casework:
   2. Mott Manufacturing Ltd, Brantford, ON, Canada, 519-752-2895: www.mott.ca.

C. Fixtures and Accessories:
   1. As listed by individual items below.

2.03 PERFORMANCE REQUIREMENTS

A. Casework and Adjustable Shelving:
   1. Chemical Resistance Requirements: Test the exterior finish of laboratory casework and adjustable shelving for resistance to chemical reagents in accordance with SEFA 8, and meets Level 1 rating - slight change in color or gloss, and with no loss of adhesion and no loss of film protection.
      a. Moisture Resistance: No visible effect when finish surface exposed to the following:
         1) Tested in accordance with SEFA 8.
         2) Constant Moisture using a 2 inch x 3 inch x 1 inch cellulose sponge, soaked with water, in contact with surface for 100 hours.
      b. Cold Crack: No effect when subjected to 10 cycles of temperature change from 20 degrees F for 60 minutes to 125 degrees F for 60 minutes.
         1) Adhesion: Tested in accordance with SEFA 8; ninety or more squares of the test sample shall remain coated after the scratch adhesion test.
         2) Flexibility: No peeling or cracking or exposure of metal when metal is bent 180 degrees over a 1/2 inch diameter mandrel.
      c. Hardness: Tested in accordance with SEFA 8 for surface hardness equivalent to 4H or 5H pencil.
      d. 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.
      e. Humidity resistance: Withstand 1000 hour exposure in saturated humidity at 100 degrees F.

2.04 PRODUCT OUTLINE

A. Numbering system indicated in the casework drawings legend are provided to indicate casework size, and configuration.
2.05 MATERIALS
   A. Sheet Steel:
      1. Mild, cold rolled and leveled unfinished steel.
      2. Minimum gauges:
         a. 20 gauge: Interior drawer fronts, scribing strips, filler panels, enclosures, drawer bodies, shelves, access panels and sloping tops.
         b. 18 gauge: Case tops, ends, bottoms, bases, backs, vertical posts, uprights, and access panels.
         c. 16 gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
         d. 14 gauge: Drawer suspensions, door and case hinge reinforcements and front corner reinforcements.
         e. 11 gauge: Table leg corner brackets and gussets for leveling screws.
   B. Mildew-Resistant Silicone Sealant: One-part, ASTM C 920, Type S, Grade NS, Class 25, Use NT, formulated with fungicide, for interior use on nonporous substrates.
      1. Products:
         a. Dow Chemical Company; Dowsil 786: www.dowcorning.com. (33 g/l)

2.06 CASEWORK HARDWARE:
   A. Floor glides, where specified for movable open-leg tables, shall be a non-marring material at least 1 inch dia. to prevent indenting composition flooring and shall have at least a 5/8 inch height adjustment. Use of metal buttons will not be acceptable.

2.07 MODULAR FREE STANDING LABORATORY WORKSTATION SYSTEM - METAL
   A. Features:
      1. Self-supporting modular laboratory workstations.
      2. Single-sided units.
      3. Adjustable height stainless steel worksurface.
      4. Integrated shelving systems.
   B. Freestanding Workstation System: comprised of Work Surface Support Frames adjustable from 31” to 37” AFF, and a Rear Frame Support Structure, single-sided, incorporating a vertical post and horizontal support. The vertical supports shall incorporate individual slots for adjustable shelving and accessories. The vertical support shall incorporate a chase for plumbing and wiring of services.
      1. Worksurface Support Frame:
         a. The frame shall be a welded four sided assembly consisting of 11 gauge steel channel formations, front adjustable height legs, and rear attachment collars.
         b. Adjustable height shall be 31” to 37” AFF including 1” work surface.
         c. Front leg members shall be 11 gauge steel tubes, 2” outside diameter and 1.75” inner telescoping leg capable of vertical adjustment in 2” increments.
         d. Legs shall include non-marring, 3/8” diameter, levelers.
         e. Rear corners shall have 2.25” diameter x 6” high, 11 gauge half-round collars welded to the worksurface frame with supporting gussets and shall be mechanically fastened to the rear upright supports with Button Head Socket Cap Screws.
         f. Load rating shall be 100 lbs per linear foot. With uniformly distributed load, the maximum allowable deflection shall be .125” measured at the center of the front rail.
         g. A full length horizontal rear cabinet stop shall be located under the work surface frame to position 24” deep mobile base cabinets 1” behind the front edge of the work surface.
2. Single-sided Rear Frame Support Structure:
   a. The rear frame support structure shall be 84” in height and available in nominal lengths of 42”, 48”, 60”, 72”, and 96”.
   b. Rear frame support structures shall consist of two (2) 2” diameter tube vertical members, with horizontal framing members that incorporate upper and lower horizontal cross rails.
   c. Vertical members shall include non-marring, 3/8” diameter, levelers.
   d. All rear frame support structures in widths of 60” wide and over shall have a center support to accommodate split shelving.
   e. The vertical members shall have shelf/accessory slots punched on 1” increments on the front starting at 55” above AFF to top of upright.

C. Adjustable Shelving:
   1. Adjustable Shelves shall be supported by 11 gauge brackets which mount to the slots in the rear frame support structure. They shall be adjustable in height on 1” increments.
   2. Shelves shall be available in depths of 9”, 12”, and 15” and nominal lengths of 21”, 24”, 30”, 36”, 42” and 48” to match the slots on the rear frame support structure.
   3. Shelf Materials:
      a. Steel shelves shall be 16 gauge steel, formed down 1” then returned back and up into a channel formation. They shall attach to the shelf brackets without additional hardware or adhesive and shall be installable without tools. Steel shelves are available with a steel retaining lip on the front and/or rear.

D. Worksurface:
   1. See 2.08.B

2.08 WORK SURFACES

A. General:
   1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated.
   2. Provide holes and cutouts for service fixtures, service fittings, and service outlets.
   3. Fabrication tolerances:
      a. Size:
         1) Length: +/- 1/16 inch.
         2) Width: +/- 1/16 inch.
         3) Thickness: +/- 1/16 inch.
      b. Cutouts:
         1) Sinks: +/- 1/8 inch.
         2) Service drilling: + 1/8 inch, - 0 inch.

B. Stainless Steel Work Surface:
   1. Material: 14 ga, Type 304 stainless steel, No. 4 finish.
   2. Edge Thickness: 1 inch thick at exposed edges.
   3. Fabrication:
      a. Fabricate stainless steel work surface without plywood backing board.
      b. Top surface and edges shall be one piece without seams or joints.
      c. Reinforcing: Steel channels welded to underside of work surface to prevent twisting, oil canning, and buckling.
      d. Edge Fabrication:
         1) Square Edge:
            (a) Form tops with 1 inch high edge and 1/2 inch return flange.
(b) Edge Reinforcement: 16 gauge stainless steel channel welded to return flange and underside of top surface.
(c) Provide continuous sealant to cover seams between reinforced channel and edge of return flange.

e. Sound deadening: 1/8 inch thick heat resistant material to prevent condensation and deaden sound. Do not apply to exposed surfaces.

2.09 LABORATORY SINKS
A. General:
1. Existing to remain

2.10 LABORATORY SERVICE FITTINGS
A. Manufacturers:
1. Speakman: speakman.com, Basis of Design
2. Prior Approved Equal from one of:
   c. Chicago Faucet Company: www.chicagofaucets.com
B. General Requirements:
1. Provide fittings comply with SEFA 7, and NSF 61.
2. Provide fittings complete with washers, locknuts, wall flanges, deck flanges, escutcheons, and other installation accessories.
3. Mount in existing worksurface penetration.
4. Provide with thermal mixing valve mounted beneath sink, see Plumbing Specification.
5. Adjust psi of eyewash to empty into sink basin.
C. Materials:
D. Service Indexes Color and Identification Code: Per SEFA standard and as listed below:
1. Cold Water Color: Dark Green, Code: CW
2. Hot Water Color: Red, Code: HW
E. Fabrication:
1. Water Service Fittings (Faucets and valves):
   b. Meet requirements of ANSI/ASME A112.18.1M.
F. Service Fittings Schedule:
1. HCW-EW1: Hot/Cold Water Mixing Faucet with Integral Eyewash, Deck Mounted.
   a. Features: 8 inch spread, rigid gooseneck, vacuum breaker; 4 inch wrist blade handles.
   b. Speakman Model SEF-1850-8-4WH

2.11 ACCESSORIES
A. Stainless Steel Pegboards:
1. Pegboard:
   a. Size: 20 inch wide by 29 inch high.
   b. Material: 20 gauge, Type 304 stainless steel, No. 4 finish.
   c. One-piece body with integral 4 inch drip trough.
   d. Front face of board shall have multiple T-shape holes to accommodate pegs.
2. Pegs: Removable 1/2 inch diameter, 6 inches long, white polypropylene. Mounted 45-degrees.
3. Drip trough shall have drain tube connector.
4. Provide each wall mounted unit with wall hanger and stabilizer bracket kit.
5. Accessories: Tygon drain tube to sink.

PART 3 EXECUTION

3.01 EXAMINATION

A. Floors shall be level to within 1/4 inch in 10 feet, noncumulative, in any one direction.
B. Final floor finish shall be completed prior to casework installation.
C. The ceiling system shall be in place including suspension grid and ceiling panels except at fume hoods and utility umbilical drops at island benches.
D. The ceiling system shall be in place including finishes of gypsum board.
E. Branch electrical circuits, including grounding conductors, shall be in place.
F. HVAC grilles, call systems, and sprinkler heads shall be installed.
G. Overhead electrical fixtures shall be installed and connected. Provide adequate lighting for installation of casework.
H. Overhead mechanical lines shall be tested for leaks before finished casework is installed in any area.
I. Where mechanical, electrical and HVAC service lines will be behind or under casework, service access or stubs shall have been installed at the appropriate rough-in point.
J. Service lines for water, gas, vacuum, and special gases shall be flushed clean of dirt and chips, capped and tested for leaks prior to the connection of service fittings.
K. No standing water shall be evident on the floor. Water producing operations such as masonry, terrazzo, and plaster shall be completed and cured prior to casework installation.

3.02 CASEWORK INSTALLATION

A. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.03 WORK SURFACE INSTALLATION

A. Alignment: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection.
B. Installation Tolerances:
   1. Level: +/- 1/8 inch in 10 feet, noncumulative.
   2. Front edges of all abutting units shall align.
   3. Visible gaps at cutouts with escutcheon or grommet: None.

3.04 SERVICE FIXTURES AND FITTINGS INSTALLATION

A. Refer to the mechanical Specifications for final connection of plumbing fixtures and fittings.

3.05 ACCESSORY INSTALLATION

A. Install in a precise manner in accordance with manufacturer's directions.
B. Turn screws to a flat seat; do not drive.
C. Adjust moving parts to operate freely without excessive bind.
3.06 INTERFACE WITH OTHER WORK
   A. Where access is required through items of laboratory casework, remove access panels, drawers, and other components, where they occur; make connections; and replace components.
   B. Perform field inspection and testing in accordance with Section 01400.

3.07 ADJUSTING
   A. Adjust hardware and fittings for smooth operation.

3.08 CLEANING AND PROTECTION
   A. Clean shop-finished surfaces, touch-up and remove or refinish damaged or soiled areas, as acceptable to Architect.
   B. Clean and polish stainless steel countertops.
   C. Protection: Protect materials and installed laboratory casework and fixtures from subsequent construction operations.
   D. Laboratory casework and counters are not to be used as workbenches or work platforms for any portion of the work by any trade. Furniture and casework, as installed, is considered to be finished equipment and shall be protected from damage.
   E. Repair or remove and replace defective work as directed by the Architect upon completion of installation.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes mechanical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

1.3 REFERENCES

A. The mechanical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:

1. AABC – Associated Air Balance Council.
2. ABMA – American Boiler Manufacturers Association.
4. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers.
7. CGA – Compressed Gas Association.
8. CSA – Canadian Standards Association.
9. FMG – Factory Mutual Global Technologies LLC.
10. HI – Hydraulic Institute.
11. ITSNA – Intertek Testing Services NA.
16. NEMA – National Electrical Manufacturer’s Association.
17. SMACNA – Sheet Metal and Air Conditioning Contractors National Association.
18. UL – Underwriter’s Laboratories, Inc.

1.4 PERFORMANCE REQUIREMENTS
A. Systems Components Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

1.5 QUALITY ASSURANCE
A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating, and Air Conditioning Sections and as indicated on Drawings.

B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.
1. Notify the Architect/Engineer in writing before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations.
2. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to A/E, the Contractor shall bear all costs arising from corrective measures.
3. No contract sum adjustments or contract time extensions will be made for Contractor claims arising from conditions which were or could have been observable, ascertainable or reasonable foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.

C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.

D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.

E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.

F. Sequence and Schedule: Work so as to avoid interference with the work of other trades. Be responsible for removing and relocating any work which in the opinion of the Owner’s Representatives causes interference.

G. Labeling Requirement for Packaged Equipment: Electrical panels on packaged mechanical equipment shall bear UL label or label of other Nationally Recognized Testing Laboratory (NRTL) (ITSNA, CSA, etc.).
1.6 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for Mechanical Work shall be secured and paid for by the Contractor. All Work shall conform to all applicable codes, rules and regulations.

B. Rules of local utility companies shall be complied with. Check with each utility company supplying service to the installation and determine all devices including, but not limited to, all valves, meter boxes, and meters which will be required and include the cost of all such items in proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

D. The purchase of potable water meters and the cost of the associated assessment fees shall be the responsibility of the University of Michigan; however, installation of the meter shall be by the City of Ann Arbor. The Contractor shall be responsible for obtaining all necessary permits.

1.7 DRAWINGS

A. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The Architectural and Structural Drawings take precedence in all matters pertaining to the building structure, Mechanical Drawings in all matters pertaining to Mechanical Trades and Electrical Drawings in all matters pertaining to Electrical Trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.8 MATERIAL AND EQUIPMENT MANUFACTURERS

A. Equipment: All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.
C. All package unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the Mechanical and Electrical Specifications.

D. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment scheduled on the Drawings. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified with no additional cost to project. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1. Where equipment changes are made that involve additional Electrical Work (larger size motor, additional wiring of equipment, etc.) the Mechanical Trades involved shall compensate the Electrical Trades for the cost of the additional Work required.

1.9 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

1.10 ITEMS REQUIRING PRIOR APPROVAL

A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, piping, sheet metal, electrical, replacement of other components, and building alterations shall be included in the original bid.

B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid, but will not affect the awarding of the contract.

1.11 SUBMITTALS

A. Submit project specific submittals for review in compliance with Division 1.

B. Prepare shop drawings to scale for the Architect/Engineer for review. Equipment and material submittals required are indicated in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating and Air Conditioning Sections. Refer to Division 1 for submittal quantities.

C. All submittals shall be submitted in groupings of similar and/or related items. Plumbing fixture submittals shall be submitted as one package including all fixtures intended to be used for this project. Incomplete submittal groupings will be returned “Rejected”. Submit shop drawing with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
D. All submittals shall be project specific. Standard detail drawings and schedule not clearly indicating which data is associated with this Project will be returned “Rejected”.

E. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.

F. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.

G. Submit detailed shop drawings of piping systems showing pipe routing and types and locations of all pipe hangers.

H. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

1.12 COORDINATION DRAWINGS
A. Submit project specified coordination drawings for review in compliance with Division 1 Specification Sections.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS
A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 1 Specification Sections.

B. Provide complete operation and maintenance instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for Owner and shall be bound in ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

C. Operation and maintenance instructional manuals shall be submitted a minimum of four (4) weeks prior to functional testing.

D. The operating and maintenance instructions shall include a brief, general description for all mechanical systems including, but not limited to:
   1. Routine maintenance procedures.
   2. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.
   3. Trouble-shooting procedures.
   4. Contractor's telephone numbers for warranty repair service.
   5. Submittals.
   6. Recommended spare parts lists.
   7. Names and telephone numbers of major material suppliers and subcontractors.
   8. System schematic drawings on 8-1/2" x 11" sheets.

1.14 RECORD DRAWINGS
A. Submit record drawings in compliance with Division 1.

B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or mylar which have been neatly marked to represent as-built conditions for all new mechanical work.
C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

1.15 INSTRUCTION OF OWNER PERSONNEL
A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of mechanical equipment and systems at agreed upon times. A minimum of 24 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
D. In addition to individual equipment training provide overview of each mechanical system. Utilize the as-built documents for this overview.
E. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

1.16 WARRANTY
A. Warranty: Comply with the requirements in Division 1 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner’s satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
B. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

PART 2 - PRODUCTS
Not Applicable

PART 3 - EXECUTION
3.1 MECHANICAL DEMOLITION WORK
A. All demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Include all items such as, but not limited to, existing piping, pumps, ductwork, supports and equipment where such items are not required for the proper operation of the modified system.
B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this Work.
C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner shall move and store these materials. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
D. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

E. Clean and flush the interior and exterior of all existing relocated equipment and its related piping, valves, and accessories that are to be reused of all mud, debris, pipe dope, oils, welding slag, loose mill scale, rust and other extraneous material so that the existing equipment and all accessories can be repainted and repaired as required to place in first-class working condition.

F. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling or at mains.

G. Provide sheet metal caps on ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation. Caps shall be of same material as service requiring such.

3.2 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.

C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.

D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement, if necessary, of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

3.3 TEMPORARY SERVICES

A. Provide temporary service as described in Division 1.

B. The existing building will be occupied during construction. Maintain mechanical services and provide necessary temporary connections and their removal at no additional expense.

3.4 WORK INVOLVING OTHER TRADES

A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in proposal.

3.5 ACCEPTANCE PROCEDURE

A. Upon successful completion of start-up and recalibration, but prior to building acceptance, substantial completion and commencement of warranties, the Architect/Engineer shall be requested in writing to observe the satisfactory operation of all mechanical control systems.

B. The Contractor shall demonstrate operation of equipment and control systems, including each individual component, to the Owner and Architect/Engineer.

C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect/Engineer for observation and approval.

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D. After all items on the punch list are corrected and formal approval of the mechanical systems is provided by the Architect/Engineer, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

E. Operation of the following systems shall be demonstrated:
   1. Air Handling Systems
   2. Heating Systems
   3. Compressed Air Systems
   4. Vacuum Systems
   5. Purified Water Systems
   6. Space Temperature Controls
   7. Lab Airflow Controls
   8. Exhaust Systems
SECTION 20 0510 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”

1.2 SUMMARY

A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheetmetal systems and equipment. This section supplements all other Division 20 Mechanical Sections, and Division 1 Specification Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

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B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. PE: Polyethylene plastic.
   4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Dielectric fittings.
   3. Mechanical sleeve seals.
   4. Escutcheons.

B. Welding certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Provide adequate weather protected storage space for all mechanical equipment and materials deliveries to the job site. Storage locations will be designated by the Owner’s Representative. Equipment stored in unprotected areas must be provided with temporary protection.
   1. Protect equipment and materials from theft, injury or damage.
   2. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
   3. Electrical equipment furnished by Mechanical Trades and installed by the Electrical Trades: Turn over to Electrical Trades in good condition, receive written confirmation of same.
   4. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
   5. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations. Coordinate with other trades to ensure accurate locations and sizes of mechanical spaces, chases, slots, shafts, recesses and openings.
B. Install Work to avoid interference with work of other trades including, but not limited to, Architectural and Electrical Trades. Remove and relocate any work that causes an interference at Contractor's expense.

C. The mechanical trades shall be responsible for all damage to other work caused by their work or through the neglect of their workers.
   1. All patching and repair of any such damaged work shall be performed by the trades which installed the work. The cost shall be paid by the Mechanical Trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
      1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS
   A. Refer to individual Division 20 piping Sections for pipe, tube, and fitting materials and joining methods.
   B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS
   A. Refer to individual Division 20 piping Sections for special joining materials not listed below.
   B. Unions: Pipe Size 2 Inches and Smaller:
      1. Ferrous pipe: Malleable iron ground joint type unions.
      2. Copper tube and pipe: Bronze unions with soldered joints.
   C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:
      2. Copper tube and pipe: Slip-on bronze flanges.
   D. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
      1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
         a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
         b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
      2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
   E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Square head bolts and nuts are not acceptable.
   F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
   G. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
   H. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
   I. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
2.4 PIPE THREAD COMPOUNDS

A. Pipe thread compounds for the fluid service compatible with piping materials provided.

B. Compounds for potable water service and similar applications acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.

C. Inorganic zinc-rich coatings or corrosion inhibited proprietary compounds for galvanized carbon steel systems to coat raw carbon steel surfaces, in lieu of subsequent painting.
   1. Manufacturers:
      a. Carboline "Carbo-Zinc 12."
      b. Tnemec.
      c. Koppers.

D. Use tetrafluoroethylene (Teflon) tape 2 to 3 mils thick for natural gas system threaded joints.
   1. Manufacturers:
      b. Permacel.
      c. Other approved.

2.5 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
   1. Manufacturers:
      b. Dresser Industries, Inc.; DMD Div.
      c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
      d. JCM Industries.
      e. Smith-Blair, Inc.
      f. Viking Johnson.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

2.6 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for domestic water 250-psig (1725-kPa) minimum working pressure at maximum 180 deg F (82 deg C) on piping sizes NPS 2 (DN 50) and smaller.
   1. Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Eclipse, Inc.
      d. Epco Sales, Inc.
      g. Zurn Industries, Inc.; Wilkins Div.
D. Brass Unions: For heating water systems up to 286 deg F (141 deg C), on piping sizes NPS 2 (DN 50) and smaller. As an option, brass unions may be used on all piping sizes NPS 2 (DN 50) and smaller.

E. Dielectric Flanges: For piping sizes NPS 2-1/2 (DN 65) and larger, factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

   1. Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Epco Sales, Inc.
      d. Watts Water Technologies, Inc.; Watts Regulator Co.

F. Dielectric-Flange Kits: For piping sizes NPS 2-1/2 (DN 65) and larger, companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Central Plastics Company.
      d. Pipeline Seal and Insulator, Inc.

   2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

   1. Manufacturers:
      a. Calpico, Inc.
      b. Lochinvar Corp.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

   1. Manufacturers:
      a. Perfection Corp.
      b. Precision Plumbing Products, Inc.
      c. Sioux Chief Manufacturing Co., Inc.
      d. Victaulic Co. of America.

2.7 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

   1. Manufacturers:
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.; Thunderline Link Seal.

   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

   3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 SLEEVES

A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall black.
B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall galvanized, plain ends.
C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

2.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping or Piping in High Humidity Areas: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping in Finished Spaces: One-piece, stamped-steel type.
      e. Bare Piping in Unfinished Service Spaces or Equipment Rooms: Split-plate, stamped-steel type with concealed hinge and set screw.
   2. Existing Piping: Use the following:
      a. Chrome-Plated Piping or Piping in High Humidity Areas: Split-casting, cast-brass type with chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
      c. Bare Piping: Split-plate, stamped-steel type with set screw or spring clips.

2.10 LEAK DETECTOR SOLUTION

A. Commercial leak detector solution for pipe system testing.
B. Manufacturers:

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 20 Sections specifying piping systems, and in accordance with manufacturer’s instructions.
B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. The Drawings shall be followed as closely as elements of construction will permit.
C. During the progress of construction, protect open ends of pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.

D. Provide dielectric connections wherever joining dissimilar metals.

E. Install piping to conserve building space and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Slope piping and arrange systems to drain at low points.

I. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel and light fixture removal.

L. Install valves with stems upright or horizontal, not inverted.

M. Provide clearance for installation of insulation and access to valves and fittings.

N. Install piping to permit valve and equipment servicing. Do not install piping below valves and/or terminal equipment. Do not install piping above electrical equipment.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install piping to allow application of insulation.

R. Select system components with pressure rating equal to or greater than system operating pressure.

S. After completion, fill, clean, and treat systems. Refer to Division 23 Sections “Hydronic Piping”.

T. Install escutcheons for penetrations of walls below ceiling, and ceilings.

U. Install sleeves for pipes passing through walls, partitions, and floor slabs.
   1. Cut sleeves to length for mounting flush with both surfaces of walls.
      a. Exception: Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
   2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Schedule 40 Black Steel Sleeves: For pipes smaller than NPS 12 penetrating interior walls.
      b. Schedule 40 Galvanized Steel Sleeves: For pipes smaller than NPS 12 penetrating floors, and roof slabs.
      c. 0.375 Inch Wall Galvanized Steel Sleeves: For pipes NPS 12 and larger penetrating floors and roof slabs.
   3. Seal sleeves in concrete floors roof slabs and masonry walls with grout.
   4. Seal sleeves in plaster/gypsumboard partitions with plaster or dry wall compound and caulk with non-hardening silicone sealant to provide airtight installation.
5. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

V. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Specification Sections for materials.

W. Seal openings around pipes in sleeves and around duct openings through walls, floors and ceilings, and where floors, fire rated walls and smoke barriers are penetrated. Fire and/or smoke barriers shall be UL listed firestopping and shall have a fire rating equal to or greater than the penetrated barrier. Refer to Division 7 Specification Sections for materials.

X. Verify final equipment locations for roughing-in.

Y. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Cut piping square.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, oil, and debris from inside and outside of pipe and fittings before assembly.

E. Use standard long sweep pipe fittings for changes in direction. No mitered joints or field fabricated pipe bends will be permitted. Short radius elbows may be used where specified or specifically authorized by the Architect.

F. Make tee connections with screwed tee fittings, soldered fittings or specified welded connections. Make welded branch connections with either welding tees or forged branch outlet fittings in accordance with ASTM A234, ANSI B16.9 and ANSI B16.11. For forged branch outlets, furnish forged fittings flared for improved flow where attached to the run, reinforced against external strains and to full pipe-bursting strength requirements. "Fishmouth" connections are not acceptable.

G. Use eccentric reducers for drainage and venting of pipe lines; bushings are not permitted.

H. Provide pipe openings using fittings for all systems control devices, thermometers, gauges, etc. Drilling and tapping of pipe wall for connections is prohibited.

I. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


K. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
L. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on gaskets and bolt threads.
   1. Assemble flanged joints with fresh-stock gasket and hex head nuts, bolts or studs. Make clearance between flange faces such that the connections can be gasketed and bolted tight without strain on the piping system. Align flange faces parallel and bores concentric; center gaskets on the flange faces without projection into the bore.
   2. Lubricate bolts before assembly to insure uniform bolt stressing. Draw up and tighten bolts in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Do not mate a flange with a raised face to a companion flange with a flat face; machine the raised face down to a smooth matching surface and use a full face gasket. After the piping system has been tested and is in service at its maximum temperature, check bolting torque to provide required gasket stress.

M. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

N. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

O. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

P. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

Q. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.

3.3 EQUIPMENT CONNECTIONS
A. Make connections to equipment, fixtures, and other items included in the work in accordance with the submittals and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
   1. Any and all additional connections not shown on the drawings but shown on the equipment manufacturer’s submittal or required for the successful operation of the equipment shall be installed as part of this Contract at no additional charge to the Owner.

B. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

3.4 PIPING CONNECTIONS
A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, where indicated on drawings, at final connection to each piece of equipment and at all control valves.
   2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, where indicated on drawings, at final connection to each piece of equipment and at all control valves.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.


3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. For suspended equipment, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect for same including loads, locations and methods of attachment.

F. Equipment Rigging Over Roof Areas: Protect building structure against damage during equipment rigging. Make provisions to distribute load of equipment to main roof structure, and to prevent damage to roof decking, roofing, or purlins.

G. The Contract Documents indicate items to be purchased and installed. The items are noted by a manufacturer’s name, catalog number and/or brief description. The catalog number may not designate all the accessory parts for a particular application. Arrange with the manufacturer for the purchase of all items required for a complete installation.

3.6 CUTTING, CORING AND PATCHING

A. Refer to Division 1 Specification Sections for requirements for cutting, coring, patching and refinishing work necessary for the installation of mechanical work.

