Appendix A - Project Specifications

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SECTION 00 22 20 - EXISTING CONDITION INFORMATION

PART 1 - GENERAL

1.1 EXISTING CONDITION INFORMATION

A. The following information is provided for reference only. The Contractor is responsible for verification of all existing conditions relevant to completion of the work, per the performance requirements stated in the documents.

1. **Wayne State University, Science Hall** :
   a. Core Samples :
      1) Area F : Approximately 3" Total Thickness
         a) Coal Tar BUR with Gravel Surfacing
         b) Perlite Insulation
         c) Isocyanurate Insulation
         d) Adhered Base Sheet
         e) Structural Concrete Deck
      2) Area S : Approximately 3" Total Thickness
         a) Coal Tar BUR with Gravel Surfacing
         b) Perlite Insulation
         c) Isocyanurate Insulation
         d) Adhered Base Sheet
         e) Structural Concrete Deck

B. The Contractor shall review and record all site conditions, existing roof conditions, and general building conditions prior to mobilization.
   1. If roof conditions are different than those listed, notify the Owner and Consultant immediately.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTON 00 22 20

SECTION 013300 - SUBMITTAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PreConstruction Submittal requirements
2. Closeout Submittals
3. Submittal Format

1.2 PRECONSTRUCTION SUBMITTAL REQUIREMENTS

A. Manufacturer Certificates:

1. Include an Approval Letter from the Manufacturer acknowledging that the assembly and proposed installation method meets or exceeds the roof system performance requirements and subsequent intent to approve for warranty as listed.
   a. Include a letter from the manufacturer indicating that the roof system meets the minimum fire resistance rating as specified
2. Contractor Approval: Provide evidence from the Manufacturer indicating that the Contractor is licensed to install the roof system as listed and provide the required warranty.

B. Product Data: For each type of product.

1. For membrane, insulation, and roof system components.

C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness if insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, thickness, and slopes.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
6. Proposed deviations or clarifications from the plans or specifications.

D. Warranties:

1. Provide samples from the Manufacturer
2. Provide samples from the Installing Contractor.

E. Safety Documents (Separate Packet)

1. Provide a safety plan, 24 hour emergency contact information, list of safety representatives, crane plan, SDS, and other pertinent and OSHA required safety documentation to the Owner in a separate packet prior to the commencement of the project.
   a. Minimum two (2) hard copies for project site.

1.3 CLOSEOUT SUBMITTALS

A. Punch List as provided by the Manufacturer and photos of the completed work.

B. Submit Maintenance data for Owner's Use. Identify maintenance items, as required by Owner to maintain system warranty.

C. Warranty and Warranty Contact information for Owner's use.

D. Submit photo documentation, verifying final cleaning was performed and site was restored to original condition.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Contractor Name
4. For products, provide a Table of Contents, identifying :
   a. The Specification Section Number and Location
   b. The name of the product, item, or services listed per specification.
      1) Indicate product dimensions of materials intended for use.
   c. The name of the designated Manufacturer/Supplier for each product, item, or service.
   d. Include the technical information sheets for all products intended for use.
5. For Shop Drawings, provide a list of all shop fabricated items and pre-fabricated items.
6. For Warranties, identify the warranty name and length on the Table of Contents

B. SAMPLE FORMAT :

SPECIFICATION SECTION	**ITEM/PRODUCT**	**MANUFACTURER/SUPPLIER**
072000	ROOF INSULATION	PROPOSED MANUFACTURER
	Size : ---" x 48" x ----"	
075300	ROOF MEMBRANE	PROPOSED MANUFACTURER
076200	SHOP DRAWINGS	Premanufactured Edge Metal
		Shop Fabricated Counter Flashing

C. CLEARLY IDENTIFY DEVIATIONS OR PROPOSED ALTERNATES TO THE CONTRACT DOCUMENTS. Owner and/or Consultant to review submittal items for completeness and

compliance with the contract documents only. No deviations will be accepted without proper RFI documentation.

D. Electronic Submittals (Primary): Prepare submittals as PDF package, incorporating complete information into each PDF file. Email or provide thumb drives for all documents.

E. Hard Copy Submittals (Secondary): Provide upon request.

F. Provide all submittals within 15 days of Notice to Proceed.

G. Allow a minimum of 15 days for review by Consultant or Owner's Representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

A. Manufacturer's Final Punch List : Provide a copy of the Manufacturer's Punch List for Warranty. Provide a written response, including photos of completed work.
B. Owner's Final Punch List : The Owner's Representative or Consultant shall provide a final Punch List for close-out. All work is to be completed as listed, Contractor to provide a written response including photos of the completed work.
C. Certificates of Release: From authorities having jurisdiction.
D. Certificate of Insurance: For continuing coverage.
E. Performance and Payment Bonds (if required) : Consent of Surety
F. Warranties : Provide final Manufacturer and Contractor's Workmanship Warranties as listed.
G. As Built Documents : Provide all As Built documents, acknowledging changes in the Contract Documents for submission to the Owner's Representative or Consultant.
H. Attic Stock : Where required, provide Owner with all attic stock. Furnish and deliver attic stock materials to the final location, per the Owner's instructions.
I. Final Clean Up : Submit photo evidence that the set-up, staging, and all other areas adjacent to the work area have been properly swept, cleaned, and otherwise returned to original condition.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

A. Provide the Manufacturer's Technical Representative and/or Authorities Having Jurisdiction for Final Punch List development.
   1. Notify the Owner's Representative or Consultant a minimum of five (5) days prior to the date that the Manufacturer's and/or AHJ's Punch List is to be performed

1.4 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion:
   1. Submit copies of all Punch List reports, indicating compliance and completion of the Punch Lists, Final Application for Payment, Certificate of Insurance, Consent of Surety, Warranties, As-Built documents, Attic Stock, and verification of Final Cleanup.

1.5 SUBMITTAL OF PROJECT CLOSE OUTS

A. Time of Submittal: Submit all close out submittals within ten (10) days of the date of Final Completion.
B. Warranty Electronic File: Provide all submittal data in PDF format.
C. In addition to electronic copy, provide the Manufacturer's Warranty, Contractor's Workmanship Warranty, and Certificates of Release in hard copy.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 77 00

SECTION 033000 - CAST-IN-PLACE CONCRETE REPAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete decking, including concrete materials and extent of the repair work
B. For all holes 12” in diameter or less, install new 16 ga. Galvanized steel plating. Plate should extend a minimum of 6” beyond the opening of the hole, on all sides. The plate should be anchored into the concrete at a minimum one fastener per corner or 6” on center. Seal all edges. Field prime in compliance with manufacturer’s warranty.
C. For all holes 12” in diameter or larger, install a new 18 ga. 1.5” Type B decking. Decking shall be supported by steel angles and anchored 6” on center around the perimeter of the deck infill.
D. For all spalling at minimum ½” depth or more, install new concrete patch materials. For deep cracks, install new concrete patch.

1.2 SUBMITTALS

A. Product Data: Provide data for Steel Decking and Concrete Patch Materials.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
B. Installing Contractor : A firm experienced in the installation of the designated products and application methods.

PART 2 - PRODUCTS

2.1 CONCRETE PATCH MATERIALS

A. One-component magnesium phosphate-based patching and repair mortar.
1. BASF MasterEmaco T545 / T545HT or equal.

2.2 RELATED MATERIALS (where required)

A. Vapor Retarder: Per Section “07 26 00 Vapor Retarders”

PART 3 - EXECUTION

3.1 CONCRETE REPAIR MATERIALS

A. Remove any loose or broken concrete from the area, providing a sound surface for application. Sawcut concrete to provide an even edge. Depth should be approximately 1/2”.

B. Abrade or scarify the adjacent concrete surface where required by the manufacturer, to ensure a proper bond to the adjacent construction.
C. Mix the patch materials using potable water and apply within the timeframe recommended in the manufacturer's instructions.
D. When the surface is dry and of sound condition for repair, mix and set the new concrete patch material in place and protect, per the manufacturer's recommendations.

3.2 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.
B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss before and during finishing operations.
C. Follow manufacturer's instructions for finishing.
D. Install roofing materials per the Manufacturer's requirements over dry, clean concrete surfaces.

END OF SECTION 033000

SECTION 061050 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Includes all removal and replacement or the addition of new wood blocking, nailers, sheathing, plywood, and anchorage systems associated with the installation for the new roof system.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For concealed lumber, use untreated dimensional lumber
   3. For exposed lumber, use treated dimensional lumber
   4. Maximum moisture content for Lumber: 15 percent for 2-inch nominal thickness or less
   5. Minimum 2x6 dimensional lumber and ½" plywood or as indicated on the drawings; 2x4 minimum for use of raising rooftop equipment
   6. Minimum pull-out resistance to comply with Roofing Manufacturer's requirements for application of sheet metal trim

2.2 REFERENCES

A. APA (American Plywood Association)
B. AWPA (American Wood Preservers Association)
C. Table 2304.9.1, "Fastening Schedule" ICC International Building Code
D. ICC-ES evaluation report for fasteners

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking, nailers, rooftop equipment bases, and support curbs.
B. Dimension Lumber Items: Construction or No. 2 grade lumber, Southern Yellow Pine or Douglas Fir, straight no warping
C. Plywood Sheathing: APA Rated, exterior grade sheathing, PS1, Grade C-D, Exp1

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or Type 304 stainless steel.

B. Fasteners by Applications :

1. Screws for Fastening to Steel Decking: #14 Minimum, screw length shall be sufficient to meet 3/4" embedment into the top flange of the decking
   a. Manufacturers :
      1) Firestone, Heavy Duty Fastener
      2) Carlisle, HP-X Fastener
      3) Johns Manville, All Purpose Fasteners
      4) Approved Equal
2. Screws for Fastening to Secondary Steel Framing : 7/32" (#12) diameter steel fastener, screw length shall be sufficient to meet ¾"embedment into joist
   a. Manufacturers :
      1) ITW Self Tapping Anchor,
         a) TEK5 (Iron)
         b) TEK3 (Stitch)
      2) Or Approved Equal
3. Screws for Fastening to Structural Concrete : ½" (13mm) steel headed or plate anchor bolts (or threaded rod) with bolts and washers. Screw length shall be sufficient to meet 5" embedment into the concrete. Combine with chemical adhesive for installation. Countersink rod to accommodate bolt and washers.
   a. Manufacturers :
      1) Hilti ½" Threaded Rod with Hilti Chemical Anchor Adhesive
      2) Or Approved equal system
4. Screws for Fastening to Masonry : ¼" coated fasteners, screw length shall be sufficient to meet 1 ¼" embedment into masonry.
   a. Manufacturers :
      1) ITW, Tapcon
      2) Or approved equal
5. Screws for Fastening to Existing Wood Nailers : Minimum 10d common nails or #8 screws, length shall be sufficient to meet 1.5" embedment
   a. Manufacturers :
      1) Grip-Rite Hot Dipped Exterior, 10d
      2) Or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Do not splice structural members between supports unless otherwise indicated.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. At Roof Edges (Wood-to-Wood):
   a. Re-secure existing edge nailers using #14 fasteners anchored at 12" o.c., staggered, increasing in density to 6" o.c. within 10' of all corners. Minimum embedment is to be 1".
   b. **Install additional nailers to meet the height of the new insulation** using 10d nails, in two staggered rows at 12" o.c. Increase density to 6" o.c. within a minimum of 10' of all corners. Minimum embedment is to be 1 ½". Weave all corners and offset joints of nailers a minimum of 12" from layer below.
   c. Fasteners (nails/screws) to be located within ½" from the outside edge and ¾" from the roof side of the nailer.
2. At Roof Edges (Wood-to-Steel) :
   a. Install a new layer of blocking over existing Steel Roof Decks (min 22ga.) using #14 fasteners in two staggered rows at 12"o.c, increasing the density to 6" o.c within a minimum of 10' of all corners. Minimum embedment is to be ¾".
3. At Roof Edges (Wood-to-Concrete) :
   a. Install a new layer of blocking over the concrete edge. Pre-drill and set new ½" threaded rod in conjunction with manufacturer's chemical adhesive. Minimum embedment is to be 5" and installed at the rate of 48" o.c max, increasing the density to 24" o.c. within a minimum of 10' of all corners.
4. At Vertical Applications (Wood-to-Masonry or Wood-to-Wood) :
   a. Install a new layer of blocking or sheathing over the existing masonry. Pre-drill and set new fasteners into the substrate at a rate 2 rows, 36" on center staggered. Minimum embedment is to be 1 ¼" at masonry and 1" at wood.
5. At Roof Curbs:
   a. Dis/reconnect all equipment prior to adjusting curb height. Install additional dimensional wood nailers to raise any curbs that do not meet the minimum flashing height of 8" above the roof surface. Anchor the nailers using appropriate fasteners and reset unit or hood as required per the manufacturer.

END OF SECTION 061050

SECTION 070150 - PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Full tear-off of entire roof system, for all roof areas listed

1.2 RELATED SECTIONS

A. See “01 01 00 Summary of Work”

1.3 EXTENT OF WORK

A. Remove and dispose of existing roof system(s) at the indicated areas. Install new insulation, coverboard, and adhered membrane roof system per the drawings and manufacturer’s instructions. Install new sheet metal and trim, integral with the roofing system, per the manufacturer’s instructions.
B. Provide all labor, materials, tools, equipment, and supervision necessary to complete the installation of a new roof system herein and as indicated on the drawings in accordance with the manufacturer’s specifications.
C. Base Bid: Remove and replace all roof systems as shown.