B. All cutting, coring, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.7 FLASHING

A. Provide all flashing required for mechanical work. Refer to Division 7 Specification Sections.

3.8 LUBRICATION

A. Provide all lubrication for the operation of the equipment until acceptance by the Owner. Contractor is responsible for all damage to bearings up to the date of acceptance of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

3.9 FILTERS

A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified.

B. Immediately prior to final building acceptance by the Owner, Contractor shall:
   1. Replace 4” 95% carbon filter pre-filter with new unit.
3.10 CLEANING
A. Each Mechanical Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.
B. Flushing, cleaning, and disinfection of domestic water piping is specified in Division 22 Section “Domestic Water Piping.”
C. Exterior surfaces of all piping, ductwork and equipment shall be wiped down to remove excess dirt and debris prior to concealment by Architectural Trades work.
D. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the Owner.

END OF SECTION
SECTION 20 0523 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 20 Section "Mechanical Identification" for valve tags and charts.
   2. Division 20 piping Sections for specialty valves applicable to those Sections only.
   3. Division 23 Section "Temperature Controls" for control valves and actuators.

1.2 DEFINITIONS

A. The following are standard abbreviations for valves:
   1. CWP: Cold working pressure.
   2. EPDM: Ethylene-propylene-diene terpolymer rubber.
   3. NBR: Acrylonitrile-butadiene rubber.
   4. NRS: Nonrising stem.
   5. OS&Y: Outside screw and yoke.
   6. PTFE: Polytetrafluoroethylene plastic.
   7. RPTFE: Reinforced polytetrafluoroethylene plastic.
   8. SWP: Steam working pressure.
   9. TFE: Tetrafluoroethylene plastic.
  10. WOG: Water, oil, and gas.

1.3 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.4 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.
   1. Exceptions: Domestic hot- and cold-water, and sanitary waste piping valves unless referenced.
B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.
B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS
2.1 VALVES, GENERAL
A. Refer to Part 3 "Valve Applications" Article for applications of valves.
B. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
C. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated. Solder joint valves may be used for copper piped systems.
D. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
G. Valve Actuators:
   1. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
H. Extended Valve Stems: On insulated valves.
J. Solder Joint: With sockets according to ASME B16.18.
   1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.
K. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES
A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.
B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, soldered or threaded ends; and 150 psig (1034 kPa) SWP and 600-psig (4140-kPa) CWP ratings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.; Apollo Div.; Series 70-140.
   b. Crane Valve Group; Crane Valves.
   c. Metso Automation; Jamesbury Valves.
   d. Milwaukee Valve Company; Model BA100S.
   e. NIBCO INC.; Models S-580-70-66 or T-580-70-66.
   f. Watts Water Technologies, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
      1. Proceed with installation only after unsatisfactory conditions have been corrected.
   B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
   C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
   D. Examine threads on valve and mating pipe for form and cleanliness.
   E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS
   A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
      1. Shutoff Service: Ball valves.
   B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
   C. Select valves, except wafer and flangeless types, with the following end connections:
      1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends heating hot water services.
      2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged, solder-joint, or threaded ends.
   D. Low-Pressure, Compressed-Air Piping Operating at Pressures of 125 psig (860 kPa) and Less: Use the following types of valves:
      1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, bronze.
   E. Domestic Water Piping: Use the following types of valves:
      1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, bronze.
   F. Heating Water Piping: Use the following types of valves:
      1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, bronze.
3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 20, 22, 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves may be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.

E. Install valves in position to allow full stem movement.

3.4 JOINT CONSTRUCTION

A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION
SECTION 20 0529 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Division 20 Section “Mechanical General Requirements.”
   3. Division 20 Section “Basic Mechanical Materials and Methods.”
   4. Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.
   5. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.2 DEFINITIONS
A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."
C. MFMA: Metal Framing Manufacturers Association.

1.3 PERFORMANCE REQUIREMENTS
A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
1.4 SUBMITTALS
   A. Product Data: For the following:
      1. Steel pipe hangers and supports.
      2. Thermal-hanger shield inserts.
   B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
      1. Trapeze pipe hangers. Include Product Data for components.
      2. Metal framing systems. Include Product Data for components.
      3. Pipe stands. Include Product Data for components.
      4. Equipment supports.
   C. Welding certificates.

1.5 QUALITY ASSURANCE
   A. Welding: Qualify procedures and personnel according to the following:
      1. AWS D1.1, "Structural Welding Code--Steel."
      4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
      5. ASME Boiler and Pressure Vessel Code: Section IX.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 HANGER ROD MATERIAL
   A. Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575.
      1. Rod continuously threaded.
      2. Use of rod couplings is prohibited.

2.3 STEEL PIPE HANGERS AND SUPPORTS
   A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
   B. Manufacturers:
      1. Anvil International, Inc.
      2. B-Line Systems, Inc.; a division of Cooper Industries.
      3. Carpenter & Paterson, Inc.
      4. Hilti USA.
      5. ERICO International Corp.
      6. PHD Manufacturing, Inc.
      7. Tolco; a brand of Nibco.
   C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.
2.4 TRAPEZE PIPE HANGERS
   A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS
   A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
   B. Manufacturers:
      2. B-Line Systems, Inc.; a division of Cooper Industries.
      4. Unistrut Corp.; Tyco International, Ltd.
      5. Hilti USA.
      6. Tolco; a brand of Nibco; TOLStrut.
   C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
   D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 FASTENER SYSTEMS
   A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
      1. Manufacturers:
         b. Empire Industries, Inc.
         c. Hilti, Inc.
         d. ITW Ramset/Red Head.
         e. MKT Fastening, LLC.
         f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS
   A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS
   A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
      2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION
3.1 HANGER AND SUPPORT APPLICATIONS
   A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
   B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
   C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
D. Use padded hangers for piping that is subject to scratching.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Single Pipes
      a. Support uninsulated pipe up to NPS 4 (DN 100) size with TYPE 1 or TYPE 10 attachments.
      b. Support uninsulated pipe NPS 6 (DN 150) size through NPS 12 (DN 300) size with TYPE 1 attachments.
      c. Support insulated pipe up to NPS 2 (DN 50) size with Type 1 attachments and insulation shield.
      d. Support insulated hot piping up to and including NPS 2-1/2 (DN 65) size, and all other insulated piping NPS 2-1/2 (DN 65) to NPS 12 (DN 300) size with TYPE 1 attachment with pre-insulated shield/support.
      e. Support insulated hot piping NPS 3 (DN 75) size through NPS 12 (DN 300) size with roller hangers TYPES 41, 43, 44 or 46 with pre-insulated shield/support designed for use with a pipe roller.

   2. Parallel Pipes:
      a. Fabricate trapeze hangers from approved structural steel shapes in accordance with “Miscellaneous Materials” requirements or use commercially available proprietary design, rolled steel. Refer to applicable requirements for “Single Pipes” and “Metal Fabrications.”

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. MSS Type 8 or spring type to meet system requirements.

G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Beam Clamps
      a. Center Loading: TYPE 21, 28, 29 and 30, unless otherwise indicated. Type 27 shall be allowed to support single pipes NPS 6 (DN 150) size or smaller only.
      b. "C" Clamps: Type 19, 20 or 23, for supporting single pipes NPS 2-1/2 (DN 65) size or smaller only. Use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting multiple pipes or pipes larger than NPS 2-1/2 (DN 65).

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields: 360 degree Type, of length recommended in writing by manufacturer to prevent crushing insulation. Use for insulated piping sized NPS 2 (DN 50) and smaller when supported on trapeze hangers.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation. Use for insulated piping sized NPS 2 (DN 50) and smaller.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe. Use for insulated piping sized NPS 2-1/2 (DN 65) and larger.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structural frame.

B. Provide necessary piping and equipment supporting elements including: building structure attachments, supplementary steel, hanger rods, stanchions and fixtures, vertical pipe attachments, horizontal pipe attachments, anchors, guides, spring supports in accordance with the referenced codes, standards, and requirements specified. Support piping and equipment from building structure, not from roof deck, floor slab, other pipe, duct or equipment.

C. At connections between piping systems, hangers and equipment of dissimilar metals, insulate, using dielectric insulating material, nonferrous piping against direct contact with the building steel by insulating the contact point of the hanger and pipe or the hanger and building steel. Test each point of dielectric insulation with an ohm meter to ensure proper isolation of dissimilar materials. Test shall be observed by the Owner's Representative and/or Architect.

D. Use copper plated or plastic coated supporting element in contact with copper tubing or glass piping.

E. File and paint cut ends and shop or field prime paint supporting element components.

F. Hang piping parallel with the lines of the building, unless otherwise indicated. Route piping in an orderly manner and maintain gradient. Space piping and components so a threaded pipe fitting may be removed between adjacent pipes and so there will be not less than 1/2 inch of clear space between finished surfaces and piping. Arrange hangers on adjacent parallel service lines in line with each other.

G. Flange loads on connected equipment shall not exceed 75 percent of maximum allowed by equipment manufacturer. Flange loads in liquid containing systems shall be checked in the presence of the Architect when piping is full of liquid. No flange load is allowed on pumps, vibration isolated equipment or flexible connectors.

H. Where necessary, brace piping and supports against reaction, sway and vibration.

I. Do not hang piping from, floor decks, roof decks, equipment, ductwork, or other piping.

J. Install turnbuckles, swing eyes and clevises to accommodate temperature changes, pipe accessibility, and adjustment for load pitch. Rod couplings are not acceptable.

K. Install hangers and supports for piping at intervals specified, at locations not more than 3 feet from the ends of each runout, not more than 3 feet from connections to equipment, and not over...
25 percent of specified interval from each change in direction of piping and for concentrated loads such as valves, etc.

L. Base the load rating for pipe support elements on loads imposed by insulated weight of pipe filled with water. The span deflection shall not exceed slope gradient of pipe.

M. Support vertical risers independently of connected horizontal piping whenever practical, with supports at the base and at intervals to accommodate system range of load with thermal conditions. Support vertical risers at each floor penetration for piping in shafts or chases. Guide for lateral stability. Fit horizontal piping connected to moving risers with two spring supports connected adjacent to riser, spaced according to required hanger spacing.

N. For risers at temperatures of 100 deg F or less place riser clamps under fittings. Support carbon steel pipe at each operating level or floor and at not more than 15-foot intervals for pipe 2 inches and smaller, and at not more than 20 foot intervals for pipe 2-1/2 inches and larger.

O. After the piping systems have been installed, tested and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.

P. Where eccentric loading beam clamps are approved and where other work is supported by similar eccentric loading support element from the same structural member, locate eccentric loading support elements to minimize structural member torsion load.

Q. Limit the location of supporting elements for piping and equipment, when supported from roof, to panel points of the bar joists.

R. Building structure shall not be reinforced except as approved by the Architect in writing.

S. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

T. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

U. Fastener System Installation: Install fasteners according to manufacturer's written instructions.

V. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


X. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

Y. Install lateral bracing with pipe hangers and supports to prevent swaying.

Z. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping.

AA. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
BB. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

CC. Insulated Piping: Comply with the following:
1. Pipe smaller than NPS 2 (DN 50): Install adjustable swivel ring or clevis type hangers with protection shield.
2. Cold Pipe NPS 2-1/2 (DN 65) and larger: Install clevis type hangers with thermal hanger shields.
3. Hot Pipe NPS 2-1/2 through NPS 5 (DN 65 through DN 125): Install single rod roller hanger with thermal hanger shield.
4. Hot Pipe NPS 6 (DN 50) and larger: Install 2-rod roller hanger with thermal hanger shield.
5. Trapeze Supported Pipe NPS 2 (DN 50) and smaller: Install with protection shield and secure to trapeze support with standard U-bolts and locknuts.
6. Trapeze Supported Cold Pipe NPS 2-1/2 (DN 65) and larger: Install with thermal hanger shield and secure to trapeze support with standard U-bolts and locknuts.
7. Trapeze Supported Hot Pipe NPS 2-1/2 (DN 65) and larger: Install thermal hanger shield and cradle pipe in adjustable cast iron roller support.

DD. Refer to individual piping sections for hanger spacing and hanger rod sizes.

3.3 EQUIPMENT SUPPORTS
A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS
A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING
A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

END OF SECTION
Wayne State University  20 0553-1
Elliman Research Building - RI Fume Hood Relocation  MECHANICAL IDENTIFICATION
WSU Project No. 629-304592

SECTION 20 0553 - MECHANICAL IDENTIFICATION

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PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples: For color, letter style, and graphic representation required for each identification material and device.
C. Valve numbering scheme.
D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in Maintenance Manuals.

1.3 QUALITY ASSURANCE

1.4 COORDINATION
A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with location of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
   1. Seton.
   2. Brady.
   3. EMED.
   5. Brimar Industries, Inc.

2.2 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
   1. Terminology: Match schedules as closely as possible.
   2. Data:
      a. Name and plan number.
      b. Equipment service.
      c. Design capacity.
      d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
   3. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

2.3 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME (ANSI) A13.1, unless otherwise indicated.
   2. Type and Size of Letters: Comply with ANSI A13.1, unless otherwise indicated.
   3. Legends: Spelled out in full or commonly used and accepted abbreviations.
   4. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
   5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

2.4 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Vinyl, 2-inch minimum character height, with permanent pressure sensitive adhesive. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust).

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, DO NOT OPERATE, and EQUIPMENT STARTED AND STOPPED BY BUILDING AUTOMATION SYSTEM.
PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL
   A. Products specified are for applications referenced in other Division 20, 22, 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION
   A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
      1. Fans, filters, terminal units.
   B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
      1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
      2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
      3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
         a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
         b. Fire department hose valves and hose stations.
         c. Meters, gages, thermometers, and similar units.
         d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
         e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
         f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
         g. Fans, blowers, primary balancing dampers, and mixing boxes.
         h. Packaged HVAC central-station and zone-type units.
         i. Tanks and pressure vessels.
         j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
   C. Area Served: Equipment serving different areas of a building other than where the equipment is installed shall be permanently marked in a manner that, in addition to identifying the equipment as specified in this Section, also identifies the area it serves.

3.3 PIPING IDENTIFICATION
   A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
      1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 3/4 inch (19 mm) wide, lapped at least 1-1/2 inches (38 mm) at both ends of pipe marker, and covering full circumference of pipe.
   B. Locate pipe markers as follows:
      1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced at maximum intervals of 25 feet (15 m) along each run.

3.4 DUCT IDENTIFICATION
A. Identify ductwork with vinyl markers and flow direction arrows.
B. Locate markers at air handling units, each side of floor and wall penetrations, near points where ducts enter into concealed spaces and at maximum intervals of 25 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 WARNING-TAG INSTALLATION
A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 ADJUSTING
A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.7 CLEANING
A. Clean faces of mechanical identification devices and glass frames of valve schedules.

3.8 SCHEDULES

PIPE LABELING AND COLOR CODING

<table>
<thead>
<tr>
<th>Pipe System Label</th>
<th>Drawing Abbrev.</th>
<th>Labels</th>
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</thead>
<tbody>
<tr>
<td>Sanitary Sewer</td>
<td>SAN</td>
<td>White on Green</td>
</tr>
<tr>
<td>Sanitary Vent</td>
<td>V</td>
<td>White on Green</td>
</tr>
<tr>
<td>Acid Waste</td>
<td>AW</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Acid Vent</td>
<td>AV</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>CW</td>
<td>White on Green</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>HW</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Domestic Hot Water Return</td>
<td>HWR</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>G</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>A</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Laboratory Vacuum</td>
<td>LVAC</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Reverse Osmosis Water</td>
<td>RO</td>
<td>White on Green</td>
</tr>
<tr>
<td>Hot Water Htg. Supply</td>
<td>HWHS</td>
<td>Black on Yellow</td>
</tr>
<tr>
<td>Hot Water Htg. Return</td>
<td>HWHR</td>
<td>Black on Yellow</td>
</tr>
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</table>

SHEET METAL WORK

<table>
<thead>
<tr>
<th>Service</th>
<th>Abbrev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning Supply</td>
<td>Supply Air</td>
</tr>
<tr>
<td>Exhaust Systems</td>
<td>Exhaust Air</td>
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<tr>
<td>Radiation Hood Exhaust</td>
<td>Radiation Hood Exhaust</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section “Basic Materials and Methods.”
   3. Division 20 Section “Hanger and Supports” for thermal hanger shield inserts.

1.2 SUMMARY
A. This Section includes mechanical insulation for pipe, duct, and equipment.

1.3 DEFINITIONS
A. ASJ: All-service jacket.
B. FSK: Foil, scrim, kraft paper.
C. FSP: Foil, scrim, polyethylene.
D. PVC: Polyvinyl Chloride.
E. PVDC: Polyvinylidene chloride.
F. SSL: Self-sealing lap.

1.4 PIPING INSULATION SYSTEMS DESCRIPTION, GENERAL
A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Fire-suppression piping.
   2. Laboratory gas and vacuum piping.
   3. Fuel gas piping.
   4. RO water piping.

1.5 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION
A. Domestic Cold Water and Non-Potable Cold Water:
   1. All Pipe Sizes: Insulation shall be either of the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Glass-Fiber Pipe Insulation, Type I: 1 inch thick.
B. Domestic Hot and Recirculated Hot Water:
   1. All Pipe Sizes: Insulation shall be either of the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Glass-Fiber Pipe Insulation, Type I: 1 inch thick.
C. Heating-Hot-Water Supply and Return, 200 Deg F and below:
   1. NPS 3 and Smaller: Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

1.6 DUCT INSULATION SYSTEMS DESCRIPTION, GENERAL
A. Plenums and Ducts Requiring Insulation:
   1. Indoor supply, including around duct mounted coils and air terminal unit coil sections.
B. Plenums, Ducts and Duct Accessories Not Insulated:
   1. Exhaust ductwork

1.7 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION
A. HVAC Duct insulation in conditioned spaces and indirectly conditioned spaces shall be:

1.8 SUBMITTALS
A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
B. Shop Drawings: Show details for the following:
   1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   3. Field application for each equipment type
1.9 QUALITY ASSURANCE
A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.10 DELIVERY, STORAGE, AND HANDLING
A. Prior to installation, protect insulation from exposure to water and from physical damage. Prior to installation, store insulation in manufacturer’s original packaging.

1.11 COORDINATION
A. Coordinate size and location of supports, hangers, and pre-insulated pipe shields/supports specified in Division 20 Section "Hangers and Supports."
B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.12 SCHEDULING
A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS
2.1 INSULATION MATERIALS, GENERAL REQUIREMENTS
A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
D. Adhesives used shall be fire resistant in their dry states and UL listed.

2.2 PIPE INSULATION MATERIALS
A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Armacell LLC; AP Armaflex.
      b. Nomaco K-Flex; Insul-Tube and Insul-Sheet.
B. Glass-Fiber, Preformed Pipe Insulation, Type I:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000 Pipe Insulation.
c. Manson Insulation Inc.; Alley-K.
d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Thermal Ceramics; FireMaster FastWrap+.
   b. 3M; Fire Barrier Wrap Products.
   c. Unifrax Corporation; FyreWrap.

2.4 DUCTWORK INSULATION MATERIALS

A. Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. CertainTeed Corp.; Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap FSK.
   e. Owens Corning; All-Service Duct Wrap.

2.5 SEALANTS

A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the products specified.
   a. Childers Products, H.B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.


6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation systems indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 TAPES
A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
      b. Compac Corp.; 130.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
      d. Venture Tape; 1506 CW NS.
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at the 4 o’clock or 8 o’clock position on horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive as recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install thermal hanger insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover thermal hanger inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at the 4 o’clock or 8 o’clock position on the pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness. Where compression of insulation is possible, fabricate/install insulation per manufacturer’s recommendations.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   5. Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations that Are Not Fire Rated: Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations:
   1. Install pipe insulation continuously through penetrations of fire-rated walls and partitions.
      a. Firestopping is specified in Division 7 Section “Through-Penetration Firestop Systems.”

D. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
      a. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible Elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

3.6 FLEXIBLE ELASTOMERIC PIPE INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 GLASS-FIBER PIPE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install PVC fitting covers when available.
   2. When PVC fitting covers are not available, install preformed pipe insulation to outer diameter of pipe flange:
      a. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
      b. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass or mineral wool blanket insulation as specified for system.
   3. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install PVC fitting covers when available.
   2. When PVC fitting covers are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install PVC fitting covers when available.
   2. When PVC fitting covers are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.8 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions. Adhesive may be omitted from top surface of horizontal rectangular ducts.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not over compress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION
SECTION 22 4200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section “Basic Mechanical Materials and Methods.”
   3. Division 22 Section “Chemical Waste Piping”
   4. Division 22 Section "Emergency Plumbing Fixtures."
   5. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers; individual-fixture, water tempering valves; and specialty fixtures not included in this Section.
   6. Division 22 Section “Drainage Piping Specialties” for floor drains, and specialty fixtures not included in this Section.

1.2 DEFINITIONS
B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
F. FRP: Fiberglass-reinforced plastic.
G. PMMA: Polymethyl methacrylate (acrylic) plastic.
H. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Operation and Maintenance Data: For plumbing fixtures and trim to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.


D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with applicable ANSI, ASME, ASSE, ASTM, ICC, NSF, and UL standards and other requirements specified for plumbing fixtures, trim, fittings, components, and features.

PART 2 - PRODUCTS

2.1 ARCHITECT-FURNISHED FIXTURES

A. Provide supply connections to faucets with stop valves. Provide direct-connected drain piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) acid resistant plastic grid strainer, P-trap, and tubular waste to wall with wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixture’s trim, fittings, and other components according to manufacturers' written instructions.

B. Install counter-mounting fixtures in and attached to casework.

C. Install fixtures level and plumb according to roughing-in drawings. Install accessible fixtures at heights required by local codes.
D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

E. Install corrosion resistant trap and tubular waste piping on drain outlet of each fixture to be directly connected to acid waste drainage system.

3.3 CONNECTIONS
A. Piping installation requirements are specified in other Division 20, 22, 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect fixtures with water supplies, stops, and risers, and with traps, acid waste, and acid vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL
A. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
B. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING
A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
B. Adjust water pressure at faucets to produce proper flow and stream.
C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING
A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
   1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
   2. Remove sediment and debris from drains.
B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION
A. Provide protective covering for installed fixtures and fittings.
B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION
SECTION 22 5400 - EMERGENCY PLUMBING FIXTURES

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS
  A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
  B. Related Sections include the following:
     1. Division 20 Section “Mechanical General Requirements.”
     2. Division 20 Section “Basic Mechanical Materials and Methods.”
     3. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers and water filters.
     4. Division 22 Section "Drainage Piping Specialties" for floor drains and cleanouts.

1.2 DEFINITIONS
  A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
  B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
  C. Tepid: Moderately warm.

1.3 SUBMITTALS
  A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
  B. Shop Drawings: Diagram power, signal, and control wiring.
  C. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
  D. Field quality-control test reports.
  E. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.
1.4 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.
   D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 HAND-HELD DRENCH HOSES
   A. Architect furnished fixture:
      1. Provide supply connections from water tempering equipment to fixture:

2.2 WATER-TEMPERING EQUIPMENT
   A. Water-Tempering Equipment:
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         a. Armstrong International, Inc. (RADA)
         b. Bradley Corporation.
         c. Guardian Equipment Co.
         d. Haws Corporation.
         e. Lawler Manufacturing Co., Inc.; Model 911 E/F.
         f. Leonard Valve Company.
         g. Powers, a Watts Industries Co.; Model ES 150.
         h. Speakman Company.
      2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
         a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at a single emergency eyewash or eye/face wash fixture, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
         b. Coordinate mixing valve selection with fixture to be served.

2.3 SOURCE QUALITY CONTROL
   A. Certify performance of emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine roughing-in for piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
      1. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2  EMERGENCY PLUMBING FIXTURE INSTALLATION
   A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
   B. Install fixtures level and plumb.
   C. Fasten fixtures to substrate.
   D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific
type valve is not indicated. Install valves chained or locked in open position if permitted. Install
valves in locations where they can easily be reached for operation. Valves are specified in
Division 15 Section "Valves."
      1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes
         emergency plumbing fixture.
      2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by
         authorities having jurisdiction.
   E. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of
different metals. Dielectric fittings are specified in Division 15 Section "Basic Mechanical
Materials and Methods."
   F. Install thermometers in supply and outlet piping connections to water-tempering equipment.

3.3  CONNECTIONS
   A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate
general arrangement of piping, fittings, and specialties.
   B. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment.
      Connect output from water-tempering equipment to emergency plumbing fixtures. Locate
      tempering equipment in casework below fixture.

3.4  FIELD QUALITY CONTROL
   A. Mechanical-Component Testing: After plumbing connections have been made, test for
      compliance with requirements. Verify ability to achieve indicated capacities and temperatures.
   B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements
      are made.
   C. Report test results in writing.

3.5  ADJUSTING
   A. Adjust or replace fixture flow regulators for proper flow.
   B. Adjust equipment temperature settings.

END OF SECTION
SECTION 22 6113 - LABORATORY AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section “Basic Mechanical Materials and Methods.”
   3. Division 20 Section “Valves.”

1.2 SUMMARY
A. This Section includes piping for laboratory gases and vacuum, and related specialties.
   1. Laboratory Gases:
      a. Compressed-air.

1.3 DEFINITIONS
A. PTFE: Polytetrafluoroethylene plastic.
B. TFE: Tetrafluoroethylene plastic.
C. CGA: Compressed Gas Association.
D. BAS: Building Automation System.

1.4 PERFORMANCE REQUIREMENTS
A. General: Provide laboratory gas and vacuum piping systems that comply with NFPA 99, Level 4 requirements for materials and installation.
B. Components and installation shall be capable of withstanding the following minimum pressure, unless otherwise indicated:
   1. Laboratory Gas Piping: 125 psig (860 kPa).
   2. Laboratory Vacuum Piping: 15 psig (103 kPa).
   3. Laboratory CO2 Piping: 125 psig (860 kPa).

1.5 SYSTEMS DESCRIPTIONS

A. Laboratory Gas Piping Systems: Use tubing, fittings, and joining methods according to the following applications:
   1. Interior Laboratory Gas Pressure Piping: Use Type K, hard copper tubing, wrought copper pressure fittings, and brazed joints.

B. Drawings indicate valve types to be used for laboratory air and vacuum piping. If specific valve types are not indicated, the following requirements apply:
   1. Shutoff Valves NPS 3 (DN 80) and Smaller: Copper-alloy ball valve.
   2. Check Valves NPS 3 (DN 80) and Smaller: Bronze.

1.6 SUBMITTALS

A. Product Data: For the following:
   1. Laboratory gas and vacuum tubing and fittings.
   2. Laboratory gas and vacuum valves and valve boxes.

B. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

C. Piping Material Certification: Signed by Installer certifying that laboratory gas and vacuum piping materials comply with NFPA 99 requirements.

D. Qualification Data: For testing agency.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For laboratory gas and vacuum piping and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

B. Comply with NFPA 54, "National Fuel Gas Code."


D. Comply with UL 544, "Medical and Dental Equipment," for laboratory gas and vacuum specialties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBES, AND FITTINGS

A. Copper Tube: ASTM B 89, Type K or L, seamless, hard drawn tubing.
   1. Fittings:
2.3 JOINING MATERIALS

A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

B. Brazing Filler Metals: AWS A5.8, BCuP series alloys. Flux is prohibited unless used with bronze fittings.

C. Threaded-Joint Tape: PTFE.

D. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos free, and suitable for service.

2.4 VALVES

A. Valves, General: Refer to Division 20 Section “Valves.”

2.5 IDENTIFICATION

A. Refer to Division 20 Section "Mechanical Identification" for identification of piping, valves, gages, alarms, and specialties.