1.2 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting removal Work, review this information onsite with the Owner’s Representative and Consultant.
B. Review and document existing site conditions, parking locations, access routes to the roof area, temporary staging and storage areas, roof area conditions, rubbish removal and disposal, temporary portable toilet locations, temporary utilities, clean up requirements, and all other job-related concerns. Contractor shall use reasonable care and responsibility to protect the site against damages during the course of work. The Contractor is responsible for any damage to the building or adjacent grounds with regard to the performance of work.
C. Ensure the roof drains are functional and draining freely prior to roofing operations. If drains are non-functional prior to the commencement of the project, Contractor shall notify the Consultant for review. If any drain is found to be clogged or blocked *after* the project is underway, the Contractor shall be responsible for returning the drain to a functional, draining condition.

1.3 SUBMITTALS

A. Per Section “013300 Submittal Requirements”

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Contractor shall be licensed to install the specified roof system and shall be a licensed builder in the State of Michigan. Owner may request references for proof of successful installations of the specified roof system extending back five (5) years or more.
B. All work shall be supervised by a qualified supervisor daily.
C. All work shall be installed per local, state, federal building code requirements, in strict accordance with the manufacturer's specifications, and in the highest standard of quality.
D. ALL ROOFING WORK SHALL BE LEFT IN A WATERTIGHT CONDITION DAILY. Clamping rings (with water-block), temporary seals, nightly tie-offs, penetrations, and other areas worked during daily operations shall be completely sealed regardless of forecasted weather conditions. Contractor is responsible for all damage associated with incomplete, unfinished, or unsealed areas should leaks occur.

1.5 JOBSITE PROTECTION

A. Owner will occupy portions of building immediately below reroofing area.
1. Conduct reroofing so Owner's operations are not disrupted.
2. Provide Owner with not less than **72** hours' written notice of activities that may affect Owner's operations.
3. Coordinate work activities daily with Owner. Place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.
a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.
B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
C. Furnish and install new ¾" plywood and a minimum 1.5" insulation for protection from travel over existing roof areas or temporary rooftop storage areas.
D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
1. Information for existing roofing system is provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
2. Protect all interior spaces used for rooftop access.
3. Restore all surfaces to original or better condition after final completion.

F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed. DO NOT OVERLOAD THE ROOF AREA. Store no more than one day's worth of materials on the roof at a time. Do not stockpile trash overnight.

G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
   1. Remove only as much roofing in one day as can be made watertight in the same day.

H. SAFETY
   1. The roofing Contractor is responsible for all means and methods for compliance for all MIOSHA or OSHA regulatory requirements. It is the roofing Contractor's responsibility to protect the general public from access to the work area or from all work activities, on both the ground and the roof areas, as well as provide safe access for the Consultant or Owner's Representative when reviewing the work.
   2. Maintain at least two (2) fire extinguishers onsite for immediate use.

PART 2 - PRODUCTS

2.1 AUXILIARY REROOFING MATERIALS

A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of the new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Seal or isolate windows, intakes, or other areas that may be exposed to airborne substances created in removal of existing materials.
B. Protect windows from damage during reroofing operations by use of ½" plywood and other protective materials. The windows do not currently leak and are in otherwise undamaged condition.
C. Shut off rooftop utilities and service piping before beginning the Work.
D. Test existing roof drains to verify that they are not blocked or restricted.
   1. Using a licensed Plumber, mechanically clear all roof drain piping in all roof replacement areas, from the roof deck to the clean out, to ensure roof drains and piping are flowing.
      a. Provide evidence that the water testing have been completed prior to construction.
   2. Immediately notify Consultant of any blockages or restrictions.
   3. Please note that the CONTRACTOR may be responsible for drain or drain plumbing replacements or repair IF evidence of prior testing cannot be provided, has not been completed, or damage to these areas has occurred during construction.
E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
   1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.

1. Prevent debris from entering or blocking roof drains and conductors.
   a. Use roof-drain plugs specifically designed for this purpose.
   b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
   a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

A. Notify Owner each day of extent of roof tear-off proposed for that day**.**
B. Notify the Owner if ACM is suspected or found prior to removal.
C. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or crane box.
D. Remove aggregate ballast from roofing.
E. Full Roof Tear-off: Remove existing roofing and other roofing system components down to the existing roof deck.
   1. Remove roof insulation and any/all cover boards.
   2. Remove base flashings and counter flashings.
   3. Remove perimeter edge flashing and gravel stops.
   4. Remove copings.
   5. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
   6. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
   7. Carefully remove fasteners from deck.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.
B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify the Owner's representative.
   1. Do not proceed with installation until directed by the Owner's representative.
C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Consultant.
   1. Do not proceed with installation until directed by the Owner's representative.
D. If required, provide additional deck securement as indicated on Drawings.
E. If required, replace roof deck as indicated on Drawings.
   1. Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents. All areas marked for repair/replacement must be identified on the roof plan, indicating area size and amount of replacement; along with photos of the existing condition, prior to replacement. Work will not begin

until receipt of a signed change order and no change order will be issued without this information.

3.4 BASE FLASHING REMOVAL

A. Remove existing base flashings.
   1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
B. Do not damage metal counter-flashings that are to remain.
C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.
   1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Owner's representative.
D. When directed by the Owner's representative, replace parapet framing, wood blocking, curbs, and nailers.

END OF SECTION 070150

SECTION 071000 – ROOF RESTORATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof Restoration Coatings

1.2 SUBMITTALS

1. Per Section “01 33 00 Submittals”

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing coating manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Firm must be able to provide evidence of successful completion of at least five (5) similar sized /type projects within the last five (5) years.

1.4 WARRANTY

A. Contractor’s Workmanship Warranty: Contractor agrees to repair or replace all components of roofing system that fail in workmanship within specified warranty period. Warranty shall include all materials and labor for the period specified below :
1. Warranty Period : 5 Years from the Date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. BASIS OF DESIGN : Karnak Corporation Roof Restoration System

2.2 ACRYLIC EMULSION COATING :

A. Acrylic Coating: Liquid acrylic elastomeric emulsion coating system specifically formulated for coating Granulated Modified Bitumen Roof Systems.
1. Pre-Wash : 799 Wash-N-Prep, Karnak
2. Repair Materials :
a. 505MS Karna-Flex WB, Karnak
b. 5540 Resat-Mat (Fabric), Karnak
3. Base Coat : 405 Bond-N-Shield, Karnak
4. Finish Coat : 501 Elasto-Brite White, Karnak