PART 3 - EXECUTION

3.1 PREPARATION

A. Interruption of Existing Laboratory Air and Vacuum Services: Do not interrupt laboratory air and vacuum services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary laboratory air and vacuum services according to requirements indicated:

1. Notify Owner not less than two weeks in advance of proposed interruption of laboratory air and vacuum services.

2. Do not proceed with interruption of laboratory air and vacuum services without Owner's written permission.

B. Cleaning of Piping: If factory-cleaned and -capped laboratory air and vacuum piping is not available or if precleaned piping must be reclaned because of exposure, perform the following procedures:

1. Clean laboratory air and vacuum tubes and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."

2. Wash laboratory air and vacuum piping and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb (0.453 kg) of chemical to 3 gal. (11.3 L) of water.

   a. Scrub to ensure complete cleaning.

   b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING SYSTEM INSTALLATION

A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.3 VALVE INSTALLATION

A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping and valve installation.
3.4 JOINT CONSTRUCTION
A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.5 HANGER AND SUPPORT INSTALLATION
A. Refer to Division 20 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
      c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.
B. Install supports according to Division 20 Section "Hangers and Supports."
C. Support vertical piping and tubing at base and at each floor.
D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
E. Install supports and anchors according to Division 20 Section "Hangers and Supports," with spacing according to NFPA 99.
F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.

3.6 CONNECTIONS
A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to specialties and equipment to allow service and maintenance.
C. Specialty and Equipment Flanged Connections: Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube.
3.7 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for laboratory air piping systems. Refer to Division 20 Section "Mechanical Identification" for labeling and identification materials.

END OF SECTION
SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section “Basic Mechanical Materials and Methods.”
   3. Division 20 Section “Testing, Adjusting, and Balancing.”

1.2 SUMMARY
A. This Section includes common requirements for fans and air moving equipment.

1.3 SUBMITTALS
A. Product Data: For the following:
   1. Fan bearings.
   2. V-belt fan drives.
   3. Direct drive couplings.

1.4 QUALITY ASSURANCE
A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
C. Sound Power Level Ratings:
   1. Ducted Fans - Rated per AMCA 301, when tested per AMCA 300.
   2. Nonducted Fans - Rated in Zones at 5 feet from acoustic center of fan rated per AMCA 301, tested per AMCA 300 and converted per AMCA 302.

1.5 ENVIRONMENTAL REQUIREMENTS
A. Do not operate equipment for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 FAN SHAFTS
A. Fan Shafts: Ground from solid cold rolled steel, and proportioned to run at least 25 percent below the first critical speed.

2.3 FAN POWER TRANSMISSION
B. A given manufacturer's V-belt drive, as applied to specific equipment provided under the Contract, shall conform to the equipment manufacturer's published recommendations, except as otherwise specified.
C. Base horsepower rating of drive on minimum pitch diameter of small sheave.
D. Locate belt drives outboard of bearings. Align drive and driven shafts by the four-point method.
E. Adjust belt tension in accordance with the manufacturer's recommendations.
F. Perform alignment and final belt tensioning in the presence of the Architect.

2.4 SHEAVES
A. Furnish sheaves of machined cast iron or carbon steel, bushing type of fixed bore, secured to the shaft by key and keyway.
B. Set pitch diameters of fixed pitch and adjustable or variable pitch sheaves when adjusted as specified, at not less than that recommended by NEMA Standard MG1-14.42.
C. For companion sheaves for adjustable or variable pitch drives, furnish wide groove spacing to match driving sheaves.
D. For all variable frequency controller (VFC) operated fans, contractor shall provide and install one set of fixed sheaves sized to allow full utilization of fan motor horsepower provided, with VFC at 100 percent of fan motor RPM.

2.5 V-BELT FAN DRIVES
A. Fan Drives: Multiple V-belt style with fixed pitch driver. Sheaves shall have split, taper style bushings. Drives shall be selected for a 150 percent service factor and shall provide for adjustment of both belt tension and alignment.
B. Manufacturers:
   1. Emerson Power Transmission; Browning.
2. Rockwell Automation; Dodge.
3. T.B. Wood’s Incorporated.

2.6 FAN DRIVE, SHAFT, AND COUPLING GUARDS
A. Safety Provisions: Include guards and screens for power transmission equipment, but do not negate vibration isolation provision.
B. Furnish ANSI and OSHA compliant mechanical power transmission apparatus guards except where superseded by other governing codes, and except as modified and supplemented. Requirements specified apply to all types of fans.
C. Fabricate mechanical power transmission device guards such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction.
D. Furnish a guard enclosure for each V-belt drive, coupling, shaft, and rotating component. Secure guards in place, easily removable for maintenance. Guard fasteners used for maintenance access shall be "captive type." Locate holes on each guard for tachometer readings on both the motor and fan shafts. Fabricate guard of minimum 16 gage sheet metal with hemmed edges at openings for shafts. Weld four mounting lugs or feet of 10 gage material to the guard. Fabricate guards for couplings five inches in diameter and larger of 12 gage sheet metal. Furnish holes in mounting feet sized for suitable machine screws.
E. Centrifugal exhaust fans shall be provided with shaft seals.

2.7 BELT DRIVE GUARDS
A. Belt Guards: ANSI and OSHA compliant with provision for readily viewing belt tension and measuring shaft speeds. Guards shall be installed with quick release pins, so that removal of three to five clip pins, will allow the guard to be removed from fan housing.
B. Fabricate guards which completely enclose moving parts of the particular drive. Design and construct guards of such rigidity as to contain a belt which breaks during operation. Minimum material thickness, 16 gage sheet metal. Where ventilation is required, perforated metal shall be used for the sides. Fabricate top of solid sheet metal.

2.8 V-BELTS
A. Notched or cogged style, endless type, of Dacron reinforced elastomer construction, with cross-section to suit sheave grooves. Determine the number of V-belts from the motor horsepower to which apply the service factor to obtain the design horsepower. Determine the corrected horsepower per belt by multiplying the nominal horsepower per belt by an arc of contact factor not greater than 0.85. Divide the design horsepower by the corrected horsepower per belt to obtain the number of belts required. In any case, furnish not less than two belts for each drive.
B. Furnish belts that have been factory or factory-authorized distributor matched and measured on a belt-matching machine. Selection by "code numbers," "sag numbers" or "match numbers" is not acceptable. Bind each belt set with wire and tag with equipment identification.
C. Manufacturers:
1. Emerson Power Transmission; Browning; AX, BX, and CX Series and 3VX and 5VX Series.
2. Rockwell Automation; Dodge; Classic Cog and Narrow Cog V-Belts.
3. T.B. Wood’s Incorporated; Classic Cog and Narrow Cog V-Belts.

2.9 V-BELT DRIVE MOTOR BASES
A. Furnish fan motors with slide or adjustable pivoted bases wherever equipment configuration permits proper installation.
B. Provide for adjustment of both belt tension and alignment.
2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS
   A. Provide extra sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each air handling system during air quantity balancing operations. Furnish sheaves as specified in this Section.
   B. Provide sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each existing air handling system requiring rebalancing during air quantity balancing operations. Furnish sheaves as specified in this Section.

2.11 MOTOR REQUIREMENTS
   A. Furnish motors in accordance with Division 20 Section “Motors.”
   B. Brake horsepower input shall not exceed 90 percent of the rated motor horsepower.

2.12 FAN BEARINGS
   A. Bearings: Anti-friction ball or roller type with provision for self-alignment and thrust load. Made in U.S.A. with ABMA L\textsubscript{10} minimum life of 200,000 hours. Use cast iron housings and dust-tight seals suitable for lubricant pressures.
      1. Lubrication Provisions - Use surface ball check type supply fittings. Provide extension tubes to allow safe maintenance while equipment is operating. Provide manual or automatic pressure relief fittings to prevent overheating or seal blow-out due to excess lubricant or pressure. Arrange relief fittings opposite supply but visible for normal maintenance observation.
      2. Bearings on Equipment with less than 1/2 horsepower rating or on shafts smaller than 1-3/4 inch in diameter: Permanently sealed, pre-lubricated anti-friction bearings per specified materials and ABMA L\textsubscript{10} life requirements.

2.13 IDENTIFICATION
   A. Nameplate: Affix metallic, corrosion-resistant data plate for each fan in a conspicuous location. Include selection point capacity conditions.

2.14 ACCESSORIES
   A. Bird Screens: Of material to match adjacent contact construction, 1/2 inch mesh or equal expanded metal. Use on inlet or outlet of each nonducted fan.

PART 3 - EXECUTION
3.1 INSTALLATION
   A. Field Rigging: Do not negate balancing. Do not bend shaft. Use lifting eyes.
   B. Install sheaves where recommended by Testing, Adjusting, and Balancing agency.
   C. Refer to individual Division 23 HVAC equipment Sections for additional requirements.

END OF SECTION
SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing to produce design objectives for the following:
   1. Air Systems:
      a. Constant-volume air systems.
   2. Hydronic Piping Systems:
      a. Variable-flow systems.
   3. Laboratory fume hood airflow balancing.

B. Include rebalancing of air systems, or system portions affected by recommended sheave changes.
1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. AHJ: Authority having jurisdiction.

C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

D. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

F. NC: Noise criteria.

G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

H. RC: Room criteria.

I. Report Forms: Test data sheets for recording test data in logical order.

J. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

K. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

L. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

M. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

N. TAB: Testing, adjusting, and balancing.

O. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

P. Test: A procedure to determine quantitative performance of systems or equipment.

Q. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.


D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.
F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. Approved Balancing Agencies.
   1. The TAB firm selected shall be from the following list:
      a. Absolut Balance Company, Inc.; South Lyon, MI.
      b. Aerodynamics Inspecting Company; Dearborn, MI.
      c. Aireconomics, Inc.; Grand Rapids, MI.
      d. Airflow Testing Inc.; Lincoln Park, MI.
      e. Barmatic Inspecting Co., Inc.; Lincoln Park, MI.
      f. Enviro-Aire/Total Balance Co.; St. Clair Shores, MI.
      g. Hi-Tech Test & Balance; Freeland, MI.
      h. Integrity Test & Balance, Inc.; Cedar, MI.
      i. International Test & Balance Inc.; Southfield, MI.

C. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
   1. Agenda Items: Include at least the following:
      a. Submittal distribution requirements.
      c. TAB plan.
      d. Work schedule and Project-site access requirements.
      e. Coordination and cooperation of trades and subcontractors.
      f. Coordination of documentation and communication flow.

D. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.


F. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

G. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
   1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.
1.6 PROJECT CONDITIONS
   A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION
   A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
   B. Notice: Provide seven days advance notice for each test. Include scheduled test dates and times.
   C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY
   A. National Project Performance Guarantee: If AABC standards are used, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
      1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
      2. Systems are balanced to optimum performance capabilities within design and installation limits.
   B. Special Guarantee: If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
      1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
      2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
   B. Examine system and equipment test reports.
   C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
   D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
   E. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
   F. Examine strainers for clean screens and proper perforations.
G. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
H. Examine equipment for installation and for properly operating safety interlocks and controls.
I. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices are operated by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
   5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes is according to the Contract Documents.
   8. Controller set points are set at indicated values.
   9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.
J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION
A. Prepare a TAB plan that includes strategies and step-by-step procedures.
B. Perform the following field tests and inspections to new and renovated portions of duct systems according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
   1. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
   2. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).
C. Complete system readiness checks and prepare system readiness reports. Verify the following:
   1. Permanent electrical power wiring is complete.
   2. Hydronic systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Equipment and duct access doors are securely closed.
   5. Balance, smoke, and fire dampers are open.
   6. Isolating and balancing valves are open and control valves are operational.
   7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING
A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air
Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.


B. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

C. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts, or use reduced scale contract documents with notations.

C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

D. Cut insulation, and drill ducts for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes with neat patches, neoprene plugs, threaded plugs, or threaded twist-on metal caps, and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check for proper sealing of air-handling unit components.

J. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:
   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Select required sheave sizes and advise installing contractor to change drive sheaves accordingly.

4. When existing air handling systems require rebalancing, select required sheave sizes and advise Mechanical Contractor to change drive sheaves accordingly.
5. Do not recommend fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Measure terminal outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

C. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts, or use reduced scale contract documents with notations.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check flow-control valves for specified sequence of operation and set at indicated flow.
   3. Set system controls so automatic valves are wide open to coils.

3.7 PROCEDURES FOR HYDRONIC SYSTEMS

A. Set calibrated balancing valves at calculated presettings.

B. Measure flow at all stations and adjust, where necessary, to obtain balance.
   1. Record settings and mark balancing devices.

3.8 PROCEDURES FOR LABORATORY FUME HOODS

A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate makeup air is available to achieve the indicated flow of the hood.

B. Measure, adjust, and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.
   1. Verify that no air is by-passed within hood. Report if baffles require modification at designated sash height.

C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.

D. After balancing is complete, do the following:
   1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.
2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter of the opening.
   a. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.
   b. Calculate and report the average face velocity by averaging all velocity measurements.
   c. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.
   d. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

3. Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.

E. With the room and laboratory fume hoods operating at indicated conditions, perform an "as-installed" performance test of the laboratory fume hood according to ASHRAE 110. Test each laboratory fume hood and document the test results.

3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
   1. Measure and record the operating speed, airflow, and static pressure of each fan.
   2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
   3. Check the condition of filters.
   4. Check the condition of coils.
   5. Check the operation of the drain pan and condensate drain trap.
   6. Check bearings and other lubricated parts for proper lubrication.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
   1. New filters are installed.
   2. Coils are clean and fins combed.
   3. Drain pans are clean.
   4. Fans are clean.
   5. Bearings and other parts are properly lubricated.
   6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
   1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
   2. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
   3. Air balance each air outlet.
3.10 TOLERANCES
A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Air handling equipment and outlets: Plus or minus 5 percent.
      a. Where terminal units serve 6 or more outlets within a common room, individual outlets may vary up to plus or minus 10 percent of design flow rates if overall room supply is within plus or minus 5 percent.
   2. Heating-Water Flow Rate: 0 to minus 10 percent.

3.11 REPORTING
A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT
A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of TAB firm.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   9. Signature of TAB firm who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
       a. Indicated versus final performance.
       b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Notes to explain why certain final data in the body of reports varies from indicated values.

14. Test conditions for fans and pump performance forms including the following:
   a. Conditions of filters.
   b. Fan drive settings including settings and percentage of maximum pitch diameter.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outside, supply, return, and exhaust airflows.
   2. Water flow rates.
   3. Terminal units.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   1. Fan Data:
      a. System identification.
      b. Location.
      c. Make and type.
      d. Model number and size.
      e. Manufacturer's serial number.
      f. Arrangement and class.
      g. Sheave make, size in inches (mm), and bore.
      h. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
   2. Motor Data:
      a. Make and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches (mm), and bore.
      f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
      g. Number of belts, make, and size.
   3. Test Data (Indicated and Actual Values):
      a. Total airflow rate in cfm (L/s).
      b. Total system static pressure in inches wg (Pa).
      c. Fan rpm.
      d. Discharge static pressure in inches wg (Pa).
      e. Suction static pressure in inches wg (Pa).

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data:
      a. System and air-handling unit number.
      b. Location and zone.
      c. Traverse air temperature in deg F (deg C).
      d. Duct static pressure in inches wg (Pa).
      e. Duct size in inches (mm).
      f. Duct area in sq. ft. (sq. m).
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H. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Test apparatus used.
      d. Area served.
      e. Air-terminal-device make.
      f. Air-terminal-device number from system diagram.
      g. Air-terminal-device type and model number.
      h. Air-terminal-device size.
      i. Air-terminal-device effective area in sq. ft. (sq. m).

   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm (L/s).
      b. Air velocity in fpm (m/s).
      c. Preliminary airflow rate as needed in cfm (L/s).
      d. Preliminary velocity as needed in fpm (m/s).
      e. Final airflow rate in cfm (L/s).
      f. Final velocity in fpm (m/s).
      g. Space temperature in deg F (deg C).

I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.

   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm (L/s).
      b. Entering-water temperature in deg F (deg C).
      c. Leaving-water temperature in deg F (deg C).
      d. Water pressure drop in feet of head or psig (kPa).
      e. Entering-air temperature in deg F (deg C).
      f. Leaving-air temperature in deg F (deg C).

J. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.13 INSPECTIONS
   A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.

B. Final Inspection:
   1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
   2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
   3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
   4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
   6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
   7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.14 ADDITIONAL TESTS
   A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION
SECTION 23 0911 - LABORATORY AIRFLOW CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this Section.

B. Related Sections include the following:
1. Division 20 Section “Mechanical General Requirements.”
2. Division 20 Section “Basic Mechanical Materials and Methods.”
3. Division 23 Section “Metal Ducts” for installation of laboratory airflow terminal units.
4. Division 23 Section “Temperature Controls.”
5. Division 23 Section “Testing, Adjusting, and Balancing.”

1.2 SUMMARY
A. This Section includes laboratory airflow controls.

B. Products Supplied But Not Installed Under This Section:
   1. Laboratory airflow terminal units and hydronic control valves.

1.3 SYSTEM DESCRIPTION
A. Design Requirements:
   1. The laboratory airflow control systems shall be furnished and installed to control the airflow into and out of the laboratory rooms, laboratory auxiliary support rooms, and
fume hoods where indicated on the drawings, and to balance the airflow (e.g. room pressurization).

2. This system shall be supply and exhaust air controls, supply and exhaust constant volume airflow terminal units plus all interconnecting wiring and pneumatic tubing to result in complete operational system.

3. All laboratory airflow control system components shall be products of a single manufacturer to ensure single source responsibility. Substitutions will not be allowed.

1.4 SUBMITTALS

A. Shop Drawings:
   1. For each room, provide a schematic drawing showing the schematic arrangement of air terminal units, fume hoods, fume hood monitors, thermostats, and control valves. Indicate airflows, hood face velocity, and room supply/exhaust offset.
   2. For each room, provide a complete point-to-point wiring and pneumatic tubing diagram. Termination points at all control components within the room shall be labeled. Indicate jumpers where required, as well as factory installed wiring and pneumatic tubing. Identify wire types.
   3. For each room, provide written sequence of operation.
   4. Complete bill of materials to identify and quantify all devices.
   5. Component schedules with design data indicating size, flow, pressure drop and pressure rating for terminal units, hydronic control valves, etc.

B. Product Data: Include description and complete engineering data for each system component.

C. Submit field reports indicating operating conditions after detailed check out of systems at Date of Substantial Completion.

D. Project Record Documents:
   1. Drawings revised to reflect actual installation and operating sequences.

E. Operation and Maintenance Data:
   1. Include as-built schematic drawings.
   2. Indicate setpoints, settings and adjustments of all components.
   3. Include equipment catalog cuts and data sheets indicating installation, operation, maintenance, repair, calibration, calibration tolerances, inspection period, cleaning methods and cleaning materials for all components, including proprietary components.
   4. Include operating instructions to allow operators to understand the systems and their interrelationships, limitations, and maintenance needs.
   5. Complete diagnostic and trouble shooting procedures set in manual form.
   6. Provide all proprietary and non-proprietary service bulletins to the Owner at no additional cost for the duration of the project and the warranty period.
   7. Provide a list of recommended spare parts required to maintain the system for one year.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain laboratory airflow control system components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

C. NEMA Compliance: comply with NEMA standards pertaining to components and devices for electrical control systems.
D. NFPA Compliance: Laboratory airflow control system and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

E. Comply with NFPA 70.

F. Comply with NEMA 250, “Enclosures for Electrical Equipment (1000 Volts Maximum).”

G. Comply with ASTM D1693, "Environmental Stress-Cracking of Ethylene Plastics."

1.6 COORDINATION

A. Coordinate work under provisions of Division 20 Section “Mechanical General Requirements,” and as supplemented in this Section.

B. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

C. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.

D. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the function or serviceability of the systems, shall not be made without the written approval of the Architect.

E. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect for resolution.

F. Provide required supervision and instruction to ensure proper installation of all laboratory airflow controls.

G. Ensure installation of components is complementary to installation of similar components in other systems.

H. Coordinate installation of system components with installation of other mechanical systems equipment.

I. Coordinate work with the temperature controls contractor as to items provided by the temperature controls contractor, and as to interface requirements such as locations and operating ranges of components, air supply requirements, pneumatic tubing requirements, etc.

J. Coordinate with Architectural Trades regarding location and exact dimensions of recessed components.

K. Cooperate fully with the Test and Balance Contractor and provide labor to operate the lab control system as required to meet the scope of work defined in Division 23 Section “Testing, Adjusting and Balancing.”

L. Ensure system is completed and commissioned.

1.7 WARRANTY

A. Warranty Period: Two years.

B. Provide 24 hour per day service during the warranty period, with maximum response period of four (4) hours. Provide phone number(s) for quick assistance by a service engineer and a software expert regarding problems.
1.8 OWNER INSTRUCTION AND TRAINING
   A. Provide a minimum of four (4) hours of on-site instruction and training to the Owner on the operation of the control systems.
   B. Instruction and training shall be performed by a competent contractor representative familiar with the control systems operation, maintenance and calibration.
   C. Training shall take place during the commissioning period at a time mutually agreed upon by the Owner and Contractor.

1.9 COMMISSIONING
   A. The Laboratory Airflow Controls Contractor shall perform commissioning services on all equipment provided as part of the work of this section.
   B. Verification testing of each system component shall be made on a laboratory by laboratory basis. Each component shall be tested and verified at its extreme operating range, as well as its normal operating range. Verify operation of all alarms. Verify fume hood average face velocity by doing an actual airflow traverse. Provide a standard commissioning report for each hood and each room.

1.10 EXTRA MATERIALS
   A. Provide a spare parts list and price list for the recommended spare parts to maintain the laboratory controls system after the second year of operation.

1.11 SPECIAL TOOLS
   A. Deliver two sets of any special tools required for operation, adjustment, resetting or maintenance.

1.12 PROTECTION OF PROPRIETARY INFORMATION
   A. All proprietary manuals subject to a non-disclosure agreement, shall be submitted by the proprietary equipment manufacturer to the Owner for approval and signature during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/SUPPLIERS
   A. Integrated Laboratory Airflow Control System Manufacturer and Supplier: Subject to compliance with requirements, provide products as manufactured by one of the following:

2.2 LABORATORY AIRFLOW TERMINAL UNITS
   A. Laboratory airflow terminal unit shall control the exhaust flow out of a fume hood, the general exhaust or return airflow out of a room or the make-up/supply airflow into a room.
   B. The laboratory supply airflow terminal units shall be of galvanized steel round inlet duct, blade style damper, four-quadrant multi-point airflow measurement.
   C. The laboratory general exhaust air terminals units shall be of galvanized slip fitting round inlet duct blade style damper with seals and orifice airflow measurement.
   D. Terminal unit duct connections shall accommodate joining methods specified in Division 23 Section “Metal Ducts,” and as indicated on the Drawings.
   E. Electronically Modulated Laboratory Airflow Terminal Units
1. Terminal units shall be pressure dependent and use closed loop control to regulate air volume linearly proportional to a digital control signal. Terminal units shall also generate a digital feedback signal linearly proportional to airflow for internal volume control, monitoring, or airflow tracking control. This feedback signal shall be factory calibrated using NBS traceable instrumentation. For a given control signal, the terminal unit shall maintain a constant, maintained airflow with an accuracy of plus or minus 5 percent regardless of inlet or exit duct configuration over the entire control range.

2. The airflow controller shall be micro-processor based with capability of 3 universal inputs, 1 digital input, 2 analog outputs and 1 digital output. The airflow controller shall store its control algorithms in non-volatile, re-writable memory. Controller shall be stand alone and capable of being networked to other room level digital airflow controllers.

3. Controller shall have local EIA-232 port for connection to a notebook PC commissioning tool.

4. Controller shall meet FCC Part 15 Subpart J Class A, and be UL916 listed.

5. The response time to vary the terminal unit's airflow to within 90 percent of its commanded setpoint value shall be no more than one second with less than a 5 percent undershoot or overshoot.

6. A high-speed electronic actuator shall be factory mounted to the terminal unit to vary the position of the terminal unit damper from its minimum to maximum flows. Loss of electrical supply power shall cause the terminal units to fail to the position indicated on the Drawings. Fail-in-last-position actuators are not acceptable.

7. Power supply for terminal units 24 V-ac.

F. Two Position Laboratory Airflow Terminal Units:

1. Terminal units shall be pressure dependent. High/low flow setpoints shall be as indicated on the drawings. Where required, terminal unit shall generate a 0 to 10 volt feedback signal linearly proportional to terminal unit airflow for monitoring or for room offset control. Signal shall be factory calibrated to a stated CFM per volt scale factor using NBS traceable instrumentation.

2. A high-speed electronic actuator shall be factory mounted to the terminal unit to vary the position of the blade damper from its minimum to maximum flows. Loss of electrical supply power shall cause the terminal unit to fail to the position indicated on the Drawings. Fail-in-last-position actuators are not acceptable.

2.3 SUPPLY/EXHAUST TRACKING CONTROLLER

A. Supply/Exhaust Tracking airflow controller shall control the airflow balance of the laboratory room. One of the Electronically Modulated Laboratory Airflow Terminal Units associated with a laboratory room (supply terminal unit is preference) shall include the algorithms to perform the lab room air balance.

B. All the electronically modulated laboratory terminal unit controllers shall be networked together to share airflow data. Airflow values of constant volume terminal units shall programmed into algorithm. Airflow feedback signal (0 to 10V proportional to programmed airflow range) from two-position terminal units shall be wired to available input point at nearest electronically modulated laboratory terminal unit controller and information shall be transmitted to make-up controller via network connection.

C. The controller shall control supply terminal units and general exhaust terminal units to the desired supply or exhaust volumes. Where applicable, multiple supply terminal units serving a common laboratory room shall be controlled in unison. Where applicable, multiple general exhaust terminal units serving a common laboratory room shall be controlled in unison.
D. The controller shall maintain a constant adjustable offset between the sum of the room’s total exhaust and the make-up/supply air volumes. This offset shall be independent of the exhaust volume magnitude and shall represent the volume of air that will enter or leave the room from/to the corridor or other room.

E. Space temperature sensor with setpoint adjustment, temperature indicator and occupancy override switch shall be provided and connected to supply terminal unit electronic controller. Each room temperature sensor shall be provided with a terminal jack to be used to connect a portable operator’s terminal to control and monitor controller points. The temperature sensor with setpoint shall be used to increase the supply airflow to the room as required to meet the room’s cooling load and to control the room’s tempering coil hydronic control valve to meet the room’s heating load. General exhaust from the room shall track as required to maintain the room airflow offset. Direct temperature sensor control of the general exhaust shall not be acceptable. Laboratory rooms shall be capable of individual room occupancy schedules – coordinate initial schedules with Owner. Room air change rate shall be reduced during unoccupied times. Occupancy override switch, set for 4 hours (adjustable) shall provide means for local override control.

F. Laboratory controls control contractor shall provide date communication network, including all necessary routers and repeaters to allow-peer-to-peer data transmission between all laboratory terminal unit controllers.

G. Point names shall conform to Owner’s naming conventions.

2.4 CONTROL AND INSTRUMENTATION TUBING

A. Control and Instrumentation Tubing shall be furnished and installed in accordance with the requirements of Division 23 Section “Temperature Controls.”

2.5 HYDRONIC CONTROL VALVES

A. Control Valves and valve operators shall be furnished and installed in accordance with the requirements of Division 23 Section “Temperature Controls.”

2.6 FACTORY IDENTIFYING AND MARKING

A. Each laboratory airflow terminal unit shall be marked before shipment to the job site with a unique identifier corresponding to its location and function in the building. This identifier shall correspond to the plans and the shop drawings.

B. Wiring shall be color coded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish fume hood monitor mounting bracket and exact cut-out dimensions to the fume hood supplier for factory mounting in a fashion to result in a fully recessed fume hood monitor on the front of the hood, neat in appearance.

B. Install the fume hood monitor fully recessed on the front of the fume hood.

C. Pneumatic tubing shall be furnished and installed in accordance with the requirements of Division 23 Section “Temperature Controls.”