PART 3 - EXECUTION

3.1 Preparation:

A. General: All roof surfaces to be coated should be sound, clean, dry and free of dirt, grease, oil, dust, debris and loose granules. Do not apply over brittle roof surfaces.
B. Adhesion of the coatings should be tested over all applicable roof surfaces prior to the system application.
C. Repair all cracks, splits, holes and large blisters with 505MS Karna-Flex WB and Resat-Mat in a three-course application. Seal all other defective areas that may affect the waterproofing integrity of the existing roof system.
D. Cut away low handing branches and vegetation that extend onto the roof.
E. Power-wash all surfaces to be coated with 799 Wash-N-Prep Roof Cleaner and water maintaining a minimum of 2000 psi. Take all necessary precautions to avoid damage to the roof system when power washing.
    1. Dilute 799 Wash-N-Prep with water at a 16:1 ratio for normal cleaning.
    2. Apply diluted cleaning agent directly to the roof surface with a Hudson-type sprayer or using a stiff nylon brush by dipping the brush into a bucket of diluted cleaner. Cleaner may also be added in full strength to the detergent reservoir for injection dilution at a 16:1 ratio.
    3. Rinse all surfaces thoroughly with a heavy duty power washer using clean water to completely remove all residues. Do not allow dirty solution to pool on the roof and dry.
    4. Allow the roof to completely dry before applying KARNAK coating products.

3.2 Repairs:

A. Seal and repair all base flashings, roof penetrations, drains, cracks, holes, large blisters and splits with 505MS Karna-Flex WB and 5540 Resat-Mat prior to applying coatings.
    1. Apply Karna-Flex WB in a 1/16” – 1/8” thickness by 6” width directly over the area to repair.
    2. While still wet, immediately embed 4” wide Resat-Mat into the wet Karna-Flex WB.
    3. Immediately apply an additional 1/16” – 1/8” thick by 6” wide application of Karna-Flex WB over the embedded Resat-Mat to completely cover the fabric, feathering the Karna-Flex WB out to the roof surface. No fabric should be visible.
    4. Total coverage of Karna-Flex WB in this application is approximately 25 lineal feet per gallon.
    5. Allow Karna-Flex WB to completely dry 6-24 hours before application of the subsequent base coating.

3.3 Base Coat Application:

A. Application of the base coat should take place when temperatures are 40°F-100°F and humidity levels are 85% or less.
B. Thoroughly mix the 405 Bond-N-Shield to overcome any settling that may occur. Mix the product to a monolithic consistency.
C. Starting at one end of the roof, apply one coat of 405 Bond-N- Shield at the rate of 1.5 to 2 gallons per 100 sq.ft. with a 3/4" nap roller or airless spray equipment.
D. If spray applying the base coat, back roll the coating to achieve maximum adhesion and even coverage.
E. Apply the coating evenly, working in the same direction. Don't overwork the coating or attempt "touch-ups" while the coating is still wet.
F. Allow 6-12 hours before applying subsequent coating application.

3.4 Finish Coat Application:

A. Application of the 501 Elasto-Brite White should take place when temperatures are 40°F-100°F and humidity levels are 85% or less.
B. Thoroughly mix the 501 Elasto-Brite White to overcome any settling that may occur. Mix the product to a monolithic consistency.
C. Starting at one end of the roof, apply one coat of 501 Elasto- Brite White at the rate of 1.5 gallons per 100 sq.ft. with a ¾" nap roller or airless spray equipment.
D. Apply 501 Elasto-Brite White perpendicular to the preceding base coat.
E. If spray applying the finish coat, back roll the coating to achieve maximum adhesion and even coverage.
F. Apply coating evenly, working in the same direction. Don't overwork the coating or attempt "touch-ups" while the coating is still wet.

END OF SECTION 071000

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Polyisocyanurate board insulation
2. GP DensDeck Coverboard Insulation

1.2 SUBMITTALS

A. Per Section “013300 Submittal Requirements”

PART 2 - PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2 (20psi), felt or glass-fiber mat facer on both major surfaces.
1. Thickness and Size :
a. 1.5” x 48” x 48”
b. 2” x 48” x 48”

B. Tapered Insulation: Provide factory-tapered insulation boards. ASTM C1289, Type II, Class 1, Grade 2 (20psi), felt or glass-fiber facer on both major surfaces.
1. Minimum Thickness: ½ inch.
2. Slope: 1/8” Field Slope; ¼” and ½” Saddle/Cricket

C. Cover Board : ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
1. Manufacturers :
a. Georgia Pacific DensDeck Prime
2. Thickness: 1/2 inch
3. Surface Finish: Factory primed
4. Minimum thickness : ½” inch, Adhered

2.2 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation or nailers to substrate, and acceptable to roofing system manufacturer.
B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows: (Contractor’s Choice)
1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

2. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. ALL DECKS : Perform fastener and/or adhesion pullout tests according to roof system manufacturer's written instructions.
   1. Submit test result within 24 hours of performing tests.
      a. Include manufacturer's requirements to achieve specified wind uplift requirements.

3.2 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
C. STAGGER JOINTS at all Tie-ins from previous day's work
D. Installation Over Decking:
   1. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows, and with long joints continuous at right angle to decking.
      a. Locate end joints over crests of decking.
      b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches minimum or as shown.
         1) Trim insulation so that water flow is unrestricted.
      e. Fill gaps exceeding 1/4 inch with insulation.
      f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
      g. <u>AT CONCRETE DECKS</u> :
         1) Adhere each layer of insulation to substrate using adhesive according to the manufacturer's instructions and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
            a) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
            b) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

   2. Install upper layers of insulation and/or tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
      a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
      b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
      c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches minimum or as shown.
f. Trim insulation so that water flow is unrestricted.
g. Fill gaps exceeding 1/4 inch with insulation.
h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
i. AT CONCRETE DECKS :
    1) Adhere each layer of insulation to substrate using adhesive according to the manufacturer's instructions and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
    2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
    3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3. Install top, tapered, and base layers of insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
    a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, install coverboard over the sloped base layers as shown.
        1) Trim insulation so that water flow is unrestricted.
    f. Fill gaps exceeding 1/4 inch with insulation.
    g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    h. Adhere each layer of insulation to substrate using adhesive according to the manufacturer's instructions and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
        1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
        2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

END OF SECTION 072100

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. SBS Modified Bitumen Vapor Retarders
B. Related Requirements:
   1. Section 03 30 00 "Concrete Deck Repairs" for under-slab vapor retarders.
   2. Section 07 21 00 "Thermal Insulation" for vapor retarders integral with insulation products.

1.2 SUBMITTALS

A. Per Section “01 33 00 Submittal Requirements”
B. Contractor must be CERTA approved. Provide documentation of valid CERTA training prior to performing work.

PART 2 - PRODUCTS

2.1 SBS MODIFIED BITUMEN VAPOR RETARDER

A. SBS Modified Bitumen Vapor Retarders: ASTM D5147, 80 mil minimum, torch applied modified polyester reinforced vapor retarder for use and approved for application within the specified roof assembly, with maximum permeance rating of 0.1 perm.
   1. Basis of Design : Ply Sheet TA 87 by Sika/Sarnafil
   2. Alternates :
      a. Carlisle Syntec
      b. Firestone Building Products
      c. Johns Manville
      d. No substitutions
B. SBS modified bitumen vapor retarder: ASTM D5147, 30 mil minimum, self-adhered modified vapor retarder for use and approved for application within the specified roof assembly, with maximum permeance rating of 0.1 perm.
   1. For application at AREA S & R only.
   2. Basis of Design : Vapor Retarder SA 31 by Sika/Sarnafil
   3. Alternates :
      a. Carlisle Syntec
      b. Firestone Building Products
      c. Johns Manville
      d. No Substitutions

PART 3 - EXECUTION

3.1 INSTALLATION OF VAPOR RETARDERS ON ROOF DECKING

A. Prepare the roof deck per the manufacturer's instructions.
B. Prime the substrate, if required by the manufacturer for proper adhesion the roof deck.
C. Extend vapor retarders to the perimeter of the roof areas. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
E. Repair tears or punctures in vapor retarders immediately before concealment by other work.

END OF SECTION 07 26 00

SECTION 075400 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Adhered polyvinyl chloride (PVC) roofing system.

1.2 SUBMITTALS

1. Per Section “01 33 00 Submittals”

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Firm must be able to provide evidence of successful completion of at least five (5) similar sized /type projects within the last five (5) years.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace all components of roofing system that fail in materials or workmanship within specified warranty period. Warranty shall include all materials and labor for the period specified below (total system warranty).
1. Warranty Period: 20 years from Date of Substantial Completion.

B. Contractor’s Workmanship Warranty: Contractor agrees to repair or replace all components of roofing system that fail in workmanship within specified warranty period. Warranty shall include all materials and labor for the period specified below :
1. Warranty Period : 5 Years from the Date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
C. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

D. FMG Listing : Provide roofing membrane, base flashings, and component materials that comply with requirements of FM 4450 and FM 4470 as part of a membrane roofing system and that are listed in FM's Approval Guide for Class 1 construction.
   1. Fire/Windstorm Classification : Class 1-60
E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Provide a letter from the manufacturer indicating minimum compliance with UL Class C for Type IIB Construction. Completed assembly must pass one hour fire rating.
F. National Roofing Contractors Association : NRCA Membrane Systems Manual, 2015 or newer, for industry best practices
G. Sheet Metal & Air Conditioning Contractors National Association : SMACNA Architectural Sheet Metal Manual, for industry best practices

2.2 POLYVINYL CHLORIDE (PVC) ROOFING

A. PVC Sheet: ASTM D4434/D4434M, Type III, fabric reinforced

1. MEMBRANE #1 :
   a. Thickness: 60 mils, nominal.
   b. Exposed Face Color: White
   c. **Locations :**
      1) Area Locations

B. **APPROVED MANUFACTURERS :**
   1. BASIS OF DESIGN : Sika Sarnafil
   2. ALTERNATES :
      a. Carlisle Syntec
      b. Firestone Building Products
      c. Johns Manville
      d. No substitutions

2.3 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
   1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
D. Bonding Adhesive: Manufacturer's standard bonding adhesive
E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, and acceptable to roofing system manufacturer.
   1. Size: Standard width by max 36” long.
   2. Color: Contrasting with roof membrane.
   3. Locations : Place new walkways at
      a. The designated walkway path as shown on the drawings
      b. All roof access doors, roof hatches, ladders, and other landings
      c. All rooftop unit access points, doors, duct supports, sleeper supports, antennas, and satellite dishes
      d. All other locations per manufacturer’s requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that the substrate is in acceptable condition for new roofing materials, per the manufacturer’s requirements.

3.2 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions per minimum uplift performance requirements and FM Global Property Loss Prevention Data Sheet 1-29.
B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition

3.3 ADHERED ROOFING INSTALLATION

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
B. Unroll membrane roof membrane and allow to relax before installing.
C. Start installation of roofing in presence of roofing system manufacturer's technical personnel **and the Owner’s Representative**
D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
H. Adhere protection sheet over roof membrane at locations indicated.

3.4 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.5 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Consultant and Owner.
B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 10

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference prior to the commencement of work.

1.3 SUBMITTALS

A. Product Data: For each of the following
1. Elastomeric sealant.
2. Butyl sealant.

B. Shop Drawings: For sheet metal flashing and trim.
1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counter-flashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304 or Type 316, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

D. Coil-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: **Smooth, flat**
2. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions
3. Color: **As selected by Owner from manufacturer's full range**
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.4 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Attach all material per the FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

F. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Surface Mounted or Slip Counterflashing (1 Piece): Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 24 ga. thick, pre-painted
2. Counter flashing is to extend a minimum of 4” over the top of the flashing, with a minimum lap joint of 4” (notched at corners and joints).
3. Fasten all counter flashing at 12” o.c. if installed over a termination bar. Increase fastening rate to 6” o.c. if slip flashing is used in lieu of a bar.
4. Provide seal at top, per manufacturer’s requirements.

B. Reglet and Removable Counterflashing (2 Piece) : Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. For New : Galvanized Steel: 24 ga. thick, pre-painted, 26 ga. Stainless Steel, .032 Aluminum, or 16 oz Copper
For Reuse at Reglet : Match existing materials for new Removable Counter Flashing
2. Counter flashing is to extend a minimum of 4” over the top of the flashing, with a minimum lap joint of 4” (notched at corners and joints).
3. Fasten all counter flashing at 12” o.c. if installed over a termination bar. Increase fastening rate to 6” o.c. if slip flashing is used in lieu of a bar.
4. Provide seal at top, per manufacturer’s requirements.

C. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 26 Ga. thick
2. Copper, 16oz, mill finish
3. All pitch pans and/or flanges shall be fabricated with rounded corners at the base, fully soldered. Minimum flange is 4”. Follow all other umbrella requirements, per manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners**,** solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   6. Do not field cut sheet metal flashing and trim by torch.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
   1. Space movement joints at maximum of 12 feet with no joints within 24 inches of corner or intersection.
   2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
   3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws or the substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated.
      a. Embed hooked flanges of joint members not less than 1 inch into sealant.
      b. Form joints to completely conceal sealant.
      c. When ambient temperature at time of installation is between 40 and 70 deg F , set joint members for 50 percent movement each way.
      d. Adjust setting proportionately for installation at higher ambient temperatures.
         1) Do not install sealant-type joints at temperatures below 40 deg F .
   2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
   1. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
   2. Do not solder metallic-coated steel and aluminum sheet.
   3. Do not pre-tin zinc-tin alloy-coated copper.
   4. Do not use torches for soldering.
   5. Heat surfaces to receive solder, and flow solder into joint.
      a. Fill joint completely.
      b. Completely remove flux and spatter from exposed surfaces.
   6. Stainless Steel Soldering:
      a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
      b. Promptly remove acid-flux residue from metal after tinning and soldering.
      c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
   7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
H. Rivets: Rivet joints in where necessary for strength.

3.2 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements**,** sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
   1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
   2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
   1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
   2. Extend counterflashing 4 inches over base flashing.
   3. Lap counterflashing joints minimum of 4 inches .
D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with **elastomeric** sealant and clamp flashing to pipes that penetrate roof.

3.3 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.5 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions.
B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Consultant.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof-edge specialties.
2. Fascia Extenders

1.2 SUBMITTALS

A. Product Data: For each type of product and location of proposed use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. SPRI Wind Design Standard: Manufacture and install copings or roof-edge specialties tested according to SPRI ES-1 and capable of resisting the manufacturer's approved design pressures.
B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): **120 deg F, ambient; 180 deg F**, material surfaces.

2.2 ROOF-EDGE SPECIALTIES

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding **12 feet** and a continuous metal receiver with integral drip-edge cleat to engage fascia cover [and secure single-ply roof membrane]. Provide matching corner units.
1. Coil-Coated Steel Sheet Fascia Covers: Pre-Painted Galvanized Steel, 24 ga
a. Surface: Smooth, flat finish.
b. Finish: Two-coat fluoropolymer.
c. Color: Per Owner's selection of standard colors
2. Corners: Factory mitered and continuously welded.
3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
4. Cleat: Galvanized-steel sheet, continuous cleat, install per manufacturer's instructions
5. Fascia Accessories: Fascia extenders with continuous hold-down cleats.
6. Fastening Pattern : Install per manufacturer's instructions.
7. Maximum size is a 7" face. Fascia extender and prefabricated edge metal shall split face dimension evenly if edge condition is over 7".

B. Roof-Edge Fascia Extenders: Two piece, fascia coverings intend to match existing construction. The lengths of the metal fascia should not exceed 12 feet and the joints must be staggered off of the edge metal materials a minimum of 12” or more. Fabricate the fascia metal as shown and per proper SMACNA detail and best practice.
   1. Materials : Materials shall be fabricated from the same materials at the prefabricated edge.
   2. Corners : Mitered
   3. Splice Plates : Match seam construction of the roof edge metal. For concealed or exposed splice plates, minimum 6” wide.
   4. Fastening Pattern : Install per manufacturer’s instructions but not more than 3” on center below edge metal and 6” on center

2.3 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
B. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
   1. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

2.5 FINISHES

A. Coil-Coated Galvanized-Steel Sheet Finishes:
   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
   1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   2. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of **12 feet with no joints within 18 inches** of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws and substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.2 INSTALLATION OF ROOF-EDGE

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof curbs.
2. Pipe / Conduit supports.
3. Roof hatches.

1.2 SUBMITTALS

A. Per Section “013300 Submittal Requirements”

1.3 WARRANTY :

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within 1**0** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
C. Material: Prime Coated, Galvanized Steel
D. Construction:
1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Fabricate curbs to minimum height of **12 inches** above roofing surface unless otherwise indicated.
3. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange

2.2 PIPE or CONDUIT SUPPORTS (Provide where missing)

A. Conduit Supports: Adjustable, Strut-Model supports capable of supporting conduit or pipe line
B. Size: Standard, height to properly support pipe
C. Material: Standard

D. Manufacturers:
1. OMG or approved equal

2.3 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
1. Type and Size: Single-leaf lid
a. Manufacturers : SafePro, Babcock-Davis, Bilco, Dur-Red, or Thycurb
b. Size to match existing opening
2. Loads: Minimum 40-lbf/sq. ft. external live load and 30-lbf/sq. ft. internal uplift load.
a. When release is actuated, lid shall open against 10-lbf/sq. ft. snow or wind load and lock in position.
3. Curb, Framing, and Lid Material: Prime Coated, Galvanized
a. Thickness: Manufacturer's standard thickness for hatch size indicated.
4. Construction:
a. Insulation: 1-inch- thick, cellulosic-fiber board or per manufacturer’s recommendation.
1) R-Value: 2.78 according to ASTM C1363.
b. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
c. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
d. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
e. Fabricate curbs OR RAISE HEIGHT to minimum height of **8 inches** above roofing surface unless otherwise indicated.
f. Roof Railing : Provide a new roof railing at the roof hatch by Roof Hatch Manufacturer
5. Hardware: Manufacturer's standard corrosion resistant; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
B. Wood Nailers: Softwood lumber, PS 20 dimensional, Structural Grade 2 or better, Southern Pine, not less than 1-1/2 inches thick.
C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
D. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

END OF SECTION 077200

SECTION 20 05 00 - MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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 01 Specification Sections.

1.03 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
3. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
4. ABMA - American Boiler Manufacturers Association; www.abma.com.
5. AGA - American Gas Association; www.aga.org.
6. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
7. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
8. ANSI - American National Standards Institute; www.ansi.org.
9. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
10. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
11. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
12. ASTM - ASTM International; www.astm.org.
13. AWS - American Welding Society; www.aws.org.
14. AWWA - American Water Works Association; www.awwa.org.
15. CDA - Copper Development Association; www.copper.org.
16. CGA - Compressed Gas Association; www.cganet.com.
17. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
18. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
19. CSI - Construction Specifications Institute (The); www.csiresources.org.
20. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
21. FM Approvals - FM Approvals LLC; www.fmglobal.com.
22. HI - Hydraulic Institute; www.pumps.org.
23. ICC - International Code Council; www.iccsafe.org.
24. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
25. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
26. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
27. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org
28. NADCA - National Air Duct Cleaners Association; www.nadca.com.
29. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
30. NEBB - National Environmental Balancing Bureau; www.nebb.org.
31. NECA - National Electrical Contractors Association; www.necanet.org.
32. NEMA - National Electrical Manufacturers Association; www.nema.org.
33. NETA - InterNational Electrical Testing Association; www.netaworld.org.
34. NFPA - National Fire Protection Association; www.nfpa.org.
35. NSF - NSF International; www.nsf.org.
36. NSPE - National Society of Professional Engineers; www.nspe.org.
37. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
38. STI - Steel Tank Institute; www.steeltank.com.
39. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
40. UL - Underwriters Laboratories Inc.; www.ul.com.
41. USGBC - U.S. Green Building Council; www.usgbc.org.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 PERFORMANCE REQUIREMENTS

A. Systems Components Pressure and Temperature Ratings: Not less than as required for system pressures and temperatures.

1.05 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 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.

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.

C. Source Limitations: Obtain equipment and other components of the same or similar systems through one source from a single 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: Perform work to avoid interference with the work of other trades. Remove and relocate work which in the opinion of the Owner's Representatives causes interference.

1.06 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.

1.07 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. Provide fittings, valves, and accessories as required to meet actual 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.

1.08 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.

1.09 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.

B. 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 reasonably foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.

1.10 SUBMITTALS

A. Submit project specific submittals for review in compliance with Division 01.

B. All submittals shall be submitted in groupings of similar and/or related items. Incomplete submittal groupings will be returned “Rejected”.

C. 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”.

D. 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.

E. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. Review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action indicated is subject to the requirement of the plans and specifications.

1. 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.
2. Contractor is responsible for:

    a. Dimensions, which shall be confirmed and correlated at the job site.
    b. Fabrication processes and techniques of construction.
    c. Quantities.
    d. Coordination of Contractor’s work with all other trades.

e. Satisfactory performance of Contractor's work.
f. Temporary aspects of the construction process.

F. 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.

1.11 RECORD DRAWINGS

A. Submit record drawings in compliance with Division 01.

B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or vellum 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.

1.12 WARRANTY

A. Warranty: Comply with the requirements in Division 01 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

3.01 MECHANICAL DEMOLITION WORK

A. Demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Include 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. Include draining of piping systems where required for demolition, modification of, or connection to existing systems.

C. 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.

D. 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.

1. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived.
2. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner will move and store these materials.
3. 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.

E. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.

F. Cap ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation.

1. Cap or plug piping with same or compatible piping material.
2. Cap or plug ducts with same or compatible ductwork material.

3.02 REFRIGERANT HANDLING

A. Refrigerant Installation and Disposal: Perform all work related to refrigerant contained in chillers, cooling coils, air conditioners, and similar equipment, including related piping, in strict accordance with the following requirements:

1. ASHRAE Standard 15 and Related Revisions: Safety Code for Mechanical Refrigeration.
2. ASHRAE Standard 34 and Related Revisions: Number Designation and Safety Classification of Refrigerants.
3. United States Environmental Protection Agency (US EPA) requirements of Section 8 08 (Prohibition of Venting and Regulation of CFC) and applicable State and Local regulations of authorities having jurisdiction.

B. Recovered refrigerant is the property of the Contractor. Dispose of refrigerant legally, in accordance with applicable rules and regulations.

3.03 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.

3.04 TEMPORARY SERVICES

A. Provide temporary service as described in Division 01.

B. The existing building will be occupied during construction. Maintain mechanical services and provide necessary temporary connections and their removal at no additional cost to the Owner.

3.05 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.

3.06 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.

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. All Equipment Raised or Relocated as a Result of This Work.

F. For systems requiring seasonal operation, demonstrate system performance within six months when weather conditions are suitable.

END OF SECTION 20 0500

SECTION 20 05 10 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 20 Section “Mechanical General Requirements.”

1.02 SUMMARY

A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheet metal systems and equipment. This section supplements all other Division 20 and 23 Mechanical Sections, and Division 01 Specification Sections.

1.03 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, crawlspaces, and tunnels.

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:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.
5. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
6. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

D. Comply with NSF 372, “Drinking Water System Components – Lead Content” for potable domestic water piping and components.

E. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

F. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

G. 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."

H. Soldering: Qualify processes and operators according to AWS B2.3/2.3M, "Specification for Soldering Procedure and Performance Qualification."

1.06 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. 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.
4. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

A. Coordinate installation of required supporting devices.

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

2.01 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.

2.02 PIPE, TUBE, AND FITTINGS

A. Match existing piping materials – cast iron soil pipe for sanitary waste vents and polypropylene pipe for acid waste vents.

2.03 JOINING MATERIALS

A. Refer to individual Division 21, 22, and 23 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. Unions in galvanized piping system shall be galvanized.
3. Copper tube and pipe: Bronze unions with soldered joints.

C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:

1. Ferrous pipe: Standard weight, forged steel weld neck flanges.
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 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 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, antimony-free, silver-bearing alloys. Include water-flushable flux according to ASTM B 813.

H. Brazing Filler Metals: Alloys meeting AWS A5.8.

1. Use Type BcuP Series, silver-bearing, copper-phosphorus alloys for joining copper or bronze socket fittings with copper pipe. Flux is prohibited unless used with bronze fittings.
2. Use Type Bag Series, cadmium-free silver alloys for joining copper with steel, stainless steel, or other ferrous alloys.

I. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

J. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

K. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

L. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent Cements for Joining ABS Piping: ASTM D 2235.

N. Solvent Cements for Joining PVC to ABS Piping Transition: ASTM D 3138.

2.04 PIPE THREAD COMPOUNDS

A. General: Pipe thread compounds for the fluid service compatible with piping materials provided.

B. Potable Water Service and Similar Applications: Compounds acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.

C. Galvanized Steel: Inorganic zinc-rich coatings or corrosion inhibited proprietary compounds to coat raw carbon steel surfaces, in lieu of subsequent painting. Compounds containing lead are prohibited.

1. Manufacturers:

a. Carboline "Carbo-Zinc 12."
b. Tnemec.
c. Koppers.

D. Natural Gas System: Use either of the following:

1. Tetrafluoroethylene (Teflon) tape 2 to 3 mils thick for threaded joints.

a. Manufacturers:

1) Cadillac Plastic.
2) Permacel.
3) Other approved.

2. Lead-free pipe thread compounds suitable for service.

a. Manufacturers:

1) HCC Holdings, Inc.; Hercules Pro Dope.
2) Mill-Rose Company (The); Clean-Fit Products; Blue Monster Thread Sealant.
3) Oatey; Great Blue Pipe Joint Compound.
4) RectorSeal LLC: A CSW Industrials Company; No. 5, No.5 Special, and No. 5 Sub-Zero Pipe Thread Sealants.

2.05 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:

a. Cascade Waterworks Mfg. Co.
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 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. IPEX Inc. (formerly Eslon Thermoplastics).

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.
e. Can-Tex Industries Division of Harsco Corp. “CT-Adaptors”.
f. Joint Inc., “Caulder”.

2.06 PIPE ROOF PENETRATION ENCLOSURES

A. Manufacturers:

1. Pate Company (The); pca Series.

2. Portals Plus, Inc.
3. Thybar Corporation; Thycurb.

B. Prefabricated roof curb with:

1. Minimum 18 gage welded galvanized steel construction.
2. Integral base plate.
3. Factory installed insect and decay resistant wood nailer.
4. Factory installed 1-1/2 inch thick, 3 pounds per cubic foot density rigid insulation.
5. EPDM compression molded rubber cap for single or multiple pipes as required.
6. Stainless steel draw-band clamps.

PART 3 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 and 23 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. Clean and lubricate elastomer joints prior to assembly.

E. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.

F. Slope piping and arrange systems to drain at low points.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Pipe Roof Penetration Enclosures:

1. Coordinate delivery of roof penetration enclosures to jobsite.
2. Locate and set curbs on roof.
3. Framing, flashing, and attachment to roof structure are specified under Division 07.
4. Attach cap to curbs, cut pipe boots to fit pipe, and clamp boots to pipe or conduit.

J. Verify final equipment locations for roughing-in.

K. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 20 and 23 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. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.

F. 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.

G. 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."

H. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

I. 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.

J. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

1. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.

K. 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.

L. 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. 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.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

M. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

N. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

O. 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.

P. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.

3.03 EQUIPMENT CONNECTIONS

A. Make connections to equipment, fixtures, and other items included in the work in accordance with the manufacturer’s installation instructions the particular equipment.

B. All piping connections to 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.

3.04 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 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 and larger, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

B. 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.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.07 FLASHING

A. Provide all flashing required for mechanical work. Refer to Division 07 Specification Sections.

3.08 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. 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 20 05 10

SECTION 221400 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal roof drains.
2. Clamping rings, ladder clamps, and all other components
3. Miscellaneous storm drainage piping specialties.

B. Related Requirements:
1. Section 076200 "Sheet Metal Flashing and Trim" for penetrations of roofs.

1.2 SUBMITTALS

A. Per Section “013300 Submittal Requirements”

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. RetroFit, General-Purpose Roof Drains **:**
1. Manufacturer : OMG Hercules Retrofit Roof Drains
2. Body Material: Aluminum or Stainless Steel
3. Size : Pipe size to fit snug within the existing pipe, install per manufacturer’s instructions
4. Dome Material: Aluminum or Stainless Steel

B. Replacement, General Purpose Roof Drains :

1. Manufacturer : Jay R Smith, Josam
2. Body Material : Cast Iron
3. Size : Bowl and components to match existing
4. Underdeck Clamp : Provide as required
5. Dome Materials : Cast Iron
6. Components : Provide all components per complete set, per manufacturer’s

C. Components, General Purpose : Include the replacement of all broken cages/strainers, clamping rings, and/or bolts and ladder clamps in the base bid. Bowl and/or plumbing to be replaced by unit price.

2.2 PIPING

A. Replacement : Match existing Construction. All interior plumbing work to be installed by a licensed plumber, using materials per current IPC requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Remove and replace roof drains at existing locations according to roof membrane manufacturer's written installation instructions.
   1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Install expansion joints, if indicated, in roof drain outlets.
   3. Position roof drains for easy access and maintenance.

B. Connect to existing interior piping using preformed rubber gasketed connection. Notify the Owner’s Representative if the existing pipe is damaged or deteriorated prior to connecting the new roof drain.

C. Provide and install underdeck clamps as needed for the stabilization.

3.2 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

C. Install per manufacturer’s instructions and industry best practices

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221400

SECTION 23 3 113 - METAL DUCTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 20 Section "Mechanical General Requirements."

1.02 SUMMARY

A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems.

1.03 DEFINITIONS

A. Low Pressure: Up to and including 2 inch WG and velocities less than 1,500 fpm.

B. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm.

C. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Application Schedule" Article, and shall match existing duct system gauges and materials.

1.05 ACTION SUBMITTALS

A. Shop Drawings: Drawn to 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
2. Seam and joint construction.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 PRODUCTS

2.01 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 G90 coating designation.

C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates:

1. Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
2. Compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods:

1. Galvanized Steel Duct: Galvanized steel, 3/8-inch minimum diameter.

2.02 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. Solvent-Based Joint and Seam Sealant:

1. Manufacturers:

a. Hardcast; Sure-Grip 404.
b. United McGill.

2. Application Method: Brush on.
3. Base: Synthetic rubber resin.
4. Solvent: Toluene and heptane.
5. Solids Content: Minimum 60 percent.
6. Shore A Hardness: Minimum 60.
7. Water resistant.
8. Mold and mildew resistant.
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch thick, full face, one piece vulcanized or dovetailed at joints.

2.03 HANGERS AND SUPPORTS

A. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

B. Trapeze Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

C. 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.

2.04 ROOF MOUNTED DUCT SUPPORTS

A. General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted duct.

B. Support: Assembly of bases, and vertical and horizontal members, for roof installation without membrane penetration.

1. Manufacturer:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Eco Support Products.
c. MIFAB, Inc.; C-Port.
d. MIRO Industries.
e. Pentair Electrical & Fastening Solutions; CADDY.
f. Portable Pipe Hangers.

2. Bases: Two or more plastic, stainless steel, or recycled rubber.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.

2.05 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."
3. Internal Tie Rods: As allowed by 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 and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.06 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. 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.

B. Duct Joints:

1. Ducts up to 20 Inches 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.
3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

PART 3 EXECUTION

3.01 DUCTWORK APPLICATION SCHEDULE

A. Ductwork materials shall math existing.

3.02 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install ducts with fewest possible joints.

C. Install fabricated fittings for changes in directions, size, and shape and for connections.

D. 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, with a minimum of 3 screws in each coupling.

E. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

F. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

G. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

1. Intermediate level.

3.03 DUCT SEALING

A. Seal all duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible". Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer’s instructions.

1. Seal Class: A.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Install roof mounted duct supports in accordance with manufacturer’s instructions. Provide additional membrane layer or walkpads under support bases as required.

3.05 FIELD QUALITY CONTROL

A. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

B. Duct system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 23 31 13

SECTION 23 34 23 - ROOF CURBS AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 20 Section “Mechanical General Requirements.”

1.02 ACTION SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Roof curbs.

1.03 INFORMATIONAL SUBMITTALS

A. 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.

1.04 CLOSEOUT SUBMITTALS

A. Field quality-control test reports.

1.05 QUALITY ASSURANCE

A. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

B. Lift and support units with manufacturer's designated lifting or supporting points.

1.07 COORDINATION

A. Coordinate size, delivery and placement of roof curbs, and equipment supports. Installation of roof curbs, equipment supports, and roof penetrations is specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.01 ROOF CURBS AND ACCESSORIES

A. Roof Curb Extensions and Adapters:

1. Manufacturers: Roof curbs shall be provided by the fan manufacturer, or one of the following:

a. Creative Metals.
b. The Pate Company.
c. Roof Products & Systems.
d. Thybar Corporation.
e. Any of the approved roof mounted exhaust fan manufacturers.

2. Curb Extensions: Constructed of minimum 18 ga. galvanized steel.

a. 4-inch high construction with no damper shelf and no damper access.
b. 8-inch high construction with damper shelf; and removable panel, or access door.
c. 12-inch high construction with damper shelf; and removable panel, or access door (minimum required for motorized damper).

3. Curb Adapters: Constructed of minimum 18 ga. galvanized steel and designed to adapt or reduce curb cap dimensions to match new fans to existing roof curbs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.

3.02 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that units are secure on mountings and supporting devices and that connections to ducts are complete.

END OF SECTION 23 34 23