D. All wiring shall be installed in raceway. Electrical wiring and raceway shall be furnished and installed in accordance with the requirements of the Division 26.
3.2 FIELD IDENTIFYING AND MARKING
   A. All sensors, switches, etc. shall be marked with the same identification number as used on the project record drawings. Marking shall be done with label maker with self-adhesive tape. Clean surface prior to applying label.
   B. Wiring shall be color coded according to functional use. Identify color coding format on project record drawings.
   C. Identify each wire as to ID number at each controller and field device.
   D. Identify control air tubing at each controller and field device.

3.3 ACCEPTANCE PROCEDURE
   A. Upon successful completion of calibration and start-up, the Architect shall be requested in writing to inspect the satisfactory operation of the control systems.
   B. Demonstrate operation of all control systems, including each individual component, to the Owner and Architect.
   C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect for inspection and approval.
   D. After all items on the punch list are corrected and formal approval of the control systems is provided by the Architect, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

3.4 TESTING, ADJUSTING AND BALANCING
   A. Laboratory Airflow Controls Contractor shall adjust laboratory airflow terminal units to achieve required air balance for each room.
   B. Coordinate work done under this section with the work of the Test & Balance Contractor.

END OF SECTION
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SECTION 23 0953 - TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

1.3 DEFINITIONS

1.4 SYSTEM DESCRIPTION

1.5 SEQUENCE OF OPERATION

1.6 SUBMITTALS

1.7 REFERENCES

1.8 QUALITY ASSURANCE

1.9 COORDINATION

1.10 WARRANTY

1.11 POSTED OPERATING INSTRUCTIONS

1.12 SPECIAL TOOLS

1.13 PROTECTION OF PROPRIETARY INFORMATION

PART 2 - PRODUCTS

2.1 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM (BAS)

2.2 DDC UNITARY CONTROLLERS

2.3 DDC INPUT/OUTPUT SENSORS

2.4 DDC DATA COMMUNICATIONS NETWORK

2.5 CONTROL AND INSTRUMENTATION TUBING

2.6 CONTROL VALVES AND VALVE OPERATORS

2.7 DAMPERS - AUTOMATED

2.8 DAMPERS, INSULATED OUTDOOR AIR / RELIEF AIR / EXHAUST AIR - AUTOMATED

2.9 DAMPER OPERATORS - ELECTRIC

2.10 LOCAL AND AUXILIARY CONTROL COMPONENT ENCLOSURE PANELS

2.11 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK

PART 3 - EXECUTION

3.1 INSTALLATION - CONTROL SYSTEMS

3.2 IDENTIFICATION AND MARKING

3.3 GRAPHIC DISPLAY GENERATION

3.4 OWNER INSTRUCTION AND TRAINING

3.5 CALIBRATION AND START-UP

3.6 ACCEPTANCE PROCEDURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements,”
   2. Division 20 Section “Basic Mechanical Materials and Methods.”

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
1.3 DEFINITIONS
A. BACnet: Communications open protocol for building automation system networks and control (developed by ASHRAE and documented per ANSI/ASHRAE Standard 135-2012.
B. BAS: Building Automation System
C. CAD: Computer Aided Design.
D. DDC: Direct-digital controls.
E. TC: Temperature Control.

1.4 SYSTEM DESCRIPTION
A. Temperature control building automation system consisting of direct digital control system controllers, sensors, transducers, relays, switches, data communication network, etc. and all associated control wiring and raceway systems.
B. BAS/DDC system programming, database generation. Graphic display generation accessible through existing remote operator workstation.
C. Electric thermostats, control valves, dampers, operators, control wiring, etc.
D. Electric and electronic control accessories and other control system devices.
E. All electrical power wiring, conduit, data communication wiring, etc. and all associated control wiring and raceway systems as it relates to the new temperature controls shall interface with the existing Siemens building automation system.

1.5 SEQUENCE OF OPERATION
A. Control sequences for HVAC systems, subsystems, and equipment are indicated on project drawings.

1.6 SUBMITTALS
A. Submit under Division 20, 22 and 23 provisions of respective project and as supplemented in this section.
B. All control submittal requirements shall be submitted at one time with exception to control valves, automated dampers, and initial phases of work associated with fast-track projects (when required). Early submittals of control valve and automated dampers shall be incorporated with the complete temperature controls submittal.
C. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. Each control device labeled with setting or adjustable range of control
D. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Shop drawings shall be done on CAD. Minimum size 11” x 17”.
   2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
   4. Details of control enclosure including panel faces and interior, including controls, instruments, terminations blocks and component labeling.
   5. Written sequence of operation for each controlled system.
6. Schedule of dampers including size, leakage, and flow characteristics (Refer to Design Data).
7. Schedule of valves including leakage and flow characteristics (Refer to Design Data).
8. Complete bill of materials to identify and quantify all control components.
9. Overall system schematic showing communication trunk cabling from Building Network Supervisory Controller(s) to BAS field level controllers including component locations and wire termination details.
10. DDC controller layouts showing connected data points and LAN connections. DDC controller terminations including power supply and remote control component termination details shall be provided.
11. Point list for each DDC controller including point descriptions and addresses. This information may be incorporated with DDC controller layouts.

F. Graphic Displays: One month after TC Shop Drawing submittal, TC Contractor shall submit graphical display backgrounds for preliminary Engineer review. Concept for each floor plan, each system, each terminal unit template. Engineer understands that final representation of graphics may not be available until BAS database is established during course of construction. Thorough graphics review will be conducted by Engineer as part of the TC/BAS acceptance procedure.

G. Design Data: Provide indicated component selection and sizing criteria for the following component categories:

1. Control valves:
   a. Component tag.
   b. Equipment served/function.
   c. Media type.
   d. Design flow rate (GPM).
   e. Design pressure drop (ft. head) or (psi), where applicable.
   f. Calculated valve Cv, where applicable.
   g. Selected valve Cv, where applicable.
   h. Resultant pressure drop (ft. head) or (psi) with selected valve.
   i. Valve size.
   j. Line size to valve connection (excluding reducers).
   k. Type (ball, butterfly, globe, etc.).
   l. Configuration (2-way, 3-way mixing, 3-way diverting).
   m. Normal position (normally open, normally closed, floating).
   n. Actuator spring range (where applicable).
   o. Actuator power requirement.
   p. Valve shut-off rating (ft. head) of (psi)
   q. Valve body pressure/temperature rating.
   r. Valve manufacturer/model number.
   s. Actuator manufacturer/model number.
2. Dampers:
   a. Component tag.
   b. Equipment served/function.
   c. Overall damper size (inch width x inch height).
   d. Quantity of damper sections with respective size(s):
   e. Material and gauge of thickness.
   f. Mounting orientation (horizontal or vertical).
   g. Blade configuration (parallel or opposed)
h. Pressure drop (in. WG).
i. Shut-off rating/differential pressure rating (in. wg).
j. Leakage rating (CFM/sq.ft. at 4 in. wg).
k. Normal position (normally open, normally closed, floating).
l. Actuator spring range (where applicable).
m. Actuator power requirement.
n. Actuator torque requirement.
o. Actuator quantity.
p. Damper manufacturer/model number.
q. Actuator manufacturer/model number.

3. Flow measuring probes - Water:
a. Component tag.
b. Equipment served/function.
c. Pipe size/inside diameter (inch)
d. Probe length.
e. Flow rate (GPM).
f. Flow velocity (FPS).
g. Probe manufacturer/model number.
h. Transmitter manufacturer/model number.

H. Wall mounted temperature sensor, thermostat and/or other temperature control device cover color shall be coordinated to match color of wall mounted electrical device components and cover plates – coordinate with electrical contractor. Provide samples of available temperature control device cover colors to Architect upon request or if available temperature control device colors do not match electrical device colors so a desired color selection may be determined. Provide sample of temperature sensor / thermostat guard upon request of Architect, Engineer or Owner.

I. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

J. Submit field reports indicating operating conditions after detailed check out of systems at Date of Substantial Completion.

K. Project Record Documents: Include the following:
1. Revise Shop Drawings to reflect actual installation and operating sequences.
2. Record actual locations of control components, including control units, thermostats, and sensors.
3. Submit the electronic files for all as-built shop drawings on diskette in pdf format.

L. Software and Firmware Operational Documentation: Include the following:
1. DDC controller keypad operating instructions and DDC controller override features, where applicable.
2. Device address list.
3. Program Software Backup: On a magnetic media or compact disc, complete with data files.

M. Maintenance Manuals: Include the following:
1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.
2. Keypad illustrations and step-by-step procedures indexed for each operator function, where applicable.
3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Calibration records and list of set points.

1.7 REFERENCES
A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
B. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure fittings.
C. ANSI/ASTM B32 - Solder Metal.
F. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
G. ASTM B75 - Seamless Copper Tube for General Engineering Purposes.
H. ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.
I. NEMA DC 3 - Low-Voltage Room Thermostats.
K. UL 1820 - Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics Only.

1.8 QUALITY ASSURANCE
A. Installer Qualifications: An experienced installer who is an authorized representative of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
B. Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control systems similar to those indicated for this Project and with a record of successful in-service performance.
C. 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.
D. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

1.9 COORDINATION
A. Coordinate work under Division 20 and 23 provisions and as supplemented in this section.
B. Coordinate location of space temperature sensors, space humidity sensor, thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
C. Coordinate installation of system components with installation of mechanical systems and equipment to achieve compatibility.
D. Ensure installation of components is complementary to installation of similar components in other systems.
E. Coordinate control wiring requirements, including actual terminal block numbers, with mechanical equipment manufacturers or suppliers.
F. Coordinate equipment with Division 28 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.
G. Ensure control system installation is complete, checked, tested and functioning properly prior to system balancing and Owner/Engineer system checkout.
H. Cooperate fully with the Test and Balance Contractor and provide labor to operate the temperature control system as required to meet the scope of work defined in Division 23 Section "Testing, Adjusting and Balancing."
1.10 WARRANTY
A. Provide warranty per Division 20 Section "General Mechanical Requirements" and as supplemented in this section.
B. Provide 24 hour per day emergency service during warranty period, with maximum response period of four (4) hours. Provide phone number(s) for quick assistance by a Service Engineer regarding hardware or software problems.
C. Provide scheduled maintenance service during warranty period to inspect, calibrate, and adjust controls. Make a minimum of one eight hour service call every six months. Notify Owner prior to each scheduled inspection trip. Submit written reports upon completion of service.
D. Provide any software or firmware revisions which are released by the DDC system manufacturer during the warranty period, at no additional cost to the Owner.

1.11 POSTED OPERATING INSTRUCTIONS
A. Provide DDC controller related as-built documents in protective binder or clear plastic display envelope for each control enclosure panel. These instructions shall include such items as as-built control diagrams and sequence of operation, simplified narrative instructions and materials necessary to aid in the operation of the equipment at the local control panels.

1.12 SPECIAL TOOLS
A. Deliver two sets of any special tools required for operation, adjustment, resetting or maintenance, not including PC laptop.

1.13 PROTECTION OF PROPRIETARY INFORMATION
A. All proprietary manuals and software that are subject to a non-disclosure agreement shall be submitted by the proprietary equipment manufacturer to the Owner for signed approval during the warranty period.

PART 2 - PRODUCTS
2.1 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM (BAS)
A. The building automation system (BAS) shall be fully integrated, distributed data processing system incorporating direct digital control (DDC) for the control and monitoring of heating, ventilating and air conditioning (HVAC) equipment and other related systems. Microprocessor based BAS field level DDC controllers shall be directly connected to HVAC equipment sensors and actuators. Existing building data communication network shall allow data exchange between the BAS field level DDC controllers.
B. Approved Manufacturer:
   1. Siemens Industry, Inc. – Desigo with Apogee 600 Controllers / Siemens Building Technologies Division (Plymouth Twp, MI).

2.2 DDC UNITARY CONTROLLERS
A. Microprocessor based controllers capable of stand-alone operation for control of miscellaneous systems and monitoring. Controllers shall be networked together and connected to the building's BAS/DDC network.
B. Programming and setpoints shall be adjustable through the portable programmer terminal.
C. Each controller shall have electronic outputs compatible with the electronically operated control valves or dampers where applicable
D. TC contractor shall provide 24 VAC power requirements including transformers.
E. Room temperature sensors for the DDC unitary controllers:
1. Sensing Element: Thermistor or resistance temperature detector (RTD) type. Accuracy shall be +/− 0.5 degrees F over the range of 55 degrees F to 95 degrees F, including calibration error, repeatability, hysteresis, and yearly drift.

2. Cover: Locking type.

3. Provide with exposed setpoint adjustment dial and exposed temperature reading.

4. Provide with exposed override switch to allow an occupant to reset the space to occupied control during the unoccupied cycle for a predetermined time period.

5. Provide with portable operator unit plug-in port.

2.3 DDC INPUT/OUTPUT SENSORS

A. Current Switches:

1. Split-core or donut type transformer for monitoring AC current, with digital output signal. Current switches used on motor side of variable frequency drives shall have low frequency detection capability.

2. Current switches with digital output shall have adjustable trip settings. Provide field adjustment of current switches to trip at approximately 90% of normal motor operating amperage.

3. Manufacturers:
   a. NK Technologies.
   b. Senva.
   c. Setra.
   d. Veris Industries.

B. Temperature Sensors:

1. Resistance temperature detectors (RTD) with platinum, nickel or balco element. Accuracy shall be +/− 0.5 deg F over the entire range. Range shall be as indicated below, or as appropriate to the application.

2. Single point duct mounted sensors shall have 18" rigid probe and calibrated span of 20 - 120°F.

3. Averaging duct mounted sensors shall have 25' long averaging element and calibrated span of 20 - 120°F.

4. Liquid immersion sensors shall have welded stainless steel thermowells for ferrous pipe and brass thermowells for copper pipe. Length of sensor and thermowell shall be selected based on the diameter of the pipe to provide accurate, reliable and homogeneous sensing of the liquid temperature. Thermowell pressure rating shall meet or exceed the system minimum pressure rating. Sensors for chilled water application shall have calibrated span of 20 - 120°F. Sensors for hot water applications shall have calibrated span of 40 - 240°F.

5. Room sensors shall have locking cover and a minimum span of 40 - 90°F.

6. Outside air sensors shall have watertight inlet fitting and shall be shielded from direct rays of sun and wind.

7. Manufacturers:
   a. Specified BAS product where available.
   b. TCS.
   c. Minco.
   d. ACI.
   e. MAMAC.
   f. Siemens.
2.4 DDC DATA COMMUNICATIONS NETWORK

A. Data communication network shall be provided to allow data exchange between the BAS field level DDC controllers and the Building Network Supervisory Controller.

B. The BAS/DDC system-wide communication network shall consist of a primary peer-to-peer network, and at the Contractor's option, secondary sub-networks linked to the primary network. The primary network shall support peer-to-peer communications between primary network BAS field level DDC controllers. The Building Network Supervisory Controller shall be connected to the primary network. Secondary sub-networks when used shall interface with the primary network though the primary network BAS field level DDC controllers. At least one DDC controller connected to the primary peer-to-peer network shall be provided in each mechanical room, or as indicated on the drawings.

C. Data communications media shall be twisted pair wires.

D. The communications network shall allow shared point and control information between BAS field level DDC controllers. All required repeaters, hubs, active links, gateways, etc. and associated power supplies shall be provided as required to provide shared point and control information between BAS field level DDC controllers.

E. Failure of any individual BAS field level DDC controller shall not cause the loss of communications between peer BAS field level DDC controllers.

F. All data transmitted must be positively acknowledged as received or negatively acknowledged as not received. Negative acknowledgments shall cause a retransmission of the data. Network connected devices must send a "functioning" message each network cycle. Lack of a "functioning" message after successive retries shall constitute a device failure and shall be recognized as such by the network.

G. Error recovery and communication initialization routines shall be resident in each network connected device.

2.5 CONTROL AND INSTRUMENTATION TUBING

A. Copper Tubing: ASTM B280 or ASTM B75, seamless, hard drawn or annealed.

B. Copper Tubing: ASTM B280 or ASTM B75, seamless, hard drawn or annealed.
   1. Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
   2. Joints: Ball Sleeve compression type.

C. Polyethylene Tubing: Black, UL 1820 flame and smoke retardant where exposed in an air plenum, virgin polyethylene, conforming to modified ASTM D1693 test. All non-metallic tubing shall be minimum 1/4" O.D.; micro-sleeve is not acceptable.
   1. Fittings: UL approved rod or forged brass rated to 200 psig at 100 degrees F.
   2. Joints: Compression or barbed type.

2.6 CONTROL VALVES AND VALVE OPERATORS

A. Pressure Independent Control Valves (2-way):
   1. Up to 2 inches: Characterized ball valve or Globe valve style with integral pressure compensating cartridge which maintains a constant pressure drop across valve seat while providing equal percentage flow control. Ball valve construction shall include bronze or brass-nickel plated body with screwed ends, stainless steel or chrome plated brass ball, characterizing disc, stainless steel or brass stem, and resilient reinforced Teflon seats. Globe valve construction shall include bronze or AMETAL (a dezincification alloy of TA), stainless steel or brass stem and EPDM type seats.
2. Over 2 inches: Control valve with integral pressure compensating spring and diaphragm which maintains a constant pressure drop across the valve seat, iron body with flanged ends, stainless steel trim.

3. Accuracy: Control valves shall accurately control flow from 0 to 100% of the full rated flow. Flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations when the pressure drop across the valve is within the range of 5 psid to 35 psid.

4. Manufacturers:
   a. Belimo.
   b. Bray / Delta Control Products.
   c. Siemens.

B. Pressure dependent Characterized Ball Valves (2-way & 3-way):
   1. Up to 2 inches: Bronze body with screwed ends, stainless steel or chrome plated brass ball, characterizing disc, stainless steel or brass stem, and resilient reinforced Teflon seats.
   2. Manufacturers:
      a. Belimo.
      b. Bray / Delta Control Products.
      c. Siemens

C. Butterfly Pattern: Refer to Division 20 Section “Valves” for valve body and trim requirements.

D. Electric Operators:
   1. Operators shall be electronic type to accept signals from direct digital controller or modulating thermostat for proportional control.
   2. Valves shall spring return to normal position as indicated. Terminal unit tempering coil control valve operators are not required to be spring return.
   3. Select with sufficient shut-off power for system pressure and highest operating torque, and torque requirements of valves which may stick because of infrequent use.
   4. Select to provide smooth proportioning control under operating conditions normal to the system.
   5. Electric Butterfly Control Valve Actuators: Permanent split capacitor, reversible electric motor which drives a compound epicyclic gear, thermal overload protection, factory tested, factory lubricated, localized mechanical position indicator readable at 25 feet, 0-90 degree reversible operation, bolt directly to valve top plate. Housing shall be weatherproof and suitable for outdoor location. Provide thermostatically controlled heater for prevention of condensation at low temperatures, 120 VAC. Actuator ambient temperature range shall be -20 degrees F to +140 degrees F. Provide separate limit switches which close at the full open and full closed position, respectively. Actuator shall include a manually operated handwheel for manual override of the valve position.

E. Hydronic Systems:
   1. Valve minimum pressure rating shall meet or exceed the system minimum pressure rating as noted for each system in Division 20 Section “Valves,” and in Division 23 Section “Hydronic Piping.”
   2. Valve minimum temperature ratings shall be 250 deg F.
   3. For globe valves: Replaceable plugs and seats of stainless steel or brass, selected for maximum lift under application conditions.
   4. Two way and three way valves shall have equal percentage characteristics. Size two way valve operators to close valves against pump shut off head.
5. Pressure independent control valves shall be used for 2-way applications unless otherwise indicated. Select to achieve scheduled flow rate of the associated heat transfer device. If the scheduled flow rate is too high to achieve with one valve, provide multiple valves sized at flow divided equally of the scheduled flow rate and control all valves in unison - coordinate control valve quantity and the need for parallel piping of control valves with mechanical contractor.

6. Pressure Drop for pressure dependent characterized ball and globe valves: As scheduled on the drawings. If not scheduled, primary HVAC equipment control valves shall be selected for a pressure drop close as possible to 11.5 feet of head (5 psig), +/- 10%. If not scheduled, terminal equipment control valves shall be selected for a pressure drop close as possible to 11.5 feet of head (5psig) with allowable minimum of 2.3 feet of head (1 psig) where flow rates are minimal and valve Cv choices are limited. TC Contractor shall use valves from listed manufacturers that meet the pressure drop requirements.

2.7 DAMPERS - AUTOMATED

A. Performance: Test in accordance with AMCA 500.

B. Frames: Galvanized steel, minimum 16 gauge, minimum 2 inches in width, welded or riveted with corner reinforcement for 12 gage structural equivalence.

C. Blades: Galvanized steel, minimum 14 gauge, maximum blade size 8 inches wide, 60 inches long, attached to minimum 1/2 inch shafts. Dampers which are required to have a static pressure rating over 4 inch W.G. shall have minimum 3/4 inch solid shafts.

D. Blade Seals: Synthetic elastomeric or Neoprene, mechanically attached, field replaceable.

E. Jackshafts (where required): Minimum 1/2 inch galvanized steel.

F. Jamb Seals: Stainless steel.

G. Bearings: Oil impregnated sintered bronze or lubricant free, solid stainless steel. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.

H. Linkages: Accessible for maintenance. Linkages may be located in airstream. Linkages located in damper frame shall be external to the duct, accessible for maintenance. Linkages located in the airstream shall be zinc-plated.

I. Leakage: Less than 8 CFM per square foot based on 4 inches W.G. pressure differential.

J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4" W.G.

K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.

L. Temperature Limits: -40 to 200 deg F.

M. Manufacturers:
   1. Greenheck.
   2. Ruskin.
   3. Tamco.
   4. Vent Products.

2.8 DAMPERS, INSULATED OUTDOOR AIR / RELIEF AIR / EXHAUST AIR - AUTOMATED

A. Performance: AMCA certified for Air Performance and Air Leakage.

B. Frames: Extruded aluminum, .080-inch thickness minimum, 4 inches deep minimum, thermally broken, and insulated with polystyrene or polyurethane foam insulation.
C. Blades: Extruded aluminum, internally insulated, and thermally broken. Maximum blade size 8 inches wide, 60 inches long.

D. Shafts: Minimum 7/16 inch hexagonal or square corrosion resistant zinc plated steel.

E. Blade Seals: Extruded EPDM, silicone, or synthetic elastomeric, mechanically attached.

F. Jamb Seals: Silicone, or synthetic elastomeric, mechanically attached.

G. Bearings: Dual bearing assembly of durable synthetic polymer resulting in no metal-to-metal contact. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.

H. Linkage: Linkage shall be installed in the frame side and shall be constructed of aluminum and/or corrosion resistant zinc plated steel.

I. Leakage: Less than 3 CFM per square foot at 1 inch W.G. pressure differential at minus 40 deg F.

J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4 inches W.G.

K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.

L. Temperature Limits: Minus 40 to 155 deg F.

M. Manufacturers:
   2. Ruskin CDTI-50BF.
   3. Tamco Series 9000 BF

2.9 DAMPER OPERATORS - ELECTRIC

A. Electric damper motor shall be 24 or 120 volt two-position or modulating as required with spring return type and sized to operate the damper with sufficient reserve power for smooth operation from full close to full open and tight shut-off. Damper motor shall have "O ring" gaskets for weatherproof operation.

B. Number: Sufficient to achieve unrestricted movement throughout damper range. Provide sufficient number of operators such that one operator does not operate more than the maximum square footage of damper area as recommended in standard catalog of manufacturer.

C. Manufacturers:
   1. Belimo.
   2. Siemens.

2.10 LOCAL AND AUXILIARY CONTROL COMPONENT ENCLOSURE PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, pushbuttons and switches flush on cabinet panel face, or as detailed on drawings. Provide panel with locking door.

B. ANSI/NEMA 250, general purpose utility enclosures with enameled finished face panel, or as indicated on the drawings.

C. Panels shall be sized for a maximum fill of 50% capacity, and shall not be smaller than 24" X 24".

2.11 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK

A. Electrical accessories such as relays, switches, contactors and control transformers shall meet the requirements of the Division 26 Specifications of respective project.
B. Electrical wiring and conduit shall meet the requirements of the Division 26 Specifications.

C. All control wiring in mechanical rooms and any other exposed areas shall be run in conduit. Low voltage temperature control wiring in concealed accessible locations (i.e. above lay-in ceilings), as well as low voltage temperature control wiring within partitions, may be run using plenum rated cable, neatly tie-wrapped and fastened to the building structure (not to ceiling or ceiling support wires).

D. Conduits carrying control wiring shall be sized for a maximum fill of 40% of capacity.

E. Where raceway is required, two separate raceway systems shall be provided; one for A.C. wiring and the other for D.C. wiring.

F. Data transmission cabling and equipment grounding procedures shall meet the latest FCC guidelines for electromagnetic field generation.

G. All control wiring sizes and types shall meet or exceed the equipment manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION - CONTROL SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of temperature sensors, thermostats and other exposed control sensors with plans and room details before installation. Locate room temperature sensors and thermostats 48 inches above floor unless noted otherwise.

C. Thermostats and Space Temperature Sensors located on walls shall have insulated foam backing/plate. In addition conduit or wire penetration through the wall shall be sealed with suitable caulk/foam material compatible with wiring and associated temperature sensing devices.

D. The location of all control-related items to be mounted on the exterior of the building must be approved by the Architect prior to installation. Indicate proposed locations on the shop drawings.

E. Caulk both sides of damper frames to duct walls to prevent leakage between damper frame and duct.

F. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. Sensors used for closed loop control must be connected to the same DDC controller as the associated output signal.

G. Provide conduit and electrical wiring where required.

H. All wiring in altered and unaltered areas shall be run concealed. "Wiremold" in finished areas shall be allowed only when wiring cannot be run concealed in walls or partitions. Minimize “wiremold” routing.

I. Splicing of DDC sensor cabling at junction boxes shall not be acceptable.

J. All equipment which has moving parts and is remotely started by the control system shall be provided with warning labels no less than 2 inches in height, and in bright warning color, stating that the equipment is remotely started by automatic controls. Such labels shall be posted clearly in the area of any moving parts, such as belts, fans, pumps, etc.

K. Locate all control components and accessories such that they are easily accessible for adjustment, service and replacement.
L. Locate, size and support sensing elements in airstreams so that they properly sense the representative condition. Controlling, transmitting and indicating elements shall be located to sense the average condition. Safety elements shall be located to sense the extreme condition.

M. Locate and size sensing elements in liquid lines so that they are in moving liquid and not in stagnant or turbulent locations. Wells shall not obstruct the flow of the liquid being measured. Pipes one inch and smaller shall be increased at least one pipe size at the point of insertion.

N. Locate pressure sensing taps in liquid lines in straight runs of pipe with at least 10 pipe diameters of straight pipe both upstream and downstream of pressure tap. Provide a shut-off cock in sensing line at each pressure tap.

O. Install pressure sensing elements in ducts and casings with clean, sharp taps to accurately read true static pressure, avoiding velocity influence and turbulence.

P. Locate, support and install all control components and accessories so that they will not be subject to vibration, excessive temperatures, dirt, moisture or other harmful conditions beyond their rated limitations.

Q. Where insulation is penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight. Provide brackets for devices to be located on insulated surfaces so as to clear the finished surface of the insulation and to avoid puncturing the vapor seal.

R. Provide all necessary relays, switches, linkages, control devices, accessories and connections as required for a complete and operational control system as specified herein and shown.

S. All electric valve and damper operators shall be capable of moving from full closed to full open, or vice versa, within 120 seconds.

3.2 IDENTIFICATION AND MARKING

A. All sensors, relays, switches, etc. shall be marked with the same identification number as used on the as-built shop drawings. Use Brother P-touch label maker or similar with black text on clear or white super adhesive tape. If label applied in wet environment, spray label with clear enamel for waterproofing.

B. Wire shall be color coded according to functional use. Identify color coding format on record drawings.

C. Identify each wire as to ID number at each controller termination, field device termination or on the field device.

D. All control panels and auxiliary enclosures shall be supplied with engraved phenolic nameplate permanently attached identifying it as control panel number, system served, area served, fed from lighting panel number, circuit number, etc.

E. Temperature control wiring junction box covers shall be painted blue to signify that they are used for temperature controls.

3.3 GRAPHIC DISPLAY GENERATION

A. Provide the following graphic displays as a minimum at the operator interface, arranged in logical penetration paths:
   1. Overall campus layout which shows all of the buildings on the Owner's campus.
   2. Individual building layout or isometric for each building connected to the system.
   3. Floor plans for each floor within each building, with display of present values of space conditions sensed by connected space sensors, display of the name of the air handler associated with each space sensor, display of the room number in which the sensor is located and color coding to indicate whether the sensed space condition is within the acceptable range, is too high, or is too low. TC Contractor shall confirm Owner desired
room names prior to graphics generation which may differ from the room names indicated on construction documents.

4. Schematic diagram for each HVAC system. Each system schematic display shall include at least the following:
   a. Schematic arrangement of ductwork, fans, dampers, coils, valves, piping, pumps, equipment etc.
   b. System name.
   c. Area served.
   d. Present value or status of all inputs, along with present setpoint.
   e. Present percent open for each damper, valve, etc. based on commanded position.
   f. Reset schedule parameters for all points, where applicable.
   g. Present occupancy mode.
   h. Present economizer mode, where applicable.
   i. Present outside air temperature.
   j. Associated space conditions and setpoints, where applicable.
   k. Status of application programs (e.g., warm-up, night cycle, duty cycle, etc.).
   l. Color coding to indicate normal and abnormal values, alarms, etc.

5. Manual override capability for each on/off or open/closed controlled digital output (for fans, pumps, 2-position dampers and valves, etc.) and each modulating analog output (for dampers, valves, VFC speed modulation type points, etc) shall be provided. Graphic display of output point auto or manual override status shall be provided.

6. Sequence of operation in written (text) format for each HVAC system.

7. Overall BAS system schematic.

8. System management graphic for each network device and/or DDC controller.

3.4 OWNER INSTRUCTION AND TRAINING

A. Provide a minimum of eight (8) hours of on-site instruction and training to the Owner on the operation of the control systems for the initial installation.

B. Instruction and training shall be performed by a competent Contractor representative familiar with the control systems operation, maintenance and calibration.

C. Training shall take place after check, test, start-up of temperature controls system at a time mutually agreed upon by the Owner and Contractor.

D. Provide 5 sets of computer training & tutorial CD’s describing workstation operation and functions.

E. Provide 5 sets of literature pertaining to the operation and maintenance of the DDC system components provided.

3.5 CALIBRATION AND START-UP

A. After installation and connection of control components, test, adjust and re-adjust as required all control components in terms of function, design, systems balance and performance. Make systems ready for environmental equipment acceptance tests.

B. After environmental equipment has been accepted and after the systems have operated in normal service for two weeks, check the adjustment on control components and recalibrate where required. Components not in calibration shall be recalibrated to function as required, or shall be replaced. Control devices, linkages, and other control components shall be calibrated and adjusted for stable and accurate operation in accordance with the design intent and to obtain optimum performance from the equipment controlled. Cause every device to automatically operate as intended to ensure its proper functionality.
3.6 ACCEPTANCE PROCEDURE

A. Upon successful completion of start-up and recalibration as indicated in this section, the Architect shall be requested in writing to inspect the satisfactory operation of the control systems.

B. Demonstrate operation of all control systems, including each individual component, to the Owner and Architect.

C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect for inspection and approval.

D. After all items on the punch list are corrected and formal approval of the control systems is provided by the Architect, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

END OF SECTION
SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 20 Section "Mechanical General Requirements."
   2. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 SUMMARY
A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems in pressure classes from minus 6- to plus 6-inch wg (minus 1500 to plus 1500 Pa).
B. Products Installed but Not Furnished Under This Section:
   1. Terminal boxes which are to be furnished by the Laboratory Airflow Controls Contractor shall be installed by the Mechanical Contractor. Refer to Division 23 Section “Laboratory Airflow Controls.”

1.3 DEFINITIONS
A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.

D. FRP: Fiberglass-reinforced plastic.


F. PVC: Polyvinyl Chloride.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.6 SUBMITTALS

A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot (1:50) scale. Show fabrication and installation details for metal ducts. Shop drawings shall be reviewed and approved by the Architect prior to any fabrication.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Duct layout indicating sizes and pressure classes.

3. Elevations of top and bottom of ducts.

4. Dimensions of main duct runs from building grid lines.

5. Fittings.

6. Reinforcement and spacing.

7. Seam and joint construction.

8. Penetrations through fire-rated and other partitions.

9. Equipment installation based on equipment being used on Project.

10. Duct accessories, including access doors and panels.

11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Welding certificates.

C. Field quality-control test reports.

1.7 QUALITY ASSURANCE


B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

D. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
1.8 COORDINATION

A. Sheet metal trades shall cooperate fully with the Laboratory Airflow Controls Trades and shall attend all field installation training sessions.

B. Sheet metal trades shall cooperate fully with the Test and Balance Contractor and provide all miscellaneous caps and any other materials required for structural integrity and leakage testing of the complete duct system in whole or in part. Refer to Division 23 Section "Testing, Adjusting and Balancing."
   1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 (Z180) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M, Type 316, and having a No. 2D finish for concealed ducts and No. 4 for exposed ducts.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

2.3 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Elastomeric Sealant Tape: 3 inches (75 mm) wide; modified butyl adhesive backed.
   1. Manufacturers:
      a. Hardcast; Foil-Grip 1402 and Foil-Grip 1402-181BFX.

C. Water-Based Joint and Seam Sealant:
   1. Manufacturers:
      a. Hardcast; Flex-Grip 550 and Versa-Grip 181.
      b. Polymer Adhesives; No. 11.
      c. United McGill.
   5. Water resistant.
   6. Mold and mildew resistant.
   7. VOC: Maximum 75 g/L (less water).
8. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
   2. Type: S.
   3. Grade: NS.
   5. Use: O.
   6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch (3.2 mm) thick, full face, one piece vulcanized or dovetailed at joints.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
   2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Attachments for stainless steel and PVC-coated duct shall be stainless steel.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

E. Load Rated Cable Suspension System: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
   1. Cable: Aircraft quality 7 x 7 and 7 x 19 wire rope.
      b. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
   2. Fastener: One-piece, die-cast zinc housing with Type 302 S26 stainless steel hardened and tempered springs, and oil impregnated, sintered, hardened and tempered steel locking wedges.
   3. End Fixings: Loop, stud or toggle; or plain end suitable for wire rope beam clamp.
   4. Manufacturers:
      b. Duro Dyne Corp.; Dyna-Tite System.

F. Welded Supports: Structural steel shapes with zinc rich paint. Equivalent, proprietary design, rolled steel structural support systems may be used in lieu of mill rolled structural steel.
2.5 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's and SMACNA guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Nexus Inc.
   c. Ward Industries, Inc.

C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.

2.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts:

1. Manufacturers:
   a. Eastern Sheet Metal (ESM).
   b. Foremost Duct, LLC.
   c. LaPine Metal Products.
   d. Lindab Inc.
   f. SEMCO Incorporated.
   g. Tangent Air, Inc.
   h. Universal Spiral Air.

C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.

1. Round fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.

D. Duct Joints:

1. Ducts up to 20 Inches (500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Bolts and fasteners for galvanized steel duct shall be carbon steel, zinc coated per ASTM A153. Bolts and fasteners for stainless steel and polyvinyl chloride coated steel duct shall be stainless steel.

E. Low Pressure Ductwork (plus or minus 2 inches W.G. Static Pressure Class)

1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

F. Medium and High Pressure Ductwork (For Static Pressure Class Greater than plus or minus 2 inches W.G.)
   1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
   2. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
   3. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
   4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

G. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

H. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

I. Fabricate elbows using die-formed, gored, or pleated construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
   1. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
   2. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
   3. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
   4. Pleated Elbows for Sizes through 14 Inches (355 mm) in Diameter and Pressures through 10-Inch wg (2500 Pa): 0.022 inch (0.55 mm).

J. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:
   1. Round Elbows 4 to 8 Inches (100 to 200 mm) in Diameter: Two piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.
   2. Round Elbows 9 to 26 Inches (225 to 660 mm) in Diameter: Standing-seam construction.
   3. Round Elbows 28 to 60 Inches (710 to 1525 mm) in Diameter: Standard gored construction, riveted and bonded.
   4. Other Fittings: Riveted and bonded joints.
   5. Couplings: Slip-joint construction with a minimum 2-inch (50-mm) insertion length.

PART 3 - EXECUTION
3.1 DUCTWORK APPLICATION SCHEDULE
   A. Ductwork materials and performance requirements are scheduled on the Drawing.
3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, and sleeves. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."

O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated. Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer’s instructions.

1. For pressure classes lower than 2-inch wg (500 Pa), seal transverse joints.

2. Seal ducts before external insulation is applied.

3. After pressure testing, remake leaking joints until leakage is equal to or less than maximum allowable. Refer to Division 23 Section “Testing, Adjusting, and Balancing” for allowable leakage rates.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.
C. Support ductwork from building structure, not from roof deck, floor slab, pipe, other ducts, or equipment.
D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
E. Use load rated cable suspension system for round duct in exposed locations.

3.5 CONNECTIONS
A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL
A. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
B. Duct system will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

END OF SECTION
SECTION 23 3300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 23 Section “Testing, Adjusting, and Balancing” for duct test holes.
   3. Division 23 Section “Temperature Controls” for motorized control dampers.

1.2 DEFINITIONS
A. NVLAP: National Voluntary Laboratory Accreditation Program.
B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Special fittings.

1.4 QUALITY ASSURANCE

LAS 10905-00  August 21, 2018
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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS
A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
C. Stainless Steel: ASTM A 480/A 480M, Types 304 and 316 as indicated.
D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

2.3 LOW PRESSURE MANUAL VOLUME DAMPERS
A. Manufacturers:
   1. American Warming and Ventilating.
   2. Arrow United Industries.
   5. Louvers and Dampers.
   6. Nailor Industries Inc.
   7. Ruskin Company.
   8. Vent Products Company, Inc.
B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
C. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.

2.4 FLEXIBLE CONNECTORS
A. Manufacturers:
   1. ADSCO Manufacturing LLC.
   2. Duro Dyne Corp.
   3. Senior Flexonics Pathway.
   4. Ventfabrics, Inc.
B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
C. Metal-Edged Connectors: Factory fabricated with a fabric strip [3-1/2 inches (89 mm)] [5-3/4 inches (146 mm)] wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-
mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.

   1. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).
   2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp and 340 lbf/inch (60 N/mm) in the filling.
   3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

2.5 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE

A. Manufacturers:
   1. Flexmaster Type 8M, UL 181, Class 1.
   3. Hart & Cooley.

B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 6 inches WG positive and 4 inches WG negative for low and medium pressure ducts.

C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by a fire retardant polyethylene vapor barrier jacket; maximum 0.23 K value at 75 deg F.

D. Acoustical performance tested in accordance with the Air Diffusion Council's Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

<table>
<thead>
<tr>
<th>Octave Band Hz.</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; diameter</td>
<td>8</td>
<td>32</td>
<td>38</td>
<td>35</td>
<td>39</td>
<td>25</td>
</tr>
<tr>
<td>8&quot; diameter</td>
<td>13</td>
<td>32</td>
<td>36</td>
<td>35</td>
<td>36</td>
<td>21</td>
</tr>
<tr>
<td>12&quot; diameter</td>
<td>15</td>
<td>29</td>
<td>28</td>
<td>33</td>
<td>26</td>
<td>14</td>
</tr>
</tbody>
</table>

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

<table>
<thead>
<tr>
<th>Octave Band Hz.</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; diameter</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>8&quot; diameter</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>12&quot; diameter</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>11</td>
</tr>
</tbody>
</table>

The self generated sound power levels (LW) dB are 10-12 Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

<table>
<thead>
<tr>
<th>Octave Band Hz.</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; diameter</td>
<td>42</td>
<td>31</td>
<td>23</td>
<td>18</td>
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<td>21</td>
</tr>
<tr>
<td>8&quot; diameter</td>
<td>41</td>
<td>34</td>
<td>27</td>
<td>19</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>12&quot; diameter</td>
<td>53</td>
<td>44</td>
<td>36</td>
<td>27</td>
<td>21</td>
<td>22</td>
</tr>
</tbody>
</table>

E. Flexible Duct Fittings: Galvanized steel, twist-in design with damper. Size as indicated.

F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches (75 to 450 mm) to suit duct size.
2.6  FLEXIBLE DUCT ELBOW SUPPORTS  
   A. Manufacturer:  
      1. Automation Industries Thermaflex; FlexFlow Elbow.  
   B. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6 inches through 16 inches.  
   C. Elbow supports shall be UL listed for use in return air plenum spaces.  

PART 3 - EXECUTION  
3.1  APPLICATION AND INSTALLATION  
   A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.  
   B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.  
   C. Provide balancing dampers where indicated on drawings. Install at a minimum of two duct widths from branch takeoff.  
   D. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.  
   E. Connect flexible ducts to metal ducts with draw bands.  
   F. Install flexible duct elbow supports at each diffuser, grille, or register, and elsewhere as indicated.  
   G. Install turning vanes in rectangular duct elbows in excess of 45 degrees, and where indicated:  
      1. Use manufactured double-vane turning vanes unless otherwise specified.  
      2. Seat outboard-most vane in heal of duct elbow.  
      3. Provide vanes for all runner punchings, practice of eliminating every other vane is prohibited.  
      4. Use single-vane turning vanes in low pressure square elbows.  

3.2  FIELD QUALITY CONTROL  
   A. Tests and Inspections:  
      1. Operate dampers to verify full range of movement.  

3.3  ADJUSTING  
   A. Adjust duct accessories for proper settings.  
   B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."  

END OF SECTION
SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section "Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each product indicated, include the following:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 AIR DIFFUSION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Anemostat; a Mestek Company.
   2. Krueger; Tomkins PLC.
   3. Nailor Industries of Texas Inc.
   5. Titus; Tomkins PLC.
   6. Tuttle & Bailey; Tomkins PLC.

B. Terminal air diffusion devices have been chosen in terms of specific air distribution requirements, spacing, and sound characteristics.

C. Air diffusion devices shall be standard off white baked enamel finish unless noted otherwise. Provide air diffusion device interior surfaces, including blank-offs, with black matte finish.

D. Air pattern adjustments shall be made from the face of the device.

E. Refer to drawings and schedules for quantities, types, and finishes.

F. Coordinate frame types with Architectural Reflected Ceiling Plan.
2.2 SOURCE QUALITY CONTROL
   A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION
3.1 EXAMINATION
   A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Install diffusers, registers, and grilles level and plumb.
   B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
   C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING
   A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION
SECTION 23 8216 - HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 20 Section “Mechanical General Requirements.”
   2. Division 20 Section “Basic Mechanical Materials and Methods.”

1.2 SUMMARY
A. This Section includes duct-mounted heating and cooling coils.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each coil. Include rated capacity and pressure drop for each coil.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.
D. Field quality-control test reports.
E. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.
B. ASHRAE Compliance:
   1. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
   2. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
PART 2 - PRODUCTS

2.1 WATER COILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Aerofin Corporation.

B. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.

C. Minimum Working-Pressure/Temperature Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).

D. Source Quality Control: Factory tested to 300 psig (2070 kPa).

E. Tubes: ASTM B 743 copper, minimum 0.020 inch (0.508 mm) wall thickness, and minimum 0.50 inch (12.7 mm) diameter.

F. Fins: Aluminum, minimum 0.010 inch (0.254 mm) thick.

G. Headers: Cast iron with cleaning plugs, and drain and air vent tappings or seamless copper tube with brazed joints, prime coated.

H. Frames, Hot Water Coils: Galvanized-steel channel frame, minimum 0.0625 inch (1.6 mm) thick for slip-in mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Straighten bent fins on air coils.

D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 15 Section "Laboratory Airflow Controls," and other piping specialties are specified in Division 15 Section "Hydronic Piping."
3.4 FIELD QUALITY CONTROL
   A. Perform the following field tests and inspections and prepare test reports:
      1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION
SECTION 26 0010 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY
A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

1.3 REFERENCES
A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
1. A.N.S.I. - American National Standards Institute
2. A.S.T.M. - American Society for Testing Materials
3. I.C.E.A. - Insulated Cable Engineers Association
4. I.E.E.E. - Institute of Electrical and Electronics Engineers
5. N.E.C. - National Electrical Code
6. N.E.C.A. - National Electrical Contractors Association
7. N.E.M.A. - National Electrical Manufacturer's Association
8. U.L. - Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.

1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
2. The Contractor understands that the work herein described shall be complete in every detail.

B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.

1. Notify the Architect/Engineer before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.

C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.

D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.

E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.

F. Sequence and Schedule: Work so as to avoid interference with the work of other trades. Be responsible for removing and relocating any work which in the opinion of the Owner’s Representatives causes interference.

1.5 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules and regulations.

B. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or Specifications shall govern.

1.6 DRAWINGS

A. The Drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.

C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.7 MATERIAL AND EQUIPMENT MANUFACTURERS

A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of electrical equipment and shall be of the manufacturer's latest design.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.

C. Where existing equipment is modified to include new switches, circuit breakers, metering or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

1.8 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

1.9 ITEMS REQUIRING PRIOR APPROVAL

A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical
information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.

B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

1.10 SHOP DRAWINGS/SUBMITTALS

A. Submit project-specific submittals for review in compliance with Division 1.

B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.

C. Provide detailed layout shop Drawings (on transparent media) of all lighting and power distribution systems, routing of conduits, combining of circuits, circuiting, details and related information necessary of installation and maintenance. After review by the Architect/Engineer, a copy of Drawings will be stamped and returned to the Contractor.

D. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

E. Submit for approval shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical Specifications for additional requirements.

1. Wiring Devices
2. Lighting Control Devices
3. Enclosed Switches and Circuit Breakers
4. Fuses
5. Interior Lighting

1.11 COORDINATION DRAWINGS

A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 1 Specification Sections.

B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for Owner and shall be bound in ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.
C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
   1. Routine maintenance procedures.
   2. Trouble-shooting procedures.
   3. Contractor's telephone numbers for warranty repair service.
   5. Recommended spare parts lists.
   6. Names and telephone numbers of major material suppliers and subcontractors.
   7. System schematic drawings on 8-1/2" x 11" sheets.

1.13 RECORD DRAWINGS
A. Submit record drawings in compliance with Division 1.
B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work.
C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

1.14 INSTRUCTION OF OWNER PERSONNEL
A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.
D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

1.15 WARRANTY
A. Warranty: Comply with the requirements in Division 1 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner’s satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.
C. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.16 USE OF EQUIPMENT
A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

1.17 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 DEMOLITION WORK

A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items such as, but not limited to, electrical equipment, devices, lighting fixtures, conduit, and wiring called out on the Drawings and as necessary whether such items are actually indicated on the Drawings or not in order to accomplish the installation of the specified new work.

B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.

C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items on which the Owner
waives ownership shall become the property of the Contractor, who shall remove and legally
dispose of same, away from the premises.

3.3 INSTALLATION OF EQUIPMENT
A. Install all equipment in strict accordance with all directions and recommendations furnished by
the manufacturer. Where such directions are in conflict with the Drawings and Specifications,
report such conflicts to the Architect/Engineer for resolution.
B. Device Location:
   1. Allow for relocation prior to installation of wiring devices and other control devices, for
      example, receptacles, switches, fire alarm devices, and access control devices, within a
      10-foot radius of indicated location without additional cost.

3.4 TEMPORARY SERVICES
A. Provide and remove upon completion of the project, in accordance with the general conditions
   and as described in Division 1, a complete temporary electrical and telephone service during
   construction.

3.5 CHASES AND RECESSES
A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate
   location and size.

3.6 CUTTING, PATCHING AND DAMAGE TO OTHER WORK
A. Refer to General Conditions for requirements.
B. All cutting, patching and repair work shall be performed by the Contractor through approved,
   qualified subcontractors. Contractor shall include full cost of same in bid.

3.7 EXCAVATION AND BACKFILLING
A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the
   electrical work. Coordinate the work with other excavating and backfilling in the same area.
B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete
   encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall
   footings with lean mix concrete up to underside of footings and extend concrete within
   excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in
   layers not more than 8 inches in thickness, 95 percent compaction throughout with approved
   compaction equipment. Tamp, roll as required. Excavated material shall not be used.
D. Backfill all excavations inside building, under drives and parking areas with well-tamped
   granular material. Granular backfill shall be placed in layers not more than 8 inches in
   thickness, 95 percent compaction throughout with approved compaction equipment. Tamp as
   required. Excavated material shall not be used.
E. Backfill outside building with granular material to a height 12 inches over top of pipe
   compacted to 95 percent compaction as specified above. Backfill remainder of excavation with
   unfrozen, excavated material in such a way to prevent settling.

3.8 EQUIPMENT CONNECTIONS
A. Make connections to equipment, motors, elevator controllers, lighting fixtures, and other items
   included in the work in accordance with the approved shop Drawings and rough-in
   measurements furnished by the manufacturers of the particular equipment furnished. All
   additional connections not shown on the Drawings, but called out by the equipment
   manufacturer's shop Drawings shall be provided.
3.9 CLEANING
   A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
   B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS
   A. Equipment and materials shall be protected from theft, injury or damage.
   B. Protect conduit openings with temporary plugs or caps.
   C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

3.11 EXTRA WORK
   A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done. Prior to any extra work which may be proposed, the Electrical Contractor shall submit unit prices (same prices for increase/decrease of work) for the following items: 3/4", 1", 1-1/2" conduit; #12, #10, #8, #6, #2 wire; receptacle, data box, fire alarm combination visual/audible notification appliance, fire alarm visual notification appliance, clock, or other devices which may be required for any proposed extra work.

3.12 DRAWINGS AND MEASUREMENTS
   A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor’s responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.
SECTION 26 0519 - CONDUCTORS AND CABLES

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. Building wires and cables rated 600V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:
   1. Division 26 Section "Control/Signal Transmission Media" for transmission media used for control and signal circuits.
   2. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
   3. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 SUBMITTALS
A. Field Quality-Control Test Reports

1.4 QUALITY ASSURANCE
A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
B. 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.
C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES
A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for types THHN/THWN-2.
C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Metal-clad cable, Type MC with ground wire.
D. Power Cable for Variable Frequency Controlled Motors: 600V and 2000V, three conductor, XLPE cable with three symmetrical positioned ground conductors and a continuous impervious corrugated aluminum armor and overall PVC jacket. Cable shield transfer impedance shall be less than 10 ohms per meter up to 30 MHZ when tested in accordance with NEMA WC 61.
1. Approved manufacturers for VFC power cables:
   a. Southwire Armor-x
   b. Draka USA

2.2 CONNECTORS AND SPLICES
A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS
A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
1. If providing aluminum feeders, contractor is responsible to provide calculations for engineer to review prior to installation. Calculations to include voltage drop, equipment ground size, conduit size and any de-rating required.
B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger, except VFC cable, which shall be extra flexible stranded.
C. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).
D. Use conductor not smaller than 12 AWG for power and lighting circuits. Unless indicated otherwise, all circuits shall be 2#12, 1#12G, ¾”C.
E. Use conductor not smaller than 14 AWG for control circuits, provided by Electrical Contractor.
F. Where equipment is listed for use with copper conductors only, splice from aluminum to copper prior to entering equipment or use copper conductors for the entire length of feeder.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
B. Feeders Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
C. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
D. Exposed Branch Circuits, including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
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CONDUCTORS AND CABLES

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
F. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN/THWN-2, single conductors in raceway.
G. Feeders and Branch Circuits on Rooftops: XHHW-2 single conductors in conduit.
H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel wire-mesh strain relief device at terminations to suit application.
I. Fire Alarm Circuits: Type THHN/THWN-2, in raceway.
J. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
K. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.
L. Connection between Variable Frequency Controllers and Motors: Use 600V rated VFC power cable for circuit lengths less than 50 feet and 2000V rated VFC power cable for circuit lengths 50 feet and greater. Support 5’ on center, minimum. Terminate according to cable manufacturer’s recommendations.
M. Isolated Power System Circuits: Use Type XLP in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
G. Complete cable tray systems installation according to Section 26 0536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
H. Support communication cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
J. Branch circuits may be combined up to 3 circuits in a homerun conduit.
K. Provide a separate neutral conductor for each circuit.
L. Electrical Contractor shall be responsible for de-rating of conductors as required by N.E.C. when more than three current carrying conductors are installed in a single raceway or cable.
M. Type MC cable shall be supported and secured at intervals not exceeding 4'-0".
N. AC cable shall not be used for home runs to receptacle or distribution panels.
O. Where MC cable is permitted by the specifications, MC cable shall not be bundled.
P. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.
Q. Do not route conductors across roof without prior approval from engineer. Where approved, conductors shall be installed in rigid steel conduit and shall be de-rated for ambient temperature per the NEC.

3.4 CONNECTIONS
A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
   1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
   2. Use compression type terminations for aluminum conductors.
C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
D. Clean conductor surfaces before installing lugs and connectors.
E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
F. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
G. Use Sta-Kon connectors to terminate stranded conductors #10 AWG and smaller to screw terminals.
H. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.5 IDENTIFICATION
A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."
B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0533 "Raceways and Boxes."

3.7 FIRESTOPPING
A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL
A. Perform the following field quality control tests in accordance with Division 26 section “Electrical Testing”
   1. Description: Test all feeders rated 100 A and above.
   2. Visual and Mechanical Inspection
      a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
      b. Test cable mechanical connections with an infrared survey.
      c. Check cable color-coding against project Specifications and N.E.C. requirements.
   3. Electrical Tests
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a. Perform insulation resistance test on each conductor with respect to ground and
   adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.

b. Perform continuity test to insure proper cable connection.

4. Test Values
   a. Minimum insulation resistance values shall be not less than fifty mega-ohms.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve
      compliance with requirements.

END OF SECTION
SECTION 26 0526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:
1. Division 26 Section "Underground Ducts and Utility Structures" for ground test wells.
2. Division 26 Section "Lightning Protection" for additional grounding and bonding materials.
3. Division 26 Section “Electrical General Requirements”.
4. Division 26 Section “Conductors and Cables”.

1.3 REFERENCES
A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
L. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.
N. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.
O. UL 96: Lightning Protection Components.
P. UL 467: Grounding and Bonding Equipment.
Q. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
R. UL 486B: Wire Connectors for Use with Aluminum Conductors.

1.4 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Product Data: For the following:
   1. Ground rods.
C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
D. Field Test Reports: Submit written test reports to include the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
   4. Indicate overall system resistance to ground.
   5. Indicate overall Telecommunications system resistance to ground.

1.5 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Division 26 “Electrical General Requirements”.
B. Accurately record actual locations of grounding electrodes and connections to building steel.

1.6 QUALITY ASSURANCE
A. Testing Agency Qualifications: Refer to specification section “Electrical Testing.”
B. 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.
   1. Comply with UL 467.
C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
E. Comply with ANSI/TIA/EIA-607 “Standard for Commercial Building Grounding and Bonding Requirements for Telecommunications”.

PART 2 - PRODUCTS
2.1 GROUNDING CONDUCTORS
A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
B. Material: Aluminum, copper-clad aluminum, and copper.
C. Equipment Grounding Conductors: Insulated with green-colored insulation.
D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
E. Grounding Electrode Conductors: Stranded cable.
F. Underground Conductors: Bare, stranded, copper unless otherwise indicated.

2.2 CONNECTOR PRODUCTS
A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
C. Welded Connectors: Exothermic-welded type, in kit form, and selected for the specific application per manufacturer's written instructions.
D. Compression-Type Connectors: Pure, wrought copper, per ASTM B187.

PART 3 - EXECUTION
3.1 EQUIPMENT GROUNDING
A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
C. Underground Grounding Conductors: No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
D. In raceways, use insulated equipment grounding conductors.
E. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
F. Verify specific equipment grounding requirements with the manufacturer’s recommendations.

3.2 CONNECTIONS
A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
B. Equipment Grounding Conductor Terminations
1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

E. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Install in conduit where routed above grade.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

C. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.

END OF SECTION
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 the following:
1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.
B. Related Sections include the following:
1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS
A. EMT: Electrical metallic tubing.
B. IMC: Intermediate metal conduit.
C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS
A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS
A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE
A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Comply with NFPA 70.

1.7 COORDINATION
A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   4. Channel Dimensions: Selected for applicable load criteria.
B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.


2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with:
      a. Two-bolt conduit clamps
      b. Single-bolt conduit clamps
c. Single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. Support single runs of MC cable using spring-steel clamps from suspended ceiling hangers, hanger wire or building structure at intervals not to exceed three feet. Do not support MC cable from ceiling grid.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel:
      a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
      b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
      c. Spring-tension clamps.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel support systems attached to substrate.

E. Slotted support systems applications:
   1. Indoor dry and damp Locations: Painted Steel
   2. Outdoors and interior wet locations: Galvanized Steel
   3. Corrosive Environments, including pool equipment rooms: Nonmetallic

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

H. Obtain permission from Architect/Engineer before using powder-actuated anchors.
I. Obtain permission from Architect/Engineer before drilling or cutting structural members.

J. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four anchors.

L. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

M. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

N. The Contractor shall replace all supports and channels that sag, twist, and/or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Provide concrete bases for all floor mounted electrical equipment.

B. Provide concrete bases for all exterior, grade level electrical equipment, and where indicated.

C. Base/Pad Construction:
   1. Construct per manufacturer’s recommendations for particular equipment, including suggested piers and dowel rods.
   2. Interior concrete bases shall have a minimum depth of 4” unless other indicated or recommended by the manufacturer.
   3. Exterior concrete bases shall have a minimum depth of 8” unless other indicated or recommended by the manufacturer.
   4. Construct concrete bases for primary and secondary power distribution equipment per requirements of the electrical utility, where submitted for its review.

D. Anchor equipment to base per both supports and equipment manufacturer’s instructions.

E. Coordinate conduit openings and sleeve locations in base with requirements of equipment to be supported.
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of the base.
   2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 26 0533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS
A. EMT: Electrical metallic tubing.
B. ENT: Electrical nonmetallic tubing.
C. FMC: Flexible metal conduit.
D. IMC: Intermediate metal conduit.
E. LFMC: Liquidtight flexible metal conduit.
F. LFNC: Liquidtight flexible nonmetallic conduit.
G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

1.5 QUALITY ASSURANCE

1.6 COORDINATION

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

2.2 FIRE ALARM EMT

2.3 BOXES, ENCLOSURES, AND CABINETS

2.4 SLEEVES FOR RACEWAYS

2.5 SLEEVE SEALS

2.6 GROUT

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

3.2 INSTALLATION

3.3 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS

3.4 SLEEVE-SEAL INSTALLATION

3.5 FIRESTOPPING

3.6 PROTECTION

3.7 CLEANING

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H. PVC: Polyvinyl Chloride.
I. HDPE: High Density Polyethylene.

1.4 SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE
A. 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.
B. Comply with NFPA 70.
C. All work in natatoriums, pool areas and fountain structures shall be in accordance with N.E.C. article 680, “Swimming Pools, Fountains, and Similar Installations.”

1.6 COORDINATION
A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, 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 METAL CONDUIT AND TUBING
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Allied Tube Triangle Century.
   4. Anamet Electrical, Inc.; Anaconda Metal Hose.
   5. International Metal Hose.
   6. Electri-Flex Co
   7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
   8. LTV Steel Tubular Products Company – Manhattan/CDT/Cole-Flex.
   11. Wheatland.
B. Rigid Steel Conduit: ANSI C80.1.
C. Aluminum Rigid Conduit: ANSI C80.5.
D. IMC: ANSI C80.6.
E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch, minimum.
F. EMT: ANSI C80.3.
G. FMC: Zinc-coated steel.
H. LFMC: Flexible steel conduit with PVC jacket.
I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
2. Fittings for EMT: Steel, set-screw type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

2.2 FIRE ALARM EMT
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allied Tube Triangle Century.
B. EMT conduit with bright red topcoat; Fire Alarm EMT.
C. EMT and Fittings: ANSI C80.3.

2.3 BOXES, ENCLOSURES, AND CABINETS
A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.
B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.
C. Nonmetallic Outlet and Device Boxes: NEMA OS 2. Shall be used in corrosive areas.
D. Floor Boxes: Cast metal, fully adjustable, rectangular.
E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.
G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.4 SLEEVES FOR RACEWAYS
A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.5 SLEEVE SEALS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, Inc.
   2. Calpico, Inc.
   3. Metraflex Co.
   4. Pipeline Seal and Insulator, Inc.
B. **Description:** Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   1. **Sealing Elements:** EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. **Pressure Plates:** Plastic. Include two for each sealing element.
   3. **Connecting Bolts and Nuts:** Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 **GROUT**

A. **Nonmetallic, Shrinkage-Resistant Grout:** ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 **RACEWAY APPLICATION**

A. **Provide raceways in interior and exterior locations in accordance with the “Raceway Application Matrix” included on the drawings.**

B. **Boxes and Enclosures, Exterior Aboveground:** NEMA 250, Type 3R.

C. **Boxes, Enclosures, and Handholes:**
   1. **Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles:** Polymer concrete, SCTE 77, Tier 15 structural load rating.
   2. **Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles:** Polymer-concrete units, SCTE 77, Tier 8 structural load rating.

D. **Boxes and Enclosures:** NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

E. **Minimum Raceway Size:** 3/4-inch trade size.

F. **Raceway Fittings:** Compatible with raceways and suitable for use and location.
   1. **Rigid and Intermediate Steel Conduit:** Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. **PVC Externally Coated, Rigid Steel Conduits:** Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
   3. **EMT:** Use setscrew, fittings. Comply with NEMA FB 2.10.
   4. **Flexible Conduit:** Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

G. **Install nonferrous conduit or tubing for circuits operating above 60 Hz.** Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

H. **Do not install aluminum conduits in contact with concrete.**

I. **Install surface raceways only where indicated on Drawings.**

J. **Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.**
3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Install temporary closures to prevent foreign matter from entering raceways.

F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
   1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

J. Support conduit within 12 inches of enclosures to which attached.

K. Raceways Embedded in Slabs:
   1. Raceways embedded in slabs shall be limited to above grade concrete decks. Embedded conduit shall be limited to servicing floor boxes and equipment located in open spaces away from accessible walls.
   2. Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
   3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   4. Space raceways laterally to prevent voids in concrete.
   5. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   6. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   7. Conduits shall run flat. Do not allow conduits to cross.
   8. Change from non-metallic raceway to EMT before turning up out of the concrete and rising above the floor.

L. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

U. Provide pull string and 25% spare capacity in every branch circuit conduit.

V. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where conduits route through, to, or from a hazardous classified space (Class I or II), provide proper seal offs when exiting or entering the hazardous classified space.
   3. Where conduits pass between spaces that are maintained at two different vapor pressures.
   4. Where otherwise required by NFPA 70.

W. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

X. Flexible Conduit Connections: Comply with NEMA RV3. Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

Y. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Provide cover clips to cover space between connecting pieces.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
BB. Locate boxes so that cover or plate will not span different building finishes.
CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
EE. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
FF. Do not route feeders across roof unless approved in writing by Engineer.
GG. Provide a pull box (a handhole for outdoor applications) for each conduit run that exceeds 250 feet. Provide two pull boxes (handholes for outdoor applications) for runs that exceed 500 feet.
HH. Route conduits in finished areas with exposed ceilings at underside of structural deck or as high as possible.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS
A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."
B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
D. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
F. Cut sleeves to length for mounting flush with both surfaces of walls.
G. Extend sleeves installed in floors 2 inches above finished floor level.
H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

3.4 SLEEVE-SEAL INSTALLATION
A. Install to seal underground, exterior wall penetrations.
B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.7 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION
SECTION 26 0553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following:
   1. Identification for raceway and metal-clad cable.
   2. Identification for conductors and communication and control cable.
   3. Equipment identification labels.

1.3 QUALITY ASSURANCE
B. Comply with NFPA 70.

1.4 COORDINATION
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Color for Printed Legend:
   1. Power Circuits: Black letters on an orange field.
   2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 EQUIPMENT IDENTIFICATION LABELS


B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   2. Tensile Strength: 50 lb, minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.5 WIRING DEVICE IDENTIFICATION

A. Description: Self adhesive label with black upper case letters on clear polyester label, font size 7.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.

C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
   1. Fire Alarm System: Red.
   3. Telecommunication System: Green and yellow.
   4. Control Wiring: Green and red.
D. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.

F. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.

G. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.

   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
   1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.
   2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
      b. Outdoor Equipment: Stenciled.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   2. Equipment to Be Labeled: If included on project. All items may not be on project.
      a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Electrical substations.
f. Emergency system boxes and enclosures.
g. Disconnect switches.
h. Enclosed circuit breakers.
i. Motor starters.
j. Power-generating units.
k. Fire-alarm control panel and annunciators.

L. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location:
1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.

C. Apply identification devices to surfaces after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
3. Colors for 480/277-V Circuits:
   b. Phase B: Orange.
   c. Phase C: Yellow.
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Label information arrangement for 3 lines of text.
1. Line one shall describe the panel or equipment. Line one example: “DP-XX,” “RP-XX,” “T-XX,” “EF-XX,” etc.
2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: “Fed from DP-XX,” “Fed from RP-XX,” etc.
3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: “First Floor Elect. Rm #XXX.”
4. Line four shall include “Via T-XX” when panel or equipment is fed from a transformer.

I. Examples:

<table>
<thead>
<tr>
<th>RP-1A</th>
<th>EF-1</th>
<th>LP-1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>FED FROM DP-1A</td>
<td>FED FROM MCC-1A</td>
<td>LOCATED IN</td>
</tr>
<tr>
<td>ELECTRICAL ROOM A100</td>
<td>MECHANICAL ROOM F101</td>
<td>ELECTRICAL ROOM A100</td>
</tr>
<tr>
<td>VIA T-1A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

J. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.

K. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

L. Degrease and clean surface to receive nameplates.

M. Install nameplate and labels parallel to equipment lines.

N. Secure nameplate to equipment front using screws.

O. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

P. Identify conduit using field painting where required.

Q. Paint red colored band on each fire alarm conduit and junction box.

R. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following lighting control devices:
   1. Occupancy sensors.
B. Related Sections include the following:
   1. Division 26 Section “Electrical General Requirements”.
   2. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.3 REFERENCES
E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
F. UL 486B: Wire Connectors for Use with Aluminum Conductors.
G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.
H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.
I. UL 917: Clock Operated Switches.
1.4 DEFINITIONS
A. LED: Light-emitting diode.
B. PIR: Passive infrared.
C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.
D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

1.5 SUBMITTALS
A. Product Data: For each type of product indicated including physical data and electrical performance.
B. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Lighting plan showing location, orientation, and coverage area of each sensor.
   2. Interconnection diagrams showing field-installed wiring.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:
   1. Description of operation and servicing procedures.
   2. List of major components.
   3. Recommended spare parts.
   4. Programming instructions and system operation procedures.

1.6 QUALITY ASSURANCE
A. 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.

1.7 COORDINATION
A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
B. Coordinate interface of lighting control devices with temperature controls specified in Division 23.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver products to the site under provisions of Division 26 Section “Electrical General Requirements”.
B. Store and protect products under provisions of Division 26 Section “Electrical General Requirements”.

LAS 10905-00 August 21, 2018
PART 2 - PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.2 TIME CONTROLLERS

A. Manufacturers:
   1. Intermatic, Inc.
   2. TORK.

B. General
   1. Provide NEMA Type 1-general purpose steel enclosure with corrosion-resistant primer and baked enamel finish in manufacturer’s standard color.
   2. Provide enclosure suitable for surface mounting with hinged front; padlock hasp; and side, bottom, and back knockouts for conduit connections.
   3. Provide heavy-duty pressure terminals suitable for wire sizes up to no. 8 AWG.

C. Electromechanical-Dial Time Controller: Type complying with UL 917.
   1. Contact Configuration: SPST.
   2. Contact Rating: 40 amperes tungsten, 120-277 V ac.
   4. Program: 24 hour dial, which can perform a minimum of 10 On/Off operations within a 24-hour period. Provide a minimum of 1 hour setting for ON or OFF operations and maximum ON time of 20 hours.
      a. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
   5. Program: Astronomical time dial which turns load on at sunset and turns load off at sunrise or can be set from 8:30 pm to 2:30 am. Provide dial suitable for Project location.

2.3 OCCUPANCY SENSORS

A. General
   1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer’s recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors and control units as required to achieve complete minor motion coverage of the space indicated.
   2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.
   3. Provide occupancy sensors with a bypass switch to override the “ON” function in the event of sensor failure.
   4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.
   5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.

B. Wall Switch Passive Infrared Occupancy Sensor
   1. Manufacturers:
      a. Perfect Sense – PS-PWS
      b. Wattstopper PW-100.
d. Greengate OSW-P-0451-W.
e. Sensorswitch WSD.
f. Philips LRS2210.
g. Leviton ODS10-IDW.

2. Description: Wall mounted, 180° coverage, passive infrared sensing occupancy sensor.
   a. Electrical Characteristics: Capable of switching up to 800W fluorescent or incandescent lighting loads at 120V and 1200 watts fluorescent loads at 277V.
   c. Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 30 minutes. Ambient light sensing shall be adjustable from 20FC to 300FC, with override.
   d. Device Body: White, plastic with momentary on/off override pushbutton designed to mount in a standard switch box with “decora” style switch plate.

3. Dual Level Switching: Provide occupancy sensor capable of controlling two switch legs independently where dual level switching is indicated.
   a. Manufacturers:
      1) Perfect Sense PWD.
      2) Wattstopper PW-200.
      4) Greengate OSW-P-0451-DMV.
      5) Sensorswitch WSD-2P.
      6) Philips LRS2215.
      7) Leviton ODSOD-IDW.

C. 360° Ceiling Mounted Dual Technology Occupancy Sensor

1. Manufacturers:
   a. Perfect Sense CDS.
   b. Wattstopper DT 300
   d. Greengate OMC-DT-2000-R.
   e. Sensorswitch CM-PDT-R.
   f. Philips LRM2255.
   g. Leviton OSC10-M0W.

2. Description: Ceiling mounted, 360° coverage, multi-tech sensing occupancy sensor.
   a. Housing: White, thermoplastic, tamper resistant ceiling mount.
   b. Functions: Automatic ON must sense motion from both ultrasonic and infrared sensing elements. Either technology shall maintain ON, with adjustable time delays.
   c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
   d. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
   e. Manual override function.

D. Occupancy Sensor Control Units:

1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
a. Control units shall be provided as required to power ceiling mounted occupancy sensors, control lighting loads and provide a minimum of one auxiliary contact.
b. Occupancy sensor control units shall mount external to 4” sq junction box in the ceiling space. Wiring between control unit and occupancy sensor shall be plenum rated.
c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
e. It is acceptable to provide controls and auxiliary contacts as required integral to the ceiling sensor, provided all required contacts are provided.
f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

PART 3 - EXECUTION
3.1 OCCUPANCY SENSOR INSTALLATION
   A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.
   B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.
   C. Locate sensors such that motion through open doors will not falsely activate sensors.
   D. Do not locate ultrasonic sensors within six feet of supply air diffusers.
   E. Locate infrared sensors to avoid obstructions.
   F. Provide the services of a manufacturer’s representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.
   G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

3.2 WIRING INSTALLATION
   A. Wiring Method: Comply with Division 26 Section "Conductors and Cables".
   B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
   C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
   D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
   E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
3.3 IDENTIFICATION
   A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
   B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL
   A. Perform the following field tests and inspections and prepare test reports:
      1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
      2. Operational Test: Verify actuation of each sensor and adjust time delays.
   B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
   C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING
   A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION
SECTON 26 2726- WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS...

1.2 SUMMARY

1.3 DEFINITIONS

1.4 REFERENCES

1.5 SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 COORDINATION

1.8 EXTRA MATERIALS

PART 2 - PRODUCTS

2.1 RECEPTACLES

2.2 WALL SWITCHES

2.3 WALL PLATES

2.4 FINISHES

PART 3 - EXECUTION

3.1 INSTALLATION

3.2 IDENTIFICATION

3.3 CONNECTIONS

3.4 FIELD QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Single and duplex receptacles
   2. Ground-fault circuit interrupter receptacles
   4. Device wall plates.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. PVC: Polyvinyl chloride.
D. RFI: Radio-frequency interference.
E. SPD: Surge protective devices.
F. UTP: Unshielded twisted pair.
G. USB: Universal serial bus.

1.4 REFERENCES

D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
E. NEMA WD 1: General Requirements for Wiring Devices.
G. UL 20: General-Use Snap Switches.
H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
I. UL 486B: Wire Connectors for Use with Aluminum Conductors.
J. UL 498: Electrical Attachment Plugs and Receptacles.
K. UL 943: Ground Fault Circuit Interrupters.
L. NECA 130-2010: Installing and Maintaining Wiring Devices.

1.5 SUBMITTALS
A. Product Data: Provide manufacturer’s catalog information showing dimensions, colors, and configurations for each type of product indicated.

1.6 QUALITY ASSURANCE
A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and source.
B. 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.
C. Comply with NFPA 70.

1.7 COORDINATION
A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

1.8 EXTRA MATERIALS
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. Floor Service Fittings: One for every 10, but no fewer than one.

PART 2 - PRODUCTS
2.1 RECEPTACLES
A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Configuration 5-20R duplex receptacle.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hubbell: 5352.
      b. Arrowhart: 5352.
      c. Bryant: 5362.
      d. Pass & Seymour/Legrand; wiring Devices Division: 5362, PT5362 (use with PTRA6STRNA prewired pigtail connector).
B. GFCI Receptacles: Straight blade, non-feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated; Wiring Device-Kellems GF20-LA.
   c. Leviton 7899.
   d. Pass & Seymour/Legrand; Wiring Devices Division 2095, PT2095 (use with PTRA6STRNA prewired pigtail connector).

C. Self-Test GFCI’s: Duplex GFCI Convenience Receptacles, 125 V, 20 A. Comply with NEMA WD1, NEMA WD6 configuration 5-20R, UL 498, Federal Specification W-C-596 and UL 943, Class A, and include indicator light that is lighted when device is tripped. Must have self-test feature and SafeLock protection™: conducts an automatic test every second, ensuring its always ready to protect. If the device fails the self-test, the indicator light flashes to signal that the GFCI should be replaced. With SafeLock Protection™, if critical components are damaged and ground fault protection is lost, power to receptacle must be discontinued.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work, include, but are not limited to the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand; Wiring Devices Division: 2096.

D. Commercial Grade Tamper Resistant Receptacles with integral USB charger:
   a. 20A circuit feed through.
   b. Comply with UL 498 and UL 1310.
   c. Comply with Part 16 of the FCC rules.
   d. Complies with Federal Specification DSCC W-C 596G testing requirements.
2. USB Charging 2.1A, 5VDC dual ports.
   a. Comply with battery charging specification USB BC1.2
   b. Compatible with USB 1.1/2.0/3.0 devices, including Apple products.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Wiring Device- USB20X2-x
   b. Arrow Hart Wiring Devices – TR7746-x.
   c. Pass & Seymour TR5362USB-W.
   d. Pass & Seymour TR5352USB – (single).

2.2 WALL SWITCHES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Incorporated; Wiring Device-Kellems 1220 Series.
2. ArrowHart Wiring Devices AH1220 Series.
3. Leviton 1220 Series.
4. Bryant 4900 Series.
5. Pass & Seymour/Legrand; Wiring Devices Division PS20AC Series.

B. Device body: Plastic handle.

D.  Snap Switches: Heavy Duty specification grade, quiet type; rated 20A, 120-277 V AC.
E.  Provide single-pole, two-pole, three-way and four-way switches as indicated.
F.  Provide pilot light where indicated.
G.  Provide key type where indicated. Furnish four keys to Owner.
H.  Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
   2.  Receptacle: NEMA WD 6, Configuration 5-20R.

2.3  WALL PLATES

A.  Manufacturers:
   1.  Provide wall plates and corresponding wiring devices from same manufacturer.
B.  Single and combination types to match corresponding wiring devices.
   1.  Plate-Securing Screws: Metal with head color to match plate finish.
   2.  Material for Finished Spaces:
       a.  0.035-inch thick, satin-finished stainless steel (except in units)
       b.  Smooth, high-impact thermoplastic (coordinate color with architect)
   3.  Material for Unfinished Spaces:
       a.  Galvanized steel
   4.  Material for Wet Locations: Gasketed Thermoplastic with spring-loaded cover, and listed and labeled for use in "wet locations."
       a.  Manufacturers:
           1) Bryant RB5752-0 (polycarbonate), Hubbell.
           2) Pass & Seymour WIUC10C (polycarbonate)
           3) ArrowHart WIU-1 (polycarbonate).
           4) Red Dot CKNM (polycarbonate).

2.4  FINISHES

A.  Color:
   3.  Wall Switches:  As selected by Architect, unless otherwise indicated.

PART 3 - EXECUTION

3.1  INSTALLATION

A.  Install products in accordance with manufacturer’s instructions.
B.  Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.
C.  Install devices and assemblies level, plumb, and square with building lines.
D.  Install wall dimmers to achieve full rating specified and indicated after derating for ganging according to manufacturer's written instructions.
E.  Install unshared neutral conductors on load side of dimmers according to manufacturers’ written instructions.
F.  Arrangement of Devices:
   1.  Coordinate locations of outlet boxes provided under Division 26 Section “Raceways and Boxes” to obtain mounting heights indicated on Drawings.
2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.
3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
4. Install horizontally mounted receptacles with grounding pole on the left.
5. Install GFCI receptacles so that the “Push To Test” and “Reset” designations can be read correctly. If printed in both directions, install with ground pole on top.
6. Install switches with OFF position down.

G. Install cover plates on switch, receptacle, and blank outlets in finished areas.
H. Use oversized plates for outlets installed in masonry walls.
I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
J. Remove wall plates and protect devices and assemblies during painting.
K. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
L. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

3.2 IDENTIFICATION
A. Comply with Division 26 Section "Electrical Identification."
1. Receptacles: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section “Electrical Identification” with black-filled lettering on face of wall plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS
A. Ground equipment according to Division 26 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.
B. Connect wiring according to Division 26 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.
C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL
A. Perform the following field tests and inspections and prepare test reports:
1. Inspect each wiring device for defects.
2. Operate each wall switch with circuit energized and verify proper operation.
3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION
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SECTION 26 2813 - FUSES

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following:
   1. Cartridge fuses rated 600 V and less for use in switches, controllers.

1.3 SUBMITTALS
A. Product Data: Include the following for each fuse type indicated:
   1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   2. Let-through current curves for fuses with current-limiting characteristics.
   3. Time-current curves, coordination charts and tables, and related data.
   4. Fuse size for elevator feeders and elevator disconnect switches.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
      a. Let-through current curves for fuses with current-limiting characteristics.
      b. Time-current curves, coordination charts and tables, and related data.
      c. Ambient temperature adjustment information.
1.4 QUALITY ASSURANCE
   A. Source Limitations: Obtain fuses from a single manufacturer.
   B. 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.
   C. Comply with:
      1. NEMA FU 1 – Low Voltage Cartridge Fuses.
      2. NFPA 70 – National Electrical Code.
      3. UL 198C – High-Interrupting-Capacity Fuses, Current-Limiting Types.
      4. UL 198E – Class R Fuses.
      5. UL 512 – Fuseholders.

1.5 PROJECT CONDITIONS
   A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION
   A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.7 EXTRA MATERIALS
   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. Fuses: Quantity equal to 10% percent of each fuse type and size, but no fewer than of each type and size.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Cooper Bussmann, Inc.
      3. Ferraz Shawmut, Inc.

2.2 CARTRIDGE FUSES
   A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
      1. Motor Branch Circuits: Class RK5, time delay.
      2. Other Branch Circuits: Class RK1, time delay.

PART 3 - EXECUTION
3.1 EXAMINATION
   A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
   B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION

A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energization at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energization of the circuit in which it is applied.

B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels indicating fuse rating and type on outside of the door on each fused switch.

END OF SECTION
SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
B. Related Sections include the following:
   1. Division 26 Section “Fuses”.

1.2 SUMMARY
A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Fusible switches.
   2. Nonfusible switches.
   5. Enclosures.
B. Related Sections:

1.3 DEFINITIONS
A. GD: General duty.
B. GFCI: Ground-fault circuit interrupter.
C. HD: Heavy duty.
D. RMS: Root mean square.
E. SPDT: Single pole, double throw.

1.4 REFERENCES
C. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
D. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
E. NEMA FU 1: Low Voltage Cartridge Fuses.
F. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
G. NEMA PB1.1: General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
H. NEMA PB2.1: General Instructions for Proper Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

1.5 SUBMITTALS
A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   4. UL listing for series rating of installed devices.
   5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Qualification Data: For testing agency.
D. Field quality-control test reports including the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
E. Manufacturer's field service report.
F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current curves, including selectable ranges for each type of circuit breaker.
1.6 QUALITY ASSURANCE
   A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
      1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
   B. 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.
   C. Comply with NFPA 70.
   D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.7 PROJECT CONDITIONS
   A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
      1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
      2. Altitude: Not exceeding 6600 feet.

1.8 COORDINATION
   A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.9 EXTRA MATERIALS
   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. Spares: For the following:
         a. Potential Transformer Fuses: 2 of each size and type.
         b. Control-Power Fuses: 2 of each size and type
         c. Fuses for Fusible Switches: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
      2. Spare Indicating Lights: Six of each type installed.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES
   A. Manufacturers:
      1. Eaton Corporation; Cutler-Hammer Products.
      2. General Electric Co.; Electrical Distribution & Control Division.
      3. Siemens Industries, Inc.
      4. Square D/Group Schneider.
B. Fusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, with clips or bolt pads to accommodate specified fuses, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Provide early break auxiliary contacts in motor disconnect switches for motors that are fed from variable frequency controllers.
   2. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   3. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
   4. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 TOGGLE DISCONNECT SWITCH

A. Manufacturers:
   1. Double Pole:
      a. Hubbell 1372.
      b. Leviton 6808G-DAC.
      c. Pass & Seymour 7812.
      d. Bryant 30102.
   2. Three Pole:
      a. Hubbell 1379.
      b. Leviton 7810GD.
      c. Pass & Seymour 7813.
      d. Bryant 30103.

B. Description: Heavy duty, 30A, 600 volt, double or three pole as required, single throw, motor rated switch without overload protection. Provide NEMA 1 enclosure and padlock attachment.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   3. Siemens Industries, Inc.
   4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
   1. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
   2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
   3. Enclosure: Provide handle capable of being locked in the open position with padlock.

5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.

7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

D. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.

2.5 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Indoor Dry Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

3.3 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Install switches with off position down.

E. Install NEMA KS 1 enclosed switch where indicated for motor loads ½ HP and larger and equipment loads greater than 30A.

F. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than ½ HP and equipment loads 30A and less.

G. Install fuses in fusible disconnect switches.

H. Install flexible liquid tight conduit from toggle disconnect switch to portable equipment. Leave a 6'-0" (1830 mm) whip.
I. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.

J. Install control wiring from early break contacts in motor disconnect switch to variable frequency controllers to shut down controller when switch is open.

K. Install equipment on exterior foundation walls at least one inch (25 mm) from wall to permit vertical flow of air behind breaker and switch enclosures.

L. Support enclosures independent of connecting conduit or raceway system.

M. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."

C. Provide adhesive label as specified in Division 26 Section "Electrical Identification" on inside door of each switch indicating UL fuse class and size for replacement.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Prepare for acceptance testing as follows:
   1. Inspect mechanical and electrical connections.
   2. Verify switch and relay type and labeling verification.
   3. Verify rating of installed fuses.
   4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

D. Perform the following field tests and inspections and prepare test reports:
   1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
   2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches. Certify compliance with test parameters.
   3. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Test all NEMA AB1, molded case circuit breakers with thermal magnetic trip or auxiliary, solid-state trip units 100A and larger. Certify compliance with test parameters.
   a. Visual and Mechanical Inspection
      1) Circuit breaker shall be checked for proper mounting and compare nameplate data to Drawings and Specifications.
      2) Operate circuit breaker to ensure smooth operation.
      3) Inspect case for cracks or other defects.
      4) Check internals on unsealed units.
   b. Electrical Tests
      1) Perform a contact resistance test.
2) Perform an insulation resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.

3) Perform long time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time. Make external adjustments as required to meet time current curves.

4) Determine short time pickup and delay by primary current injection.

5) Determine ground fault pickup and time delay by primary current injection.

6) Determine instantaneous pickup current by primary injection using run-up or pulse method.

7) Perform adjustments for final settings in accordance with coordination study.

8) For circuit breakers 800A and larger, verify all functions of trip unit by means of secondary injection in lieu of primary injection.

c. Test Values
1) Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.

2) Insulation resistance shall not be less than 100 megohms.

3) Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.

4) All trip times shall fall within N.E.T.A. Acceptance Testing Specifications, Table 10.7 Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.

5) Instantaneous pickup values shall be within values shown on N.E.T.A. Acceptance Testing Specifications, Table 10.8 or manufacturer’s recommendations.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING
A. Set field-adjustable switches and circuit-breaker trip and time delay settings to values as determined by the protective device coordination study.

3.7 CLEANING
A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION
SECTION 26 5119 - LED INTERIOR LIGHTING

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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. Interior solid-state luminaires that use LED technology.
   2. Lighting fixture supports.
B. Related Requirements:
   1. Section 26 0923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2. Section 26 0926 "Lighting Control Panelboards" for panelboards used for lighting control.
3. Section 26 0933 "Central Dimming Controls" or Section 26 0936 "Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.

4. Section 26 0943.16" Addressable-Luminaire Lighting Controls" and Section 26 0943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.
B. CRI: Color Rendering Index.
C. Fixture: See "Luminaire."
D. IP: International Protection or Ingress Protection Rating.
E. Lamp: LED and substrate as a replaceable assembly.
F. LED: Light-emitting diode.
G. Lumen: Measured output of lamp and luminaire, or both.
H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
   6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project per IES LM-79 and IES LM-80.
      a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products or certified by a qualified independent testing agency.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. 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.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lighting luminaires.
   2. Suspended ceiling components.
   3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
   4. Structural members to which equipment or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
   a. Other luminaires.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
   f. Ceiling-mounted projectors.
7. Moldings.

D. Qualification Data: For testing laboratory providing photometric data for luminaires.
E. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
G. Sample warranty.

1.5 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 5% attic stock of each type and rating installed. Furnish at least one of each type.
   2. LED Drivers 5% attic stock of each type and rating installed. Furnish at least one of each type.
   3. Diffusers and Lenses: 1% attic stock of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: 5% attic stock of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE
A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
C. Provide luminaires from a single manufacturer for each luminaire type.
D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
E. 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.
F. Comply with:
   1. NFPA 70 - National Electrical Code.
6. Michigan Department of Community Industry Services requirements that all lamps shall be protected from breakage. Exposed lamps are not acceptable.

G. FMG Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

H. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 COORDINATION
A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY
A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
B. Warranty Period: Five year(s) or manufacturer’s standard warranty length (whichever is longer) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRES (LIGHTING FIXTURES)
A. Provide Luminaires as included in specification 26 5700 “Luminaire Product Data.” This section contains product data sheets from the basis of design manufacturer with annotations.
B. Acceptable alternate manufacturers are indicated on the product data sheets. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.
C. The Luminaire schedule shown on the drawings is supplemental provided for convenience and reference only. The requirements of this section and 26 5700 shall govern.

2.2 LUMINAIRE REQUIREMENTS
A. 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.
B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
D. Unless otherwise specified in Luminaire product data, provide products with a minimum CRI of 80.
E. Unless otherwise specified in Luminaire product data, provide products with a CCT of 4100 K.

F. Unless otherwise specified in Luminaire product data, provide products with an IES LM-80 rated lamp life of 50,000 hours.

G. Driver
   1. Provided as an integrated component of the luminaire or as an external component of an assembly of luminaries.
   2. Nominal Input Voltage: As specified in product data.

2.3 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Provide edge lit signs with a mirror plaque background.

2.4 EMERGENCY LIGHTING UNITS

A. General: Self-contained units complying with UL 924.
   1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
   2. Charger: Fully automatic, solid-state type with sealed transfer relay.
   3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   4. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.

2.5 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
   1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Glass: Annealed crystal glass unless otherwise indicated.
   3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598 Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage, and coating.
      c. CCT and CRI for all luminaires.
2.6 METAL FINISHES
   A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE FIXTURE SUPPORT COMPONENTS
   A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
   B. Single-Stem Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
   C. Wires: Unless otherwise specified in Luminaire product data, provide products with a minimum ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
   D. Rod Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
   E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING
   A. Do not use permanent luminaires for temporary lighting.

3.3 INSTALLATION
   B. Locate ceiling luminaires as indicated on reflected ceiling plan.
   C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
      1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
      2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
      3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   D. Support luminaires independent of ceiling framing. Support recessed grid luminaries from two opposite corners directly to structure. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
   E. Install recessed luminaires to permit removal from below.
   F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

H. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Provide support for luminaire without causing deflection of ceiling or wall.
   4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

I. Flush-Mounted Luminaire Support:
   1. Secured to outlet box.
   2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
   3. Trim ring flush with finished surface.

J. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

K. Ceiling-Mounted Luminaire Support:
   1. Ceiling mount with pendant mount with 5/32-inch- diameter aircraft cable supports 120 inches in length.
   2. Ceiling mount with hook mount.

L. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
   4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

M. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

C. Bond products and metal accessories to branch circuit equipment grounding conductor.

D. Connect luminaires to branch circuit outlet boxes provided under Division 26 Section "Raceways and Boxes" using 1/2" flexible conduit.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

D. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures, misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.

3.7 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 26 0943.16 "Addressable-Fixture Lighting Controls."

B. Comply with requirements for startup specified in Section 26 0943.23 "Relay-Based Lighting Controls."

3.8 ADJUSTING

A. Adjust exit sign directional arrows as indicated on Drawings.

B. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner’s representative and Architect/Engineer.

3.9 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures and lenses.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

END OF SECTION
Cruze LED is a specification lensed troffer series. This high quality luminaire is dedicated to the latest solid state lighting and driver technology for optimal performance and energy efficiency. The Cruze is compatible with all of today’s popular ceiling systems and is available with a number of options and accessories for application versatility.

The Cruze series features efficiency, quality and performance. The series is an excellent choice for commercial office spaces, schools, hospitals or retail merchandising areas.

**SPECIFICATION FEATURES**

**Construction**
Rigid housing is die formed of code gauge prime cold rolled steel and features full length die-formed stiffeners and unibody endplate for added strength. Side flanges are hemmed. Innovative design provides superior lens brightness uniformity and visual comfort. Unibody endplates are securely attached with interlocking tabs and screws. Four auxiliary fixture end suspension points provided. Endplates have integral Grid-lock feature for safety and convenience.

**Controls**
Metalux LED luminaires come standard with 0-10V dimming drivers (1% standard). Options compatible with Eaton’s Connected Lighting Systems:
- WaveLinx sensor
- LumaWatt Pro sensor
- SVPD sensor and driver
- Fifth Light DALI driver
Other options include step-dimming and 3rd party drivers. Refer to the Connected Lighting options page and ordering information for more details.

**Electrical**
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED’s available in 3000K, 3500K, 4000K or 5000K with a minimum CRI of 80. Projected life is 60,000 hours at 80% lumen output. cULus listed. Electronic drivers are available for 120-277V and 347V applications.

**Emergency Battery Pack Option**
Optional 120v-277v integral emergency battery pack is available in 7 watts or 14-watts to meet critical life-safety lighting requirements. The 90-minute batteries provide constant power to the LED system, ensuring code-compliance. A test switch/indicator button can be tested safely from the ground using a laser pointer, while the patented EZ Key prevents accidental discharge of the battery during construction. Emergency/generator transfer options available – see ordering information for details.

**Finish**
Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibition. Housing finished with 90% reflective white enamel for superior performance.

**Hinging/Latching**
Positive cam action steel latches with baked white enamel finish. Safety-lock T-hinges allow hinging and latching either side. Door assembly hinges down for easy access from below.

**Frame/Shielding**
Die formed, heavy gauge, flat steel door with reinforced mitered corners and painted after fabrication, baked matte white enamel finish. Positive light seals. Acrylic frosted lens.

**Compliance**
Modules are UL recognized components and indoor luminaires are cULus listed for 25ºC ambient environments, RoHS compliant, and LED modules comply with IESNA LM-79 and LM-80 standards. DesignLights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.designlights.org for details.

**Warranty**
Five year warranty.
### Photometric Data

#### Zonal Lumen Summary

<table>
<thead>
<tr>
<th>Zone</th>
<th>Zone</th>
<th>Lumen</th>
<th>% Fixtures</th>
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#### Lumen Maintenance

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<th>Ambient Temperature</th>
<th>TM-21 Lumen Maintenance (60,000 hours)</th>
<th>Theoretical L70 (Hours)</th>
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<td>25°C</td>
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### 90 CRI

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<th>Lumen Adjustment Factors 80-&gt;90 CRI</th>
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<td>4000K</td>
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#### Example of Lumen Adjustment Calculation

24CZ-LDS-40-UNV-L835-CD1-U
at 90CRI at 3500K

Lumen Adjustment Factor = 0.861

Total Light Output = 3,964 lm x 0.861 = 3,413 lm

Efficacy = \[
\frac{3,413 \text{ lm}}{29 \text{ W}} = 117.6 \text{ lm/W}
\]
### ENERGY AND PERFORMANCE DATA BY CATALOG NUMBER

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<tr>
<th>Stock or MTO*</th>
<th>Catalog Logic (Ribbed Lens)</th>
<th>Delivered Lumens</th>
<th>Watts</th>
<th>Efficacy (lm/W)</th>
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*Made to order (MTO) requires a typical three week lead time.

### Standard Efficacy Versions

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*Made to order (MTO) requires a typical three week lead time.
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<td>MTO 24CZ-LD5-75-S-UNV-L835-CD1-U</td>
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</tbody>
</table>

*Made to order (MTO) requires a typical three week lead time.
### Luminaire Product Data

**Elliman Research Building - RI Fume Hood Relocation**

Wayne State University  
August 21, 2018

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**Sample Number:** 24CZ-LD5-45-UNV-L835-CD1-U  
**Lamp Type:** LED 5.0  
**Voltage:** 120-277V  
**Flux:** 5500 Lumens  
**Driver Type:** 50% or 100% Dimming

**Options:**
- Emergency  
- 0-10V Dimmable  
- Smooth Lens with Round Pattern Insert  
- Made-to-order (MTO) requires a typical three week leadtime.

**Sensor Accessories:**
- SVPD1 = 0-10V Stand-alone Integrated Sensor  
- LWTPD1 = LumaWatt Pro Wireless Tile-mount Sensor  
- LWIPD1 = WaveLinx Wireless Integrated Sensor  
- SWPD1 = Integrated Sensing Systems  
- ELV14W = 14-watt 120V-277V emergency battery pack installed  
- ISH-01-07 = Decorator Slide Dimmer, 0-10V  
- ISH-10 = Decorator Dimmer, 0-10V  
- SH1200 = 2' x 4' Tall Surface Mount Kit  
- DF-24-W = 2' x 4' Drywall Frame Kit  
- T-BAR Safety Earthquake Clips  
- LU = Lutron HiLume (L3D series) 1%-100% EcoSystem/3-wire Driver  
- LH = Lutron HiLume (LDE1 series) 1%-100% EcoSystem Driver (50% or 100% Dimming)  
- SR = 3/8" Flex with 0-10V Dimming Leads  
- 1%-100% Dimming Driver  
- 2 Driver s  

**Cable tray and approved raceway rated, install per NEC®**

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**้ว์**

**Specifications & dimensions subject to change without notice.** Consult your Eaton Representative for availability and ordering information.

---

**Shipping Data**

**Catalog No.** 24CZ-LD5-45  
**Wt.** 20.5 lbs.  
**Catalog No.** 24CZ-LD5-55  
**Wt.** 20.5 lbs.
INTEGRATED SENSOR

The Cruze with Integrated Sensor technology provides automatic energy savings without sacrificing performance. Traditionally, these types of energy savings required coordination between the luminaire and a lighting control system. The Cruze delivers superior lighting with integrated occupancy and daylighting controls.

Capture the benefits of traditional lighting controls, without complicated coverage planning or special wiring. Ideal for new construction or retrofit, the Cruze delivers automatic ON to an energy saving light level, while ensuring lighting is turned OFF when the space is unoccupied.

The integral daylight sensor reduces the need for special daylight zone planning. Each luminaire will automatically adjust the light level based on reflected light beneath the sensor in a closed loop method. Occupied daylight light levels and unoccupied light levels can be adjusted using the integrated sensor programming remote (Catalog Number: ISHH-01). The integrated sensor personal remote (Catalog Number: ISHH-02) provides code compliant manual raise, lower, ON, OFF control.

The Cruze with Integrated Sensor is easy to install with no special wiring and ensures energy savings out-of-the-box with default control settings.

How it works:
- As the user enters the space controlled by the integral sensor, the lighting turns ON to the default daylight level.
- Lighting will remain at that the daylight level until the space is unoccupied. This will start the occupancy timeout period (default 20 minutes).
- If the space remains unoccupied for half of the timeout period, the lighting will automatically reduce to the Energy Saver light level. This adjustable light level is typically half of the occupied daylight level.
- At the end of the timeout period the lighting will go to the unoccupied light level. This adjustable light level uses the OFF default setting.
MEDMASTER DOWNLIGHT
Luminaires for MRI Applications
MRIDL SERIES

PRODUCT FEATURES:
+ 6" recessed, rectangular downlight with regressed or flush lens trim
+ Designed for MRI applications with non-ferrous construction and RF-free electronics
+ Delivered lumens: 391 - 2,953 lm
+ 1% Dimming via 0-10V control

SPECIFICATIONS

HEAT SINK: Die-cast aluminum with external radial fins for natural convection.

ROUGH-IN FRAME: Die-formed aluminum construction. Vertically adjustable collar accommodates ceiling thicknesses up to 2", adjustable post-installation. Universal mounting brackets accept 3/4" and 1-1/2" lathers channel, 1/2" EMT conduit and hanger bars. Quick-access junction box accessible post-installation from above and below ceiling. Includes (4) 1/2" and (4) 3/4" knock-outs to allow straight conduit runs. Listed for (8) 12AWG, 90°C conductors and feed-thru branch wiring. Provided with PNC with electrical quick-connect to Trim Section.

TRIM/HOUSING SECTION: P-rated housing section incorporates the heat sink, LED module, optics and lens trim. Configurable with an IP44-rated Regressed or Flush lens trim that is secured to the Rough-In frame with hidden torsion springs, and an IP65 Flush lens trim secured with four (4) phillips head, captive fasteners. External finish standard on all exposed painted surfaces. See trim ordering information for available options.

OPTICAL: High Efficiency mixing chamber design with regressed diffused tempered-glass lens producing uniform light output. Available with various reflector distribution patterns and finishes. Flush lens trim options include a clear lens. See distribution and reflector finish ordering information for available options.

ELECTRICAL: LED array available in various CCT and CRI combinations with a minimum 3-step MacAdam variation allowance. See Trim Ordering Information for available options. Luminaries input 24VDC from remote-located, 120-240VAC, high-power-factor power supply (see MRIPS-312, ordered separately). Standard 0-10V dimming with 1-100% range and dim-to-dark capabilities.

PHOTOMETRICS: Photometry tested to the IESNA LM-79-08 standard by an ILAC/ISO17025 accredited laboratory. For photometric information, go to www.kenall.com.

LED LAMP SPECIFICATIONS:
- Lamp Amps/Max. Luminaires/Power Luminaire per Power Supply Per room
  - 31L 1.7 6
  - 23L 1.2 8
  - 13L 0.8 13

ORDERING INFORMATION (EX: MRIDL6-5B-23L-40K8-W-CSS-T-RIMRI6-24V-DIM1)

TRIM

<table>
<thead>
<tr>
<th>MRIDL6</th>
<th>Model</th>
<th>Trim Style</th>
<th>Trim Finish</th>
<th>Lamp Power</th>
<th>Lamp Color</th>
<th>Distribution</th>
<th>Reflector Finish</th>
<th>Flush Lens Type</th>
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</thead>
<tbody>
<tr>
<td>R</td>
<td>Regressed lens (IP64)</td>
<td>R</td>
<td>30K8</td>
<td>3000K / 80 CRI min.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Flush lens (With fasteners - IP64)</td>
<td>F</td>
<td>30K8</td>
<td>3000K / 80 CRI min.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Serrated lens (IP64)</td>
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<td>35K8</td>
<td>3500K / 80 CRI min.</td>
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<tr>
<td>T</td>
<td>Tapered lens (IP64)</td>
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<td>40K8</td>
<td>4000K / 80 CRI min.</td>
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<td></td>
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<tr>
<td>C</td>
<td>Convex lens (IP64)</td>
<td>C</td>
<td>50K8</td>
<td>5000K / 80 CRI min.</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Driver Type Options
- ROUGH-IN: catalog number only
- MRIR6: RMR Rough-In
- DIM1: 0-10V Dimming to 1%

Driver Type:
- Input Voltage: 24V
- 24 Volts

Lamp Amps Max. Luminaires per Power Supply/Per room:
- 13L: 0.8 13
- 23L: 1.2 8
- 31L: 1.7 6

www.kenall.com P: 800-4-Kenall F: 262-891-9701 10200 55th Street Kenosha, Wisconsin 53144

Approved by
For additional photometry, go to www.kenall.com

MEDMASTER DOWNLIGHT
Luminaires for MRI Applications
MRIDL SERIES

PERFORMANCE - REGRESSED LENS
Subject to change without notice. Visit www.kenall.com for ies files and additional information.
# MEDMASTER DOWNLIGHT

Luminaires for MRI Applications

## MRIDL SERIES

### PERFORMANCE - REGRESSED LENS

<table>
<thead>
<tr>
<th>Wide Distribution Candela Curve</th>
<th>MRIDL6-R-13L-40K8-W-CS</th>
<th>Distance to illuminated plane (ft)</th>
<th>MRIDL6-R-13L-40K8-M-CS</th>
<th>Medium Distribution Candela Curve</th>
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</thead>
<tbody>
<tr>
<td>Initial center beam foot-candles</td>
<td>25.3 7.6 5'</td>
<td>54.3 3.6</td>
<td>20.3 7.9 6'</td>
<td>37.7 4.1</td>
</tr>
<tr>
<td>14.8 9.0 7'</td>
<td>27.7 4.8</td>
<td>11.4 11.0 8'</td>
<td>21.2 5.5</td>
<td>9.0 11.8 9'</td>
</tr>
<tr>
<td>7.3 12.6 10'</td>
<td>13.6 7.8</td>
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<td></td>
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</tbody>
</table>

Spacing Criteria: 1.42 foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)  
Beam Angle: 60°  
Beam diameter is where foot-candles drop to 50% of maximum

<table>
<thead>
<tr>
<th>Wide Distribution Candela Curve</th>
<th>MRIDL6-R-223L-40K8-W-CS</th>
<th>Distance to illuminated plane (ft)</th>
<th>MRIDL6-R-223L-40K8-M-CS</th>
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<tbody>
<tr>
<td>Initial center beam foot-candles</td>
<td>47.1 7.6 5'</td>
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<td>70.1 4.1</td>
</tr>
<tr>
<td>27.6 9.0 7'</td>
<td>51.5 4.8</td>
<td>21.2 11.0 8'</td>
<td>39.4 5.5</td>
<td>16.8 11.8 9'</td>
</tr>
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<td>13.6 12.6 10'</td>
<td>25.2 7.8</td>
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</table>

Spacing Criteria: 1.42 foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)  
Beam Angle: 60°  
Beam diameter is where foot-candles drop to 50% of maximum

<table>
<thead>
<tr>
<th>Wide Distribution Candela Curve</th>
<th>MRIDL6-R-31L-40K8-W-CS</th>
<th>Distance to illuminated plane (ft)</th>
<th>MRIDL6-R-31L-40K8-M-CS</th>
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<tbody>
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<td>67.0 7.6 5'</td>
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<td>99.6 4.1</td>
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<td>39.3 9.0 7'</td>
<td>73.2 4.8</td>
<td>30.1 11.0 8'</td>
<td>56.0 5.5</td>
<td>23.9 11.8 9'</td>
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<td>19.3 12.6 10'</td>
<td>35.9 7.8</td>
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Spacing Criteria: 1.36 foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)  
Beam Angle: 60°  
Beam diameter is where foot-candles drop to 50% of maximum

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For additional photometry, go to www.kenall.com

Luminaire Product Data

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Wayne State University  Elliman Research Building - RI Fume Hood Relocation  WSU Project No. 629-304592  26 5700 -9

LAS 10905-00  August 21, 2018
**MEDMASTER DOWNLIGHT**

Luminaires for MRI Applications

**MRIDL SERIES**

**PERFORMANCE - FLUSH LENS**

<table>
<thead>
<tr>
<th>Optic</th>
<th>Lamp Power</th>
<th>Initial Delivered Lumen, By Lamp Color</th>
<th>Efficacy (lm/W)</th>
<th>Input Power (W)</th>
<th>Est'd. L70 LED Life (hrs)</th>
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<tr>
<td></td>
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<td>35K8</td>
<td>35K9</td>
<td>40K8</td>
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<tr>
<td>M</td>
<td>13L</td>
<td>862</td>
<td>721</td>
<td>862</td>
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<tr>
<td></td>
<td>23L</td>
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<td>1,340</td>
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<td>1,906</td>
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<td>CSS</td>
<td>13L</td>
<td>810</td>
<td>677</td>
<td>810</td>
<td>842</td>
</tr>
<tr>
<td></td>
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<td>1,258</td>
<td>1,505</td>
<td>1,273</td>
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<td>1,789</td>
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<td>934</td>
<td>781</td>
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<tr>
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<td>13L</td>
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<td>802</td>
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<td>698</td>
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<td>1,406</td>
<td>1,682</td>
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<td>31L</td>
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<td>2,000</td>
<td>2,392</td>
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<td>591</td>
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<td>CSS</td>
<td>13L</td>
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<td>31L</td>
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### MEDMASTER DOWNLIGHT
Luminaires for MRI Applications

**MRIDL SERIES**

#### PERFORMANCE - FLUSH LENS

<table>
<thead>
<tr>
<th>MRIDL6-FF-13L-40K8-W-CS-T</th>
<th>Distance to illuminated plane (ft)</th>
<th>Initial center beam foot-candles</th>
<th>Beam diameter (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5'</td>
<td>22.9</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td>6'</td>
<td>18.1</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>7'</td>
<td>13.2</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>8'</td>
<td>10.1</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>9'</td>
<td>8.1</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>10'</td>
<td>6.5</td>
<td>13.0</td>
</tr>
</tbody>
</table>

**Medium Distribution Candela Curve**

Spacing Criteria: 1.4  foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)  Spacing Criteria: 0.62

Beam Angle: 59°

**MRIDL6-FF-23L-40K8-W-CS-T**

<table>
<thead>
<tr>
<th>Initial center beam foot-candles</th>
<th>Distance to illuminated plane (ft)</th>
<th>Beam diameter (ft)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5'</td>
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<tr>
<td>33.6</td>
<td>6'</td>
<td>91.7</td>
</tr>
<tr>
<td>24.6</td>
<td>7'</td>
<td>67.4</td>
</tr>
<tr>
<td>18.9</td>
<td>8'</td>
<td>51.6</td>
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<tr>
<td>15.0</td>
<td>9'</td>
<td>40.8</td>
</tr>
<tr>
<td>12.1</td>
<td>10'</td>
<td>33.0</td>
</tr>
</tbody>
</table>

**Wide Distribution Candela Curve**

Spacing Criteria: 1.4  foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)  Spacing Criteria: 0.62

Beam Angle: 34°

**MRIDL6-FF-31L-40K8-W-CS-T**

<table>
<thead>
<tr>
<th>Initial center beam foot-candles</th>
<th>Distance to illuminated plane (ft)</th>
<th>Beam diameter (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.4</td>
<td>5'</td>
<td>187.9</td>
</tr>
<tr>
<td>47.8</td>
<td>6'</td>
<td>130.5</td>
</tr>
<tr>
<td>35.0</td>
<td>7'</td>
<td>95.8</td>
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<tr>
<td>26.8</td>
<td>8'</td>
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<td>58.0</td>
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<tr>
<td>17.2</td>
<td>10'</td>
<td>47.0</td>
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</tbody>
</table>

**Medium Distribution Candela Curve**

Spacing Criteria: 1.36  foot-candle multipliers for 30K8(.96), 30K9(.80), 35K8(.96), 35K9(.81), 40K9(.81), 50K8(1.0)  Spacing Criteria: 0.36

Beam Angle: 21°
MEDMASTER DOWNLIGHT
Luminaires for MRI Applications
MRIDL SERIES
DIMENSIONAL DATA

CROSS SECTION

BOTTOM VIEW

RECOMMENDED CEILING CUT-OUT
R and NF Trims: 7.13" Dia.
PP Trims: 7.38" Dia.

26 5700-12
Luminaire Product Data
INSTALLATION INSTRUCTIONS

MRI DOWNLIGHTS

IMPORTANT SAFEGUARDS

When using electrical equipment, basic safety precautions should always be followed, including the following:

THIS PRODUCT MUST BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE INSTALLATION CODE BY A PERSON FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THE PRODUCT AND THE HAZARDS INVOLVED. DISCONNECT POWER TO ALL CIRCUITS BEFORE WIRING FIXTURE. INSTALL IN ACCORDANCE WITH ALL NATIONAL, STATE, AND LOCAL CODES. DO NOT CONNECT TO AN UNGROUNDED SUPPLY. READ ALL FIXTURE MARKINGS AND LABELS TO ENSURE CORRECT INSTALLATION OF FIXTURE. SUPPLEMENTAL INSTRUCTIONS MAY BE LOCATED ON THE FIXTURE, IN ADDITION TO THIS INSTRUCTION SHEET, REGARDING ORIENTATION, OR MOUNTING RESTRICTIONS.

CE PRODUIT DOIT ÊTRE INSTALLÉ SELON LE CODE D’INSTALLATION PERTINENT, PAR UNE PERSONNE QUI CONNAÎT BIEN LE PRODUIT ET SON FONCTIONNEMENT AINSI QUE LES RISQUES INHÉRENTS.

THE DOWNLIGHT CONTAINS SENSITIVE ELECTRONICS. TAKE CARE TO AVOID DAMAGE BY IMPROPER HANDLING OR STATIC ELECTRICITY DISCHARGE (ESD). EITHER TYPE OF DAMAGE COULD RENDER THE SYSTEM INOPERABLE OR CAUSE LATENT FAILURE.

ROUGH-IN SECTION

Recommended ceiling opening for trims with torsion springs (R or NF trim style): 7.125" Dia.
Recommended ceiling opening for trims secured with screws (FF trim style): 7.375" Dia

1. Insert non-magnetic ½” conduit or C channels, by others, into mounting brackets. Fig. 1
2. Secure the channels or conduit to framing members or grid.
3. Loosen two (2) screws in mounting brackets to adjust the height of the Rough-In frame to level with the bottom of the joists. Re-tighten when in position.
4. Adjust plaster ring flush to finished ceiling by loosening (4) screws. Fig. 2. Slide ring to proper position and re-tighten screws.

SAVE THESE INSTRUCTIONS

Figure 1

Figure 2

Loosen Screws to Adjust Plaster Ring

CONDUIT OR CHANNELS
SUPPLIED BY OTHERS

August 21, 2018

LAS 10905-00
**INSTALLATION INSTRUCTIONS**

**ELECTRICAL CONNECTION**

1. Mount and wire the MRIPS-312 external power supply per the procedures provided in the supplementary instruction sheet. Run conduit and DC wiring to an MRI room with EMI filter sized to the load of the power supply (supplied by others). Make sure wiring is completely enclosed in grounded aluminum conduit. Any gaps, regardless of size, must be closed or wrapped in copper foil tape.

2. If a 0-10V dimmer is to be connected, install at this time. Dimmer must be installed outside the shielded MRI environment with an intermediate MRI room EMI filter to the luminaires. Kenall recommends using a Leviton® IllumaTech™ IP710 series dimmer or Grafik Eye GRX-TVI control interface. Contact Kenall for suitability of using an alternate sink-type 0-10V dimmer.

**WARNING:** ALL DC POWER AND DIMMING SIGNAL WIRING MUST BE RUN THROUGH SEPARATE EMI FILTERS.

3. Remove junction box cover and make conduit connections to the appropriate 1/2” knockout(s).

**NOTE:** 24VDC and Dimming Wires to be run through same conduit.

4. Run the 24VDC supply from the EMI filter to the luminaire(s) using at least 18 AWG wires rated at least 90C. See Figure 3. Class 1 wiring is required. Make sure wiring is completely enclosed in grounded aluminum conduit. Any gaps, regardless of size, must be closed or wrapped in copper foil tape. Special attention should be paid to the wiring entry point into the shielded space.

5. Run the dimming signal (if applicable) from the dimmer EMI filter to the luminaire(s) using at least 18AWG wires. Make sure wiring is completely enclosed in grounded aluminum conduit. Any gaps, regardless of size, must be closed or wrapped in copper foil tape. Special attention should be paid to the wiring entry point into the shielded space.

6. Using at least an 18 AWG wire, ground the last housing in the sequence to the shielded ceiling. This can be done by fastening the wire to the copper ground wire in the luminaire’s junction box.

7. Make DC supply and (optional) dimmer control connections within each luminaire. Cap gray and violet leads if dimmer is not connected. See Figure 4.

8. Replace junction box cover and seal covers using supplied copper foil tape.
TRIM SECTION

Before installation check the labels on the trim and frame to be sure the correct wattage trims are being installed.

1. Connect cable terminal loop to plaster ring to aide in supporting the trim. See Figure 1.
2. Connect LED plug to socket. See Figure 2.
3. Place the LED connector into the casting opening and secure the trim using the two retained screws on the harness assembly.
4. For trims with torsion springs, compress torsion spring and insert into receiver in plaster ring and push up to seat. See Figure 3.
5. For trims with screws, insert the trim into the plaster ring and rotate until the four reflector screws pass into the four holes in the plaster ring. The four trim mounting screws are now aligned with the cage nuts in the plaster ring and may be tightened to secure the trim. See Figure 4.
INSTALLATION INSTRUCTIONS

CUSTOMER SERVICE

For technical assistance, call 1-800-4KENALL (1-800-453-6255). For additional instructions, go to www.kenall.com/Installs

WARRANTY

This product is warranted by Kenall to be free of defects in workmanship and materials for a period of one year from the date of the invoice. The external DC power supply carries a three year warranty from the date of the invoice.

Kenall reserves the right to issue credit, repair, or replace the defective merchandise, at its discretion, upon notification and confirmation by its local representative of the defect. Kenall also reserves the right to test and examine the defective product if the defect is questionable and to deny the warranty herein for any product altered, improperly installed, or installed in applications for which it is not intended. This includes operation in ambient temperatures above stated limits for any length of time. Failure by electrical surge shall not be covered under warranty.

Kenall assumes no responsibility for labor or freight costs incurred in connection with the installation, removal, or replacement of products determined to be defective or any other consequential or incidental damages arising from the use of the product. Kenall’s entire liability on any claim of loss or damage resulting from a defective product is limited to the replacement price of the product.

The foregoing warranty is exclusive of all other warranties and no other warranties of any kind are expressed or implied.
CUSTOMER ACKNOWLEDGEMENT
MRI INSTALLATION REGISTRATION FORM

I certify that the lighting installation for the listed MRI suite location is completed per the provided installation instructions and to the best of my abilities.

Please check off items to denote status:

☐ Installation instruction sheets for MRIPS-312 power supply and individual luminaire(s) read and followed.
☐ MRIPS-312 power supply and EMI filters are located outside the shielded enclosure.
☐ All DC supply wiring is completely enclosed within grounded aluminum conduit. Installation has no ungrounded/unshielded portions of conduit or openings of any size or shape.
☐ All dimming signal wiring is completely enclosed within grounded aluminum conduit. Installation has no ungrounded/unshielded portions of conduit or openings of any size or shape. Check here if dimming is not applicable: ☐
☐ MRI Room EMI filters for the 24VDC supply are of the type intended for MRI suites and are sized to the electrical load.
☐ DC supply power and dimming signal are NOT running through the same EMI filter. Check here if dimming is not applicable: ☐
☐ Lighting system fully tested (including dimming operation, if applicable) while MRI machine is in idle and scan operation mode.

If any of these steps cannot be completed or you need technical assistance, please contact Kenall Technical Support at 1-800-4KENALL (1-800-453-6255).

Electrical Contractor
Name: ___________________________________  City/State: ________________________________  Phone:________________________

Installation Date: ___________________________

Installation Site
Name: ___________________________________
City/State: ________________________________

FAX FORM TO (847) 360-1781

(Do not write below line)

Kenall Received By: ___________________________  Received Date: ________________________________

© 2015 Kenall Mfg. Co. All rights reserved.
MEDMASTER™ EXTERNAL POWER SUPPLY
MRIPS-312 SERIES

PRODUCT FEATURES:
» Recommended for MRI CleanScene™, Downlight, Auracyl™ Sconce, Stratalume™ Undercabinet and Envela™
» Remote mounted outside EMI shielded structure – 13.5” x 8.5”
» Provides DC Power to MedMaster MRI luminaires
» ETL Listed power supply and enclosure

SPECIFICATIONS
HOUSING: Die formed marine grade extruded aluminum. Black TGIC polyester powder coat finish – 5-stage pre-treatment; Salt spray test: 1,000 hours.

ELECTRICAL:
INPUT: 120~240 VAC, 50/60 Hz. Active PFC Function, PF>0.95.
OUTPUT: Constant-voltage DC output. Factory preset at 24VDC, adjustable range 20~26.4VDC. Maximum current load 13ADC.

WARRANTY: This product is warranted by Kenall Manufacturing to be free of defects in workmanship and materials for a period of one year from the date of invoice. The DC power supply contained in the enclosure carries a five-year warranty from the date of invoice. Warranty is void if all wiring is not completely shielded in grounded conduit.

LISTINGS: Power supply is certified to UL1012 and CSA C22.2 No. 107.1 by Intertek Testing Services. Dry Location only.

NOTE: See Kenall luminaire specifications that utilize remote power supplies for use with this unit.

INSTALLATION
WIRING/CONDUIT: All power and signal wiring must be completely shielded in grounded conduit. Total length of low-voltage supply wires, at least 18AWG, from power supply to filter to luminaires, should not exceed 50 feet (15m).

EMI FILTERS: All MRI room EMI filters must be sized as suitable for power supply load (supplied by others).

AMBIENT TEMPERATURE/HUMIDITY: The surrounding ambient temperature must remain below 104°F (40°C). The working temperature is between -20~+65°C. Allowable relative humidity is 20~90% non-condensing.

PRODUCT LOCATION: The MRIPS-312 power supply must be installed outside the shielded MRI environment. It contains ferrous components that can damage or interfere with MRI equipment. A minimum free-air spacing must exist of 3” around all sides and 6” over exhaust fan. Location should not allow excessive dirt/dust to clog ventilation holes and prevent internal air circulation.
MEDMASTER™
External Power Supply for MRI Luminaires

MRIPS SERIES

INSTALLATION INSTRUCTIONS

IMPORTANT SAFEGUARDS
When using electrical equipment, basic safety precautions should always be followed, including the following:

THIS PRODUCT MUST BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE INSTALLATION CODE BY A PERSON FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THE PRODUCT AND THE HAZARDS INVOLVED. DISCONNECT POWER TO ALL CIRCUITS BEFORE WIRING FIXTURE. INSTALL IN ACCORDANCE WITH ALL NATIONAL, STATE, AND LOCAL CODES. DO NOT CONNECT TO AN UNGROUNDED SUPPLY. READ ALL FIXTURE MARKINGS AND LABELS TO ENSURE CORRECT INSTALLATION OF FIXTURE. SUPPLEMENTAL INSTRUCTIONS MAY BE LOCATED ON THE FIXTURE, IN ADDITION TO THIS INSTRUCTION SHEET, REGARDING ORIENTATION, OR MOUNTING RESTRICTIONS.

SAVE THESE INSTRUCTIONS

INSTALLATION INSTRUCTIONS

This instruction sheet applies for the Kenall MRIPS-312 External Power Supply. It describes the proper mounting procedure and wiring instructions for singular and multiple fixture configurations. A separate instruction sheet is provided with the MRI luminaire(s). Both sheets together are intended to provide comprehensive instructions on system installation and electrical wiring.

The Kenall MRIPS-312 power supply and EMI filter (by others) must be installed outside the shielded MRI environment. It contains ferrous components that can damage or interfere with MRI equipment.

Wayne State University
Elliman Research Building - RI Fume Hood Relocation
WSU Project No. 629-304592

LAS 10905-00 August 21, 2018
**INSTALLATION INSTRUCTIONS**

**Power Supply Mounting Procedure**

Follow instructions provided with the luminaires for the proper installation procedure. Make electrical connections to power supply after luminaires are mounted.

1. Locate suitable mounting location for the power supply. Location should be chosen based on the following requirements:
   - **Ambient Temperature/Humidity**: The surrounding ambient temperature must stay below 104°F (40°C). Allowable relative humidity is 20~90% non-condensing. Product is rated for DRY locations only.
   - **Wire Distance**: The length of 24V DC supply wires from power supply to luminaires should not exceed 50 feet (15m). In multiple-luminaire configurations, this is the distance to the last luminaire in the run.
   - **Ventilation Hole Spacing**: Maintain at least 3” of free-air spacing must exist around all sides and at least 6” over exhaust fan.
   - **Contaminants**: Location should not allow excessive dirt/dust to clog ventilation holes and prevent internal air circulation.

2. Securely mount enclosure to a mechanically-sound surface. Use hardware appropriate for the installation (not provided).

**Single Power Supply Wiring Procedure**

Use the following procedure if only one power supply is to be connected in this installation. Refer to page 3 for multiple power supply installations.

3. Open wire access cover to expose wiring compartments (see Figure 1).

4. Secure conduit to low voltage and line voltage compartments using either the front or side KO locations. Class 1 wiring is required.

5. Make 120-240VAC, 50/60Hz supply connections on line voltage side. Make sure proper ground is connected.

---

**NOTE**: 24VDC and Dimming Wires to be run through same conduit.
6. Run conduit and DC wiring to an MRI room EMI filter sized to the load of the power supply (supplied by others). See Figure 2. Make sure wiring is completely enclosed in grounded conduit. Any gaps, regardless of size, must be closed or wrapped in copper foil tape.

7. If a 0-10V dimmer is to be connected, install at this time. See Figure 2. Dimmer must be installed outside the shielded MRI environment with an intermediate MRI room EMI filter to the luminaires. Kenall recommends using a Leviton® IllumaTech™ IP710 series dimmer or Grafik Eye GRX-TVI control interface. Contact Kenall for suitability of using an alternate sink-type 0-10V dimmer.

WARNING: all DC power and dimming signal wiring must be run through separate EMI filters.

8. Run low voltage supply wires to luminaires using at least 18 AWG wires. Wire distances should not exceed 50 feet (15m) to prevent significant line losses. Class 1 wiring is required. Make sure wiring is completely enclosed in grounded conduit. Any gaps, regardless of size, must be closed or wrapped in copper foil tape. Special attention should be paid to the wiring entry point into the shielded space.

9. Make connections to luminaires following the procedure in the luminaire installation instructions.

NOTE: see “Maximum Fixture Connection” section for the maximum number of luminaires that can be connected to each power supply.

10. Complete any remaining steps on luminaire installation.

11. Connect power on line voltage side and test system operation. Test operation of lighting during MRI machine idle mode and during scanning operations.

12. Fill out the Installation Registration Form (attached) and fax to Kenall at (847) 360-1781.

**Multiple Power Supply Wiring Procedure**

Installations involving many luminaires may require multiple power supplies to handle the load. This section describes the procedure for properly wiring this situation. See “Maximum Fixture Connection” section for the maximum number of fixtures that can be connected to each power supply.

13. Mount power supplies in the same manner as described in Section II.

14. Wire line voltage and low voltage connections similar to Section II, except follow the wiring diagram shown in Figure 3 to connect to each fixture group. **All DC Ground (black) leads must be tied together.**

WARNING: do not exceed the rated wattage of each power supply (312W). MRI room EMI filters are still required and must be sized to the load of the supply.
INSTALLATION INSTRUCTIONS

Maximum Fixture Connection

Use the table below to determine the maximum number of luminaires that can be connected to an individual power supply. The maximum recommended DC amperage leaving the power supply should not exceed 13.0A.

<table>
<thead>
<tr>
<th>Luminaire</th>
<th>Amps per Luminaires</th>
<th>Max. Luminaires per Power Supply per room</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSMB22</td>
<td>0.4</td>
<td>28</td>
</tr>
<tr>
<td>CSMB24</td>
<td>0.3</td>
<td>16</td>
</tr>
<tr>
<td>CSMB44</td>
<td>0.3</td>
<td>16</td>
</tr>
<tr>
<td>MRDGE (13L)</td>
<td>0.5</td>
<td>13</td>
</tr>
<tr>
<td>MRDGE (23L)</td>
<td>0.4</td>
<td>12</td>
</tr>
<tr>
<td>MRDGE (41L)</td>
<td>0.3</td>
<td>8</td>
</tr>
<tr>
<td>MRMAAS813 (8W)</td>
<td>0.4</td>
<td>16</td>
</tr>
<tr>
<td>MRMAAS813 (14W)</td>
<td>0.6</td>
<td>16</td>
</tr>
<tr>
<td>MRMAAS826</td>
<td>1.0</td>
<td>10</td>
</tr>
<tr>
<td>MRMAAS838</td>
<td>1.3</td>
<td>8</td>
</tr>
<tr>
<td>MRMAAS850</td>
<td>1.7</td>
<td>6</td>
</tr>
<tr>
<td>MRHAUC 18</td>
<td>0.7</td>
<td>16</td>
</tr>
<tr>
<td>MRHAUC 36</td>
<td>1.4</td>
<td>8</td>
</tr>
<tr>
<td>ME11MRI</td>
<td>1.4</td>
<td>8</td>
</tr>
<tr>
<td>LP5MRI-12</td>
<td>0.7</td>
<td>16</td>
</tr>
<tr>
<td>LP5MRI-22</td>
<td>0.7</td>
<td>16</td>
</tr>
</tbody>
</table>

CUSTOMER SERVICE

For technical assistance, call 1-800-4KENALL (1-800-453-6255).

WARRANTY

When installed to these instructions, this product is warranted by Kenall to be free of defects in workmanship and materials for a period of one year from the date of invoice. The DC power supply contained in the external power supply carries a three year warranty from the date of invoice. The warranty is void if all power and dimming signal wiring is not completely shielded in grounded aluminum conduit and installed with a suitable MRI room filter (by others).

Kenall reserves the right to issue credit, repair, or replace the defective merchandise, at its discretion, upon notification and confirmation by its local representative of the defect. Kenall also reserves the right to test and examine the defective product if the defect is questionable and to deny the warranty herein for any product altered, improperly installed, installed in applications for which it is not intended. This includes operation in ambient temperatures above stated limits for any length of time. Failure by electrical surge shall not be covered under warranty.

Kenall assumes no responsibility for labor or freight costs incurred in connection with the installation, removal, or replacement of products determined to be defective or any other consequential or incidental damages arising from the use of the product. Kenall’s entire liability on any claim of loss or damage resulting from a defective product is limited to the replacement price of the product. The foregoing warranty is exclusive of all other warranties and no other warranties of any kind are expressed or implied.
**APPLICATION GUIDE: STANDARD SPECIAL SIGNAGE**

Lithonia Lighting offers special signage signs to suit many applications. The Signature and Quantum families highlighted below are illuminated with energy-efficient, long-life Light Emitting Diodes (LEDs).

**WARRANTY** — Complete warranty terms located at:  
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application. Specifications subject to change without notice.

---

**ORDERING INFORMATION**

Lead times will vary depending on options selected. Consult with your sales representative.

Example: LE P 1 R EL N SW02

---

**Family** | **Face type** | **Housing color** | **Number of faces** | **Letter color** | **Input voltage** | **Operation**  
---|---|---|---|---|---|---  
LE | Signature die-cast aluminum sign | (blank) Matte black, brushed aluminum face | 1 | B | (30)2/277 Dual voltage | EL N Nickel-cadmium battery  
LQM | Quantum thermoplastic sign | Matte black, brushed aluminum face | 1, 2, 3 | B, G | 120/277 Dual voltage, EL N Nickel-cadmium battery  
| | | | |  
| | | | |  

**Special wording**

| SW01 | AREA OF REFUGE | SW05 | BEAM IN USE | IN USE | SW10 | IN USE | SW13 | ON AIR | EL N | HANDICAP SYMBOL  
| SW02 | AREA OF RESCUE | SW06 | DARK ROOM IN USE | IN USE | SW11 | MAGNET IN USE | SW14 | ROOM IN USE | EL N | HANDICAP SYMBOL  
| SW03 | AREA OF RESCUE ASSISTANCE | SW07 | EXIT Arabic/English | IN USE | SW12 | NO EXIT | SW15 | SALIDA | EL N | HANDICAP SYMBOL  
| SW04 | AREA OF RESCUE ASSISTANCE with access pictogram | SW08 | EXIT with access pictogram | IN USE | SW16 | X-RAY IN USE | SW17 | HANDICAP SYMBOL | EL N | HANDICAP SYMBOL  

---

**Notes**

1. See spec sheet LE-LRE for complete specifications.  
2. Only available in white housing. EL N operation only available in red letters for LQM family.  
3. See spec sheet LQM for complete specifications.  
4. Only available with LQM family.  
5. Only required when ordering LQM family (ex: LQM P 1 R EL N SW02).  
6. UL Listed as an electric sign.  
7. Not available with EL N operation.  
8. Only available in red letters.  
9. Not available with UL listing.
CUSTOM SIGNAGE

MAINTENANCE

All life safety equipment, including emergency lighting for path of egress must be maintained, serviced, and tested in accordance with all National Fire Protection Association (NFPA) and local codes. Failure to perform the required maintenance, service, or testing could jeopardize the safety of occupants and will void all warranties.
SECTION 28 3100 - FIRE ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections include the following:
   1. Division 26 Section “Electrical General Requirements.”

1.2 SUMMARY
A. This Section includes design and installation of a new fire alarm system

B. Related Sections include the following:
   1. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.3 DEFINITIONS
A. FACP: Fire alarm control panel.
B. LED: Light-emitting diode.
C. NICET: National Institute for Certification in Engineering Technologies.
D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
1.4 SYSTEM DESCRIPTION
   A. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.
      1. Interface with existing fire alarm system.
   B. Fire alarm system shall consist of the following:
      1. Audible and visual notification appliances in all public and common areas of the building.

1.5 PERFORMANCE REQUIREMENTS
   A. Comply with NFPA 72.
   B. A complete functional system meeting the requirements of this specification, including alarm initiating devices and notification appliances at locations and ratings to meet the requirements of the Authorities Having Jurisdiction and all applicable codes shall be provided.
   C. Coordinate and avoid conflicts with casework, marker boards, feature walls, and other areas where fire alarm devices would interfere with furnishings, finishes, etc.
   D. Fire alarm system vendor shall provide sound pressure level calculations demonstrating compliance with NFPA 72 and establish quantities and tap settings of audible devices.
   E. No additional charges for work or equipment required for a code compliant system approved by the Authority Having Jurisdiction will be allowed.
   F. Obtain and refer to mechanical drawings for smoke damper locations, smoke rated transfer openings, and air handling equipment CFM’s. Provide smoke detection as required by applicable codes.
   G. Premises protection includes residential.
      1. Refer to drawings for complete code analysis including construction type, use groups, special occupancy types, rated walls, smoke barriers and partitions, etc.
   H. System functional performance shall be as indicated on the fire alarm matrix on the drawings.

1.6 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings:
      1. Shop Drawings shall be prepared by persons with the following qualifications:
         a. Trained and certified by manufacturer in fire alarm system design.
         b. Fire alarm certified by NICET, minimum Level III.
      2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer’s standard descriptions for generic systems are not acceptable.
      3. Device Address List: Include address descriptions that will appear on the FACP display.
      4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
      5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and system with all terminals and interconnections identified. Show wiring color code.
      6. Batteries: Provide battery sizing calculations. Battery size shall be a minimum of 125% of the calculated requirement.
      7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.

9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

10. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show device layout, size and route of cable and conduits.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

G. Documentation:
   1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and Authorities Having Jurisdiction.
   2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
      a. Hard copies on paper to Owner, Architect, and Authorities Having Jurisdiction.
      b. Electronic media may be provided to Architect.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Work of this Section be performed by a UL-listed company.

C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.

D. 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.

1.8 EXTRA MATERIALS

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. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
   2. Smoke, Fire, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
   3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
   4. Keys and Tools: One extra set for access to locked and tamperproofed components.
5. Audible and Visual Notification Appliances: One of each type installed.
6. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. FACP and Equipment:
      a. SimplexGrinnell LP; a Tyco International Company.

2.2 SYSTEM SMOKE DETECTORS

A. General Description:
   1. UL 268 listed, operating at 24-V dc, nominal.
   2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   3. Multipurpose type, containing the following:
      a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
      b. Piezoelectric sounder rated at 88 dBA at 10 feet according to UL 464.
      c. Heat sensor, combination rate-of-rise and fixed temperature.
   4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
   5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
   7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
      a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F per minute.
      b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F.
      c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:
   1. Sensor: LED or infrared light source with matching silicon-cell receiver.
   2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:
   1. Photoelectric Smoke Detectors:
      a. Sensor: LED or infrared light source with matching silicon-cell receiver.
      b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
   2. UL 268A listed, operating at 24-V dc, nominal.
   3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for
mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.

a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.

5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where required.

7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

8. Each sensor shall have multiple levels of detection sensitivity.

9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.

10. Relay Fan Shutdown: Provide two (2) sets of contacts rated to interrupt fan motor-control circuit.

2.3 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.


2. Finishes:
   a. Wall mounted appliances: Provide white finish with red lettering.
   b. Ceiling Mounted Appliances: Provide white finish.

B. Voice/Tone Speakers:

1. UL 1480 listed.

2. High-Range Units: Rated 2 to 15 W.

3. Low-Range Units: Rated 1 to 2 W.

4. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.

C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output: 15, 30, 60, 75, 110, 135, 185 candela as required to meet NFPA 72 requirements.

2. Strobe Leads: Factory connected to screw terminals.

2.4 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

2.5 ADDRESSABLE CONTROL MODULE

A. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:

1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.

2. Provide NO/NC contact pairs rated at 2 amps 120 VAC or 24 VDC.
2.6 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Fire alarm wire and cable shall be as specified by the system manufacturer including conductor gage, conductor quantity, conductor twists and shielding required to meet NFPA class and style performance specified.

C. Signaling Line Circuits and other power limited fire alarm circuits (PLFA):
   1. PLFA circuits installed in conduit or raceway: U.L. Listed type FPL
   2. PLFA circuit cable installed exposed in accessible ceiling spaces, risers and elsewhere: U.L. Listed type FPLP.
   3. PLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Circuit integrity cable, NFPA 70 Article 760, Classification CI, UL listed as Type FPL, FPLR or FPLP as required, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

D. Non-Power-Limited Fire Alarm Circuits (NPLFA):
   1. NPLFA circuits installed in conduit: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
      a. Low-Voltage Circuits: No. 16 AWG, minimum.
      b. Line-Voltage Circuits: No. 12 AWG, minimum.
   2. NPLFA circuit cable installed exposed in ceiling spaces, risers and elsewhere: Multi-conductor cable, U.L Listed type NPLFP.
   3. NPLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Multi-conductor cable, U.L Listed type NPLFP-CI
   4. NPLFA circuit cable installed exposed in ceiling spaces, shafts and elsewhere: Multi-conductor Armored Cable, NFPA 70 Type MC, copper conductors, copper drain wire, aluminum or steel armor with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Smoke or Heat Detector Spacing:
   1. Smooth ceiling spacing shall not exceed 30 feet.
   2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
   3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

B. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

C. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct.

D. Remote Status and Alarm Indicators: Install near each smoke detector, each duct detector and each sprinkler water-flow switch and valve-tamper switch that is above 10’-0” aff, concealed, or otherwise not readily visible from normal viewing position. Coordinate exact locations with local fire department and submit to architect for approval.

E. Audible Alarm Notification Appliances: Install wall mounted appliances not less than 6 inches below the ceiling.
F. Visible Alarm Notification Appliances: Install wall mounted appliances at 96” AFF or 6 inches below the ceiling, whichever is less.
G. Coordinate ceiling mounted appliances with reflected ceiling plans. Do not install visual appliances where pendant mounted or suspended lighting fixtures will obstruct intended viewing angles.
H. Install wall mounted and ceiling mounted notification appliances flush on recessed j-box or back box for all new work and on existing gyp-board partition walls.
I. Install notification appliances on existing CMU walls on surface back-boxes matching the dimensions and finish of the notification appliance.
J. Device Location-Indicating Lights: Locate in public space near the device they monitor.
K. Provide all 120V branch circuits for all control panels, sub panels, and ancillary equipment required for the system.

3.2 WIRING INSTALLATION
A. Install wiring according to the following:
   1. NECA 1.
   2. TIA/EIA 568-A.
B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes."
   1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
C. Wiring Method:
   1. Fire alarm circuits shall consist of multi-conductor cables installed in accessible ceiling spaces.
   2. Where ceilings consist of exposed construction, fire alarm multi-conductor cable shall be installed on top of joists, beams etc. and shall be concealed from view. Where the structural elements do not allow for the cable to be installed in a concealed fashion, then install the cable in conduit.
   3. Install fire alarm cable in conduit in mechanical rooms, loading docks and similar service spaces.
   4. Drops to surface mounted devices shall be installed in conduit or surface raceway. No exposed cable shall be visible below the ceiling. Where the ceiling is exposed, route the conduit or raceway up to the structural member that will conceal the cable.
   5. Drops to devices recessed in partition walls shall be installed in conduit.
   6. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
   7. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits, if the system manufacturer permits it.
D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Electrical Identification."

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

D. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.

2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
   a. Include the existing system in tests and inspections.

3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
   a. Detectors that are outside their marked sensitivity range shall be replaced.

5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.
3.6 PROGRAMMING

A. Coordinate final address descriptions for alarm, supervisory and trouble indication that appear on FACP and Annunciator displays with the Owners representative. This shall include all room names, room numbers, building areas for fire protection zones, exit door descriptions and similar items. This coordination shall take place and be implemented in the programming prior to Demonstration and Owner Training.

3.7 ADJUSTING

A. 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 outside normal occupancy hours for this purpose.

B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

C. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

D. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

3.8 WARRANTY

A. All newly installed equipment shall be warranted by the contractor for a period of one year following acceptance. The warranty shall include parts, labor, prompt field service, pickup and delivery.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION