TEXAS A&M UNIVERSITY-CORPUS CHRISTI
PURCHASING DEPARTMENT
6300 OCEAN DRIVE
CORPUS CHRISTI, TX 78412

CSP Number:
CSP4-0003

Central Plant Improvements – Chaparral Bldg.

Addendum #1

The University has received the following questions from vendors. The corresponding department has provided answers for the questions provided within the allocated time to respond. The questions and answers should be considered incorporated as part of this Competitive Sealed Proposals (CSP). Please see the attached document Attachment A.

This document and attachments shall be attached to and become a part of the contract documents for this project. This addendum shall be signed for acknowledgement that you have received Addendum #1 and shall be returned with your proposal.

COMPANY NAME: _____

STREET ADDRESS: _____

CITY/STATE: _____

TELEPHONE AND FAX: _____

SIGNATURE: _____ **DATE:** _____

Attachment A

NRG ENGINEERING
5656 S. Staples, Suite 312
Corpus Christi, TX 78411
361/852-2727 FX: 361/852-2922
TX Firm Registration No. F-005318

Addendum #001

DATE: **2/15/2024**

Re: **TAMUCC**
Chaparral Building CUP Improvements
223 N. Chaparral
Corpus Christi, TX 78401

Prospective bidders are hereby notified of the following modifications to the contract documents. These modifications shall become a part of the contract documents. All provisions of the contract documents not specifically affected by the Addenda shall remain unchanged.

Item #1: See attached response to Vendor questions.

Item #2: See attached added specification sections:
- 01 41 19 – Windstorm Construction Requirements
- 07 01 50.19 – Preparation For Reroofing
- 07 52 16 – Styrene-Butadiene (SBS) Modified Bituminour Membrane Roofing
- 07 62 00 – Sheet Metal Flashing and Trim
- 07 72 00 – Roof Accessories

Item #3: See updated electrical drawing sheets E7.1 and E7.2.
- Distribution Panel EDP to be provided by the Contractor.
- Contractor shall provide 1200amp feeder breaker in the Main Switchboard MSB to feed distribution panel EDP.
- Main Switchboard is manufactured by Siemens.
- Feeder breaker in EDP that is to feed the generator load center shall be a 100amp breaker.
- See Conduit Schedule for change to feeder P118.

Respectfully,

2/15/2024

2/15/2024

Attachment A

Vendor Questions
CSP4-0003 – Central Plant Improvements-Chaparral Bldg.

1. Can you clarify panel EDP will be supplied by owner?

   RESPONSE: Panel EDP shall be provided by the contractor.

2. Notes 8 and 11 on AD1.00 are called out but no keynote is referenced. Please clarify.

   RESPONSE: Notes 8 & 11 are not applicable to this phase. Remove notes 8 and 11 completely.

3. Can you provide roofing specifications?

   RESPONSE: See attached roofing specification.

4. Can you clarify asbestos monitoring will be contracted by owner?

   RESPONSE: Yes. Asbestos monitoring will be contracted by the owner.

5. Sheet S1-2 shows existing W12x26's. These do not exist. Please clarify.

   RESPONSE: No. The drawings indicate new W12x26's. See sheet S2-1. The mechanical platform does not exist. Contractor is to provide all new steel as indicated on drawings. The only items that exist are the plinths that extend beyond the roof.

6. Can you provide cut sheets on all owner supplied equipment?

   RESPONSE: Yes. Equipment cut sheets will be supplied after the award of the contract.

7. With phase one and this project running simultaneously, clarify Barcom Construction will be named as additional insured to the insurance policy of the awarded contractor.

   RESPONSE: Yes. The awarded contractor shall name Barcom Construction as an additionally insured for this contract.

8. We are assuming that the owner supplied equipment and material will be delivered as needed to the jobsite. Please clarify we can coordinate with the owner on delivery dates for GC to offload and install equipment on the same day as deliveries.

   RESPONSE: Yes. Delivery dates of equipment that are being furnished by the owner will be coordinated with everyone to ensure same day offloading and installation.

9. Please clarify all hauling and storage of owner supplied equipment will be coordinated and paid for by owner.

   RESPONSE: It is anticipated that the owner supplied equipment will be placed or stored at the job site. The contractor shall be responsible for properly disposing of any waste and packing materials.

SECTION 01 41 19
WINDSTORM CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provision of the contract, including general and supplementary conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. All components and cladding must meet or exceed the wind load requirements as specified in this section.

B. Exterior wall and roof openings shall be protected with impact resistant covers or designed to meet impact resistance requirements.

C. Exterior mechanical and electrical equipment shall be secured against indicated windstorm loads.

D. Owner shall pay for Texas Department of Insurance Inspection services for Windstorm Certification on the exterior components and the structure. The Contractor is responsible for all other costs related to Windstorm Certification.

E. The Contractor shall be responsible for coordinating and scheduling the site inspections of the Owner's Windstorm Engineer.

1.3 DEFINITIONS

A. Components and Cladding: Elements assembled to form the exterior wall and roof systems that are either directly loaded by the wind or receive wind loads originating at relatively close locations, and that transfer those loads to the main wind force resisting system. Examples: Curtain walls, exterior glass windows and panels, roof sheathing, studs, soffits, etc.

B. Exterior Wall and Roof Openings: Openings that are likely to be breached during high winds. Examples: skylights, smoke vents, HVAC equipment, windows, doors, roof hatches, louvers, etc.

1.4 DESIGN REQUIREMENTS

A. Wind loads shall be determined from the pressures developed by a 120 mph wind velocity (ASD) (3-second gust) and an equivalent 155 mph wind velocity (LRFD), Exposure D, Risk Category III, and appropriate shape factor from the American Society of Civil Engineers (ASCE) 7-10 "Minimum Design Loads for Buildings and Other Structures."

B. Impact resistance shall be as determined by the Texas Windstorm Code.

1. Impact Cyclic Wind Pressure Criteria. Impact protective systems and exterior opening products must be tested for windborne debris resistance under ASTM E 1886 and ASTM E 1996 or other windborne debris standards or procedures that are recognized by the Texas Department of Insurance. The missile criteria must be as follows:
   a. Products located within 30 feet of grade must be tested to resist large, and if required small missile. If ASTM E 1996 is the test standard used, then missile level D from Table 2, Applicable Missiles, must be used.
   b. Products located above 30 feet of grade must be tested to resist a small missile. If ASTM E 1996 is the test standard used, then missile level D from Table 2, Applicable Missiles, must be used.
2. Impact Protective Systems. Impact protective systems must be installed under the manufacturer's installation instructions and in the manner in which they were tested for uniform static wind pressure resistance and for windborne debris resistance.
3. Exterior Opening Products.
   a. If the exterior opening products are not protected from windborne debris by an impact protective system, then they must be manufactured to resist windborne debris under Section 1.4.B.1.
   b. Exterior opening products must be installed under the manufacturer's installation instructions and under the manner in which they were tested for uniform static wind pressure resistance and for windborne debris resistance.

1.5 SUBMITTALS

A. All components and cladding listed in the Texas Windstorm Approved Materials catalog shall have the appropriate product evaluation number indicated on the submittal.

B. Components and cladding not listed will require certification that they meet or exceed the design requirements of this section by the manufacturer.

C. Installation instructions indicating fasteners, minimum attachment requirements, and other necessary pertinent information for installation shall be submitted.

D. Forms: The following Texas Department of Insurance may be found on the TWIA website:
   1. TWIA Insurability Requirements.
   2. WPI-1 Application for Certificate of Compliance.
   3. WPI-2-BC-7 Inspection Verification.

1.6 QUALITY ASSURANCE

A. Notify the Architect not less than 72 hours in advance of a requested windstorm inspection. The Contractor shall provide, and have available at the job site, all necessary installation instructions during construction. It is incumbent upon the Contractor to have the project superintendent and knowledgeable representatives of the trades/craftwork being inspected in attendance with documentation to illustrate compliance of installation to TDI requirements.

B. Prior to covering or concealing the fasteners or connectors, the contractor shall notify the architect/engineer in time to allow visual structural inspections by the Architect/Engineer for the multiple inspections required for Windstorm Certification by the Architect/Engineer. DO NOT COVER UP FASTENERS WITHOUT HAVING THEM REVIEWED AND APPROVED BY THE WINDSTORM ENGINEER.

C. The Contractor shall furnish, upon completion, written confirmation that the installation and materials used for all components and cladding is in conformance with requirements of this section to the Windstorm Engineer.

D. Re-inspection: The Windstorm Engineer will re-inspect the Work upon receipt of notice that the inspection list items from earlier inspections have been completed.
   1. Upon completion of windstorm re-inspection, the Windstorm Engineer will notify the Contractor that the work being inspected complies with windstorm requirements. If the Work is incomplete, the Windstorm Engineer will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, re-inspection will be repeated one time for a total of three (3) inspections of the work in question. Additional re-inspections required due to Contractor's failure to complete the list of incomplete windstorm items will be billed to the Contractor at the Windstorm Engineer's customary billing rates for the personnel involved.

PART 2 - Products (Not Applicable)

PART 3 - Execution (Not Applicable)

END OF SECTION 01 41 19

SECTION 07 01 50.19
PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes preparation work for roof replacement at Gymnasium Building:
   1. Full tear-off of existing roof system to the structural concrete deck.
   2. Preparation of MEP curbs to accommodate new roof system.
   3. Re-cover preparation.
   4. Structural concrete preparation, as needed/required by roof system manufacturer to receive a fully adhered roof system.
   5. Removal of flashings and counter-flashings, trim, gutters and downspouts.

1.2 PREINSTALLATION MEETINGS

A. Roof Replacement Conference: Conduct conference at Project site to comply with requirements in Division 01 General Requirements. Review methods and procedures related to roofing system tear-off and replacement including, but not limited to, the following:
   1. Meet with General Contractor, Owner’s Representative; Architect; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects roof replacement including installers of roof accessories and roof-mounted equipment.
   2. Methods and procedures related to roof replacement preparation, including membrane roofing system manufacturer's written instructions.
   3. Temporary protection requirements for existing roofing system that is to remain, during and after installation.
   4. Roof drainage during each stage of roof replacement and roof drain plugging and plug removal requirements.
   5. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   6. Existing deck removal procedures and Owner notifications.
   7. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
   8. Structural loading limitations of deck during roof replacement.
   9. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect roof replacement.
   10. HVAC shutdown and sealing of air intakes.
   11. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
   12. Asbestos removal and discovery of asbestos-containing materials.
   13. Governing regulations and requirements for insurance and certificates if applicable.
   14. Existing conditions that may require notification of Architect before proceeding.

1.3 INFORMATIONAL SUBMITTALS

A. Product List: Submit list of proposed Products and manufacturers, including all items specified in Part 2 – Products or otherwise required by the Work.

B. Product Data: For each type of product indicated or required to perform the Work.
   1. Provide data for each required product indicating characteristics, performance criteria, mixing and preparation requirements, limitations, and Material Safety Data Sheets (MSDS).

C. Demolition and Removal Procedures and Schedule: Outline all work tasks and schedule them, showing clearly when each area is to be performed. Coordinate with Owner and other contractors to avoid impact to other work Owner's occupancy.

D. Temporary Roofing (if needed): Submit Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of temporary membrane, and that its inclusion will not adversely affect the roofing system's resistance to fire and wind or its FM Global rating.

E. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.
   1. Submit before Work begins.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Approved by warrantor of existing roofing system to work on existing roofing.

1.5 FIELD CONDITIONS

A. Existing Roofing System: Multi-ply modified bitumen roof system over unknown insulation directly adhered to the structural concrete deck.

B. The Owner will occupy portions of building immediately below reroofing area. This includes equipment and finishes that must be protected at all times.
   1. Conduct reroofing so Owner's operations are not disrupted.
   2. Provide Owner with not less than three (3) days' written notice of activities that may affect Owner's operations. This includes temporary interruption of electrical service or other utilities.
   3. Coordinate work activities daily with Owner so Owner has adequate advance notice to 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.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

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 the Owner as far as practical.

F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to 150 lbs. for rooftop equipment wheel loads and 15 PSF for uniformly distributed loads.

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.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void any existing roofing system warranty still active.

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 new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Deck Repair:
   1. Immediately notify Architect if any cracks are found in structural concrete deck.

B. Curbs and Support Members: Raise all wood, concrete or metal curbs and support items as indicated and required to accommodate new roof system and insulation, while maintaining a minimum flashing height of 8-inches.

C. Miscellaneous Metals: Conform to existing products and installations.

D. Plumbing and Mechanical Piping: Match existing where practical and conform to products and execution specified in Division 22 - Plumbing.

E. Mechanical Equipment: Match existing where practical and conform to products and execution specified in Division 23 Section - HVAC.

F. Electrical Fixtures and Equipment: Match existing where practical and conform to products and execution specified in Division 26 Section - Electrical.

G. Seal or isolate windows or HVAC air intakes that may be exposed to airborne substances created in removal of existing materials.

H. Shut off rooftop utilities and service piping before beginning the Work.

I. Test existing roof drains to verify that they are not blocked or restricted.
   1. Immediately notify the Architect of any blockages or restrictions.

J. 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.

K. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

L. 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/General Contractor each day of extent of roof tear-off proposed for that day.

B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.

C. Full Roof Tear-off: Remove existing roofing and other roofing system components down to the existing structural concrete deck.
   1. Remove substrate board vapor retarder roof insulation and cover board.
   2. Remove base flashings and counter flashings.
   3. Remove perimeter edge flashing and gravel stops.
   4. Remove copings.
   5. Remove expansion-joint covers.
   6. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
   7. Remove wood blocking, curbs, and nailers.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
   1. Do not proceed with installation until directed by Architect.

3.4 BASE FLASHING REMOVAL

A. Remove existing base flashings.
   1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

END OF SECTION 07 01 50.19

SECTION 07 52 16
STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUR MEMBRAME ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
2. Qualifications, Standards and Materials for new roof assembly.
3. Reinforced PMMA Flashing System.
4. Roof insulation
5. Traffic pads / Walkways

1.2 PREINSTALLATION MEETINGS

A. Roof Replacement Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system tear-off and replacement including, but not limited to, the following:
1. Meet with Owner's Representative; Architect; testing and inspecting agency representative; roof system manufacturer's representative; deck Installer; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects roof replacement including installers of roof accessories and roof-mounted equipment.
2. Methods and procedures related to roof replacement preparation, including membrane roofing system manufacturer's written instructions.
3. Temporary protection requirements for existing roofing system that is to remain, during and after installation.
4. Roof drainage during each stage of roof replacement and roof drain plugging and plug removal requirements.
5. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
6. Existing deck removal procedures and Owner notifications.
7. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
8. Structural loading limitations of deck during roof replacement.
9. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect roof replacement.
10. HVAC shutdown and sealing of air intakes.
11. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
12. Asbestos removal and discovery of asbestos-containing materials.
13. Governing regulations and requirements for insurance and certificates if applicable.
14. Existing conditions that may require notification of Architect before proceeding.

1.3 ACTION SUBMITTALS

A. Product List: Submit list of proposed Products and manufacturers, including all items specified in Part 2 – Products or otherwise required by the Work.

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

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work, including the following:
   1. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
   2. Layout and thickness of insulation.
   3. Base flashings and membrane terminations.
   4. Flashing details at penetrations.
   5. Tapered insulation, including slopes.
   6. Crickets, saddles, and tapered edge strips, including slopes.
   7. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
   8. Tie-in with adjoining air barrier.

D. Samples for Verification: For the following products:
   1. Sheet roofing materials, including roofing membrane sheet, flashing backer sheet, membrane cap sheet, and flashing sheet, of color specified.
   2. Roof insulation.
   3. Walkway pads or rolls.
   4. Six insulation fasteners of each type, length, and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer to certify and document items in Article on Quality Assurance.

B. Manufacturer's Certification: Provide current letter(s) on membrane manufacturer's letterhead, signed by an authorized employee or corporate officer attesting to following:
   1. Products: Certify that roofing system complies with requirements specified in "Performance Requirements" Article. Submit evidence of meeting performance requirements, including that:
      a. Fastener patterns prescribed by manufacturer in Submittal will resist specified uplift pressures, including Safety Factor (times two), calculated according to ASCE/SEI 7.
      b. Roofing system components are physically and chemically compatible for installation as designed, and;
      c. All proposed materials, including those by other manufacturer, are acceptable to membrane manufacturer for use in system, and;
      d. Proposed system meets all criteria for issuance of required manufacturer's warranty.
      e. Specifically identify and define any deviations.
   2. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
   3. The use of products from various manufacturers must be approved by the Primary Manufacturer of the roof system. Contractor must provide a Systems Letter where Primary Manufacturer declares that all products are compatible, and the roof system is eligible to receive a 20-year NDL Warranty. For example, in the case of the reinforced PMMA flashings, if a Manufacturer does not have a PMMA material among their product offerings, they must provide a system letter stating that the

use of PMMA from another Manufacturer is compatible with their roof system and approving its use with their products with no effect on the 20-year NDL system warranty that is being provided by roof system manufacturer. Or, else, a substitution can be submitted, for review (following the substitution approval process outlined in the project manual.

4. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Research reports.

E. Field Test Reports:
   1. Concrete internal relative humidity test reports.
   2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

F. Field quality-control reports.

G. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

C. Maintenance Data: For roofing system to include in maintenance manuals.

D. Project Record Documents: Accurately record exact location of all roof membrane penetrations.

E. Warranties: Sample of special warranties.

F. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes membrane roofing, base flashings, PMMA flashings, membrane roofing accessories, roof insulation, fasteners, cover boards, walkway products, roofing accessories, and other components of membrane roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Installer's Warranty: Roofing Installer's warranty, on warranty form in Division 01 "Applicator Warranty", signed by Installer, covering Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

1.7 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.
   1. Minimum three projects of comparable size, using specified system, installed in the State of Texas within that five-year period.

B. Installer Qualifications: A qualified firm that has been continuously approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product for minimum of three years prior to Bid Date, and that is eligible to receive manufacturer's warranty; with minimum five years documented experience, including:
   1. Minimum three projects of comparable size and specified systems during that time.
   2. Personnel trained and certified by local authority having jurisdiction for all torch applications.

C. Workers: All roofers and laborers to be direct employees of Primary Contractor.
   1. Project Manager and Superintendent: Minimum five years roofing experience and employed by Contractor for a minimum one year prior to Bid Date.
   2. Non-working Supervisor: Able to communicate effectively with School staff and Applicator's workers and employed by Contractor for a minimum one year prior to Bid Date.
   3. Tradesmen: Minimum 50-percent of installation crew to have been employed by Contractor for a minimum six months prior to Bid Date.

D. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

F. Perform Work in accordance with NRCA Manual of Roof Maintenance and Roof Repair, NRCA Roofing and Waterproofing Manual, and manufacturer's instructions.

G. Maintain one copy of each document accessible to site.

H. Install all roofing materials using personnel directly employed by Applicator (Roofing Contractor) with NDL certification from roofing material manufacturer - no Sub-Contracting permitted.

I. Assign a qualified, full time, non-working supervisor to be on Project site at all times during installation of Work.

J. Designate a responsible Project Manager or Superintendent to inspect all installed Work, particularly tie-ins and temporary flashings, at end of each working day and as otherwise required to ensure water-tightness.
   1. Verify Inspection by signature on approved Daily Inspection Form signifying installation is in accordance with specified requirements.

K. Maintain and operate all equipment in accordance with equipment manufacturer's instructions.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable local codes for roof assembly fire hazard requirements and application procedures.

B. Provide certification of inspection confirming approval of design and installation by authority having jurisdiction.

C. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

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/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

C. Wind Uplift Resistance: Provide installed membrane roofing and base flashings that withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

D. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7-05 and ASCE 7-16 with a safety factor of 2.0.:
   1. Refer to the design uplift pressures indicated on Structural Notes as calculated in accordance with ASCE 7.

E. Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements as part of a tested membrane roofing system, for Type I

or noncombustible construction, as applicable. Identify materials with Approvals markings.
1. Fire Classification: Class A.

F. Energy Performance: Provide roofing system that meet or exceed any of the following options for Reflectance and Emittance (in accordance with Table C402.3 of the 2015 ICC IEC):
1. Three-year aged solar reflectance of 0.55 and three-year aged thermal emittance of 0.75.
2. Three-year aged solar reflectance index of 64.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Siplast, Inc.
2. Polyglass
3. Johns Manville
4. Soprema

2.3 ROOF SYSTEM

A. Roofing Membrane Sheet (Base Ply): ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) or ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.
1. Basis of Design for application by torch to cover board: Paradiene 20 TS F, by Siplast, Inc.
2. Basis of Design for application by self-adhesion: Paradiene 20 SA, by Siplast, Inc.
3. Basis of Design for application by torch to mechanically fastened Base sheet: Paradiene 20 TS, by Siplast, Inc. (not used in this project).

B. Granule-Surface Roofing Membrane Sheet (Cap Sheet): ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) or ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granular surfaced; suitable for application method specified, and as follows:
1. Basis of Design for application by torch: Paradiene 30 FR TG BW, by Siplast, Inc.
2. Granule Color: To Meet the Specified Emittance and Reflectance Requirements in section 2.1, F (above).

2.4 BASE SHEET

A. SBS-Modified Bitumen Fiberglass Mat Base: ASTM D6163/D6163M, Type II, Grade S, SBS-modified asphalt sheet, reinforced with fiberglass fabric, smooth surfaced, suitable for torch application method.

2.5 BASE FLASHING SHEET

A. Backer Sheet: ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) or ASTM D 6164, Grade S, Type I or II, SBS-modified

asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

1. Basis of Design for application by torch: Paradiene 20 TG, by Siplast, Inc.

B. Granular Surfaced Flashing Sheet: ASTM D 6162, Grade G, Type II, SBS-modified asphalt sheet (reinforced with polyester fabric); or ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) granular Surfaced; suitable for application method specified; suitable for application method specified, and as follows:
   1. Basis of design for application by torch: Parafor 30 TG BW or Paradiene 40 FR TG BW, by Siplast, Inc.
   2. Granule Color: To Meet the Specified Emittance and Reflectance Requirements in section 2.1, F (above).

2.6 REINFORCED PMMA FLASHING MATERIALS

A. PMMA Vertical Grade Primer: Fast-curing PMMA-based primer for use in vertical applications over concrete, concrete repair materials, masonry, wood and plywood substrates. PMMA Primer:

B. PMMA horizontal Grade Primer: Fast-curing PMMA-based primer for use over horizontal substrates.

C. Primer for Asphaltic Substrates: PMMA-based primer for use over asphaltic materials to serve as a bleed-blocker.

D. Reinforced PMMA Membrane/Flashing System Components:
   1. Catalyst: A peroxide-based reactive agent used to induce curing of acrylic resins.
   2. Resin for Flashing Applications: A flexible, polymethylmethacrylate (PMMA) based resin combined with a thixotropic agent for use in combination with fleece fabric to form a monolithic, reinforced flashing membrane.
   3. Resin for Field Membrane Construction: A flexible, polymethylmethacrylate (PMMA) based resin for use in combination with fleece fabric to form a monolithic, reinforced roofing membrane.
   4. Fleece for Membrane and Flashing Reinforcement: A non-woven, 110 g/m², needle-punched polyester fabric reinforcement as supplied by the membrane system manufacturer.
   5. Color Finish Resin: A pigmented, polymethylmethacrylate (PMMA) based resin for use as a wearing coat over the field of the finished roof membrane and to provide a desired color finish.
   6. Clear Finish Resin: A clear, flexible, polymethylmethacrylate (PMMA) based resin for use as a wearing coat over colored quartz.
   7. Thixotropic Agent: A liquid additive used to increase the viscosity of the PMMA-based resin products, allowing the resins to be applied over vertical or sloped substrates.
   8. Ceramic Granules: No. 11 grade specification ceramic granules suitable for broadcast into the PMMA based wearing layer, to meet the Specified Emittance and Reflectance Requirements in section 2.1, F (above).

2.7 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. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen; non-hardening, non-migrating, non-skinning, and nondrying.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG Approvals 4470; designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
   1. Mechanical Fasteners for Base Sheet:
      a. Lightweight Concrete Deck: CR Base Sheet Fastener, manufactured by Olympic.
      b. Secondary Disks for All Fasteners: Sized to meet requirements to resist wind up-lift pressures specified in Part 1 “Performance Requirements” of this Section.
   2. Mechanical Fasteners for Flexible Flashing:
      a. Masonry: Specially heat treated, stress relieved, 1-1/4-inch length; Masonry Nail, manufactured by Simplex Nails, Inc.
      b. Wood Blocking: Stainless steel (for fastening into ACQ treated lumber) or high carbon, zinc coated steel (for fastening into non- ACQ treated lumber); annular threaded 1-inch shank nails; with minimum 1-inch x 30 gage metal disk; Roofing Nail, manufactured by Simplex Nails, Inc.
      c. Concrete: Power actuated fasteners, suitable for application.
   3. Mechanical Fasteners for Metal Fabrications (Support Framing): Appropriate for purpose intended, size as required to suit application and achieve positive anchorage to substrate material.
   4. Roofing Nails: Stainless steel (for fastening into ACQ treated lumber), hot-dipped galvanized or non-ferrous type (for fastening into non- ACQ treated lumber); with annular rings, size as required to suit application; minimum 11-gage with 3/8-inch diameter head.

E. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

F. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.

G. Metallic Coating (for Metal Clad Flexible Flashing): Elastomeric, coating with metallic pigments, fibers, mineral fillers, and solvents as supplied or recommended by membrane manufacturer; color to match flexible flashing.

H. Termination Bar: Hot-dipped galvanized steel; 1/8-inch x 1-inch bar stock, pre-drilled holes.

I. Vents (if required): Johns Manville FP-10 one-way breather vents or approved equal.

J. Expansion Joint Filler:
   1. Flexible Vapor Retarder: Minimum 60 mil thick vinyl sheet or approved equal.
   2. Compressible Insulation: Fiberglass batt insulation or approved equal.

K. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

L. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

M. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel bars, approximately 1 by 1/8 inch thick; with anchors.

N. Cold-Applied Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, as tested/recommended by roof system manufacturer.

O. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer’s standard solvent-and asbestos-free, cold-applied adhesive, as tested/recommended by roof system manufacturer.

P. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

2.8 COVER BOARD

A. Cover Board Manufactured according to ASTM C1325, Class A, UL790 (fire resistance for unlimited slope); ASTM E84; ASTM D3273 (mold resistant)
   1. Basis of design: USG Corporation, Securock® Cement Roof Board,
   2. Thickness: 1/2-inch
   3. Board Size: 4'x8'.

2.9 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class I, Grade 2 (20 psi), felt or glass-fiber mat facer on both major surfaces.
   1. Maximum Board Size: 48 x 48-inch
   2. Minimum Board Thickness: 1-inch.

C. Tapered Insulation: Provide factory-tapered rigid polyisocyanurate insulation boards with the same characteristics as above; fabricated to slope of 1/8-inch per 12 inches unless otherwise indicated.

1. Cricket and Saddle Taper:1/8, 1/4 or 1/2-inch per foot as required by the edge condition.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated or required for sloping to drain. Fabricate to slopes indicated.

2.10 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer; Roofgrip with Climaseal™ coating, manufactured by Buildex.
1. Length: As required for thickness of material to penetrate substrate 1/2-inch minimum.
2. Top Plate: Plastic or metal washer/disc type, sized to meet requirements to resist wind up-lift pressures specified in Part 1 “Performance Requirements” of this Section.

C. Bead-Applied Insulation Adhesive: Insulation manufacturers recommended bead-applied, low-rise, one-component or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

E. Insulation Cant Strips: ASTM C 728, perlite insulation board.

F. Tapered Edge Strips: ASTM C 728, perlite insulation board.

G. Wood Nailer Strips: Comply with requirements in "Rough Carpentry” Section.

2.11 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D41/D41M.

2.12 WALKWAYS

A. Walkway Pads: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer,
1. Pad Size: 12 x 24-inches.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
   1. Inspect for damage. Remove from site and replace any damaged materials.
   2. Store products in weather protected environment, clear of ground and moisture.
   3. Stand and store roll materials on end.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
   1. Do not store more materials on roof than can be installed within two days, unless specifically approved otherwise.
   2. Maximum Allowable Loading on Roof: 20 pounds per square foot.

3.2 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
   1. Do not apply roofing membrane during inclement weather.
   2. Do not apply roofing membrane to damp or frozen deck surface.
   3. Observe wind chill and other cold weather conditions for proper bituminous application.

3.3 COORDINATION

A. Coordinate work under provisions of Division 01 Section “Administration Requirements.”

B. Coordinate with demolition work and with work of other trades to ensure sufficient materials and manpower are available to completely replace and make watertight all roofing removed each day.

C. Limit tear off of existing roof system and application of new base sheet (if required), including insulation, to amount that can be completely covered with new roof system by end of day.

D. Coordinate installation of associated metal flashings, and roof-related items as work of this Section proceeds. Strip-in all flanged metal components to roof membrane with hot bitumen on same day they are installed.

E. Schedule work to avoid storage on and traffic over finished work.

F. Schedule installation of membrane cap sheet to minimize buck-water laps and within membrane manufacturer's recommended exposure time limit.

3.4 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

B. Verify that surfaces and site conditions are ready to receive work and that deck is supported and secured.

C. Verify the deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains or eaves.

D. Verify that deck surfaces are dry and free of snow or ice. Verify flutes of metal deck are clean and dry. Confirm deck dryness by moisture meter; maximum allowable: 12-percent.

E. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through the roof are solidly set and wood nailing strips are in place.

F. Beginning of installation means installer accepts existing surfaces.

3.5 INSTALLATION OF ROOFING, GENERAL

A. Protect all building surfaces against damage from roofing work.

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions and maintain free from all deleterious material during roofing operations. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

D. Repair or replace damaged or deteriorated deck in accordance with Division 07 Section "Roof Replacement Preparation".

E. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
   1. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

G. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified in corresponding “Air-Barrier” Section(s).

H. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.6 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Comply with roofing system manufacturer's written instructions for installing roof insulation.

D. Installation over metal decks:
   1. Mechanically fasten base layer of insulation to substrate according to roofing system manufacturer's written instructions.
      a. Fasten base layer of insulation with fasteners and plates in fastening patterns to resist uplift pressures at corners, perimeter, and field of roof.
   2. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.
   3. Install tapered insulation under area of roofing to conform to slopes indicated.
   4. Lay tapered boards for a distance of 24-inches back from roof drains for positive drainage.
   5. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4-inch with insulation.
      a. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.
   6. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7-inches or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6-inches in each direction.
   7. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   8. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
   9. Apply no more insulation than can be sealed with membrane in same day.
   10. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
      a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

11. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type if required by manufacturer or set each layer of insulation in a bead-applied insulation adhesive:
    a. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof specified in Part 1 “Performance Requirements” of this Section.
    b. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
12. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6-inchesin each direction from joints of insulation below. Loosely butt cover boards together. Tape joints if required by roofing system manufacturer.
    a. Set cover boards in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover boards in place.
    b. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

E. Installation Over Concrete Decks:

1. Install base sheet as per manufacturer’s installation instructions. Clean/prime concrete surface as necessary.
2. Install base layer of insulation with joints staggered not less than 24 inches (600 mm) in adjacent rows.
    a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
    c. 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 (600 mm).
        1) Trim insulation, so that water flow is unrestricted.
    d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
    e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
    f. Adhere base layer of insulation to temporary roof as per roofing manufacturer’s tested system. Generally:
        1) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
        2) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
3. Install upper layers of flat insulation and/or tapered insulation, with joints of each layer offset not less than 12 inches (300 mm) from previous layer of insulation.
    a. Staggered end joints within each layer not less than 24 inches (600 mm) in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inches (300 mm) 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 (6 mm) 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 (600 mm).
   1) Trim insulation, so that water flow is unrestricted.
f. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
g. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
h. Adhere each layer of insulation to substrate using adhesive according to roof system manufacturer's tested system assembly.
   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.

3.7 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
   1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   2. At internal roof drains, conform to slope of drain sump.
      a. Trim cover board, so that water flow is unrestricted.
   3. Cut and fit cover board tight to nailers, projections, and penetrations.
   4. Adhere cover board to substrate using adhesive according to manufacturer's tested system (Re.: Roof Systems Letter), as follows:
      a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      b. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.8 INSTALLATION OF ROOFING MEMBRANE, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
   1. Substrate Type: cementitious cover board (Securock)
   2. Adhering Method: T (torched).
   3. Number of SBS-Modified Asphalt Sheets: Two.
   4. Surfacing Type: M (mineral-granule-surfaced cap sheet).

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Do not torch roof membrane directly to polyisocyanurate insulation (if present).

D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

E. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.9 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
   1. Torch applied to substrate.
      a. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
   1. Repair tears and voids in laps and lapped seams not completely sealed.
   2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing membrane sheets so side and end laps shed water.

D. Apply plys smooth, free from air pockets, wrinkles, fishmouths, lap joints, or tears. Do not lay any plys that buck water.

E. Extend membrane sheet up cant strips and a minimum of 2 inches onto vertical surfaces. Torch additional ply of sheet products as recommended to act as base flashing over roofing membrane. Secure to nailing strips at 4 inches o.c.

F. Install two glass fiber ply sheets and bitumen glaze coat for cut-off at end of day's operation. Remove cut-off before resuming roofing.

G. Torch and seal two additional layers of glass fiber ply sheet around roof penetrations.

H. Prohibit foot and cart traffic from newly applied felts. Do not "walk-in" plies.

3.10 INSTALLATION OF FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   2. Backer Sheet Application: Adhere backer sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
   3. Backer Sheet Application: Torch apply flashing sheet to substrate.
   4. Maximum flashing base and top ply width: Width of roll (39-inches)

B. Extend base flashing up walls or parapets a minimum of 8-inchesabove roofing membrane and 4-inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing at 4 inches on center.
   1. Maximum Fastener Spacing:
      a. Wood: 4-inches on center.
      b. Masonry or Concrete: Provide termination bars and fasten 8-inches on center.
   2. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Inspect flashing seams and repair unsealed locations, voids, and fishmouths with three course seal or as recommended by membrane manufacturer.

E. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

F. Coordinate installation of roof scuppers, sumps, and related flashings.

G. Apply metallic coating over all bitumen overruns on flashing surface.

H. Seal flashings and flanges of items penetrating membrane with calk.

I. Roof Drains: Set 30-by-30-inch- (760-by-760-mm-) Insert dimensions 4-pound (1.8 kg) lead flashing in bed of asphaltic adhesive on completed roofing membrane.
   1. Cover lead flashing with roofing cap-sheet stripping and extend a minimum of 4 inches (100 mm) 6 inches (150 mm) beyond edge of metal flashing onto field of roofing membrane.
   2. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
   3. Install stripping according to roofing system manufacturer's written instructions.
   4. Install 72”x72” square PMMA flashing “target” over each roof drain.

3.11 PMMA FLASHING INSTALLATION

A. Install PMMA Flashing system according to manufacturer's recommendations.
   1. Extend liquid flashing not less than 3 inches (76 mm) in all directions from edges of item being flashed.

3.12 INSTALLATION OF WALKWAYS

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.
   1. Install walkways at the following locations:
      a. Perimeter of each rooftop unit.
      b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
      c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 3-inch (76-mm) clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. Walkway Cap Sheet Strips: Install walkway cap sheet strips over roofing membrane, using same application method as used for roofing cap sheet.

1. Install walkways strips at the following locations:
   a. Perimeter of each rooftop unit.
   b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
   c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   d. Top and bottom of each roof access ladder.
   e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
   f. Locations indicated on Drawings.
   g. As required by roof membrane manufacturer’s warranty requirements.
2. Provide 3-inch (76 mm) clearance between adjoining strips.

3.13 TORCH APPLICATION SAFETY REQUIREMENTS

A. Maintain a fire watch during all torching applications and for a minimum of 2-hours after torch work is completed for day.

B. Maintain a minimum two (2) fire extinguishers of class and capacity required by local authority having jurisdiction, but not less than 20-pound capacity. Keep fire extinguishers within 25-feet of all torch activity. Provide multiple extinguishers if torching in more than one area.

C. Provide training on proper use of fire extinguishers to all personnel used on project.

D. Turn torches off when not actively in use. Do not place active or hot torches on any combustible materials or surfaces.

E. Remove torches and fuel sources from site at end of each day and when superintendent is not on premises.

F. Secure fuel sources on roof surface to prevent tipping or falling.

3.14 FIELD QUALITY CONTROL

A. Do not perform demolition during roofing operations.

B. Testing Agency: Owner will engage qualified testing and/or inspecting agency to perform tests and inspections and to prepare test reports.

C. Test Cuts: Test specimens may be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
   1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
   2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
   3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

D. Field inspection and testing will be performed under provisions of Division 01 Section “Quality Requirements”.

E. Upon substantial completion, Owner may have Work inspected using infrared scanning and other appropriate means to establish conditions of completed Project.

F. Correct identified defects or irregularities. Cut out and repair membrane defects before end of each day.

G. Do not perform demolition during roofing operations.

H. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect and Owner 72 hours in advance of date and time of inspection.

I. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

J. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Perform additional testing and inspecting, at Contractor's expense, to determine if replaced or additional work complies with specified requirements.

3.15 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Division 01 Section “Quality Requirements.”

B. Request site attendance of roofing materials manufacturers during installation of the work on bi monthly schedule.

C. Post Construction Inspection: Contractor and manufacturer’s representative to inspect roofing installation 23 months after Substantial Completion and prior to expiration of Contractor’s Warranty.

3.16 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.
   1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 52 16

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Formed Products:
      a. Formed roof drainage sheet metal fabrications.
      b. Formed low-slope roof sheet metal fabrications.
      c. Formed equipment support flashing.
      d. Formed expansion-joint cover flashings.
      e. Miscellaneous sheet metal accessories.
      f. Precast concrete splash blocks.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Division 07 Section “Roof Replacement Preparation” for removal procedures for existing materials.
   3. Division 07 Section Styrene-Butadiene-Styrene (SBS) Modified Bituminous Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
   4. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. A 240 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   3. A 653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
   4. A 666 - Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
   5. A 755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   6. A 792 - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   7. B 32B - Solder Metal.
   8. B 749 - Lead and Lead Alloy Strip, Sheet, and Plate Products.
   9. C 920 -Elastomeric Joint Sealants.
   10. C 1311B - Solvent Release Sealants.
   11. D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   12. D 1187 - Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

13. D 4397 - Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
14. D 4586 - Asphalt Roof Cement, Asbestos-Free.
15. D 4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

B. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.

C. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA): Architectural Sheet Metal Manual.

D. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual for Architectural and Metal Products

1.4 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated to 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. Edge Design: Fabricate and install parapet Copings that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist roof edge design pressure (P) as identified in ANSI/SPRI-ES-1, as calculated according to ASCE 7.
1. Design Pressures: As per Engineer of Record calculations provided in the Construction Drawings.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 ACTION SUBMITTALS

A. Product List: Submit list of proposed Products and manufacturers, including all items specified in Part 2 – Products or otherwise required by the Work.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

C. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

D. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

C. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE

A. General: Work of this Section to physically protect membrane roofing, base flashings, and expansion joints from damage that would permit water leakage to building interior.

B. Fabricator Qualifications: Shop that 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, with three years minimum experience.

C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

D. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.

3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

B. Coordinate with demolition work and with work of other trades to ensure sufficient materials and manpower are available to completely replace and make watertight all roofing removed each day.

C. Limit removal of existing sheet metal components, to ensure new membrane installation can be made watertight by end of day.

D. Coordinate installation of flanged metal components, including gravel guards, pitch pans, and accessories to ensure strip-in with hot bitumen (where applicable) on same day they are installed.

E. Schedule work to avoid storage on, and traffic over finished work.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

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

B. Metallic-Coated Steel Sheet Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
   2. Aluminum-Zinc Alloy-Coated (Galvalume) Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
   3. Surface: Smooth, flat.

C. Prepainted Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   1. Aluminum-Zinc Alloy-Coated (Galvalume) Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
   2. Surface: Smooth, flat.
   3. Exposed Coil-Coated Finish:
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent 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.
      b. Minimum Exposure Tests:
         1) Humidity Resistance: 2000 hours.
         2) Salt-Spray Resistance: 2000 hours.
   4. Color:
      a. As selected by Architect from manufacturer's full range.
   5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

D. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete

sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal 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.
   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.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   3. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.
   4. Rust-resistant and compatible with materials to be joined.
   5. Length: As required for thickness of material to penetrate substrate 1/2-inch minimum.

C. Mechanical Fasteners for Sheet Metal to Substrate Anchorage:
   1. Masonry: One-step, screw-type drive anchor (nailing); heat-treated, stress relieved, stainless-steel pin; zinc jacketed; sized for intended application; minimum 1-1/4-inch length x 1/4-inch diameter; Hammer-Screw® manufactured by Powers Fasteners, Inc.
   2. Wood Blocking: Hexagonal head screws, stainless steel, with neoprene rubber washers; jacket color to match pre-painted sheet metal.
   3. Concrete: Same as masonry or other power actuated fasteners, suitable for application.

D. Roofing Nails: Stainless steel (for fastening into ACQ treated lumber), hot-dipped galvanized or non-ferrous type for fastening into non-treated lumber); with annular rings, size as required to suit application; minimum 11-gage with 3/8-inch diameter head.

E. Mechanical Fasteners for Sheet Metal to Metal Fabrications (Support Framing) Anchorage: Appropriate for purpose intended, size as required to suit application and achieve positive anchorage to substrate material.

F. Solder:
   1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
   2. For Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
   3. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

G. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch-wide and 1/8 inch thick.

H. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus, as specified in Division 07 Section “Sealants (for Roofing)”; of type, grade,

class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

K. Splash Blocks: Precast concrete of size and profile indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment; suitable for downspouts discharging at grade level or onto roof surface.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to the greatest extent possible.

B. 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.
   1. Obtain field measurements for accurate fit before shop fabrication.

C. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

D. Fabrication Tolerances: 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 as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

E. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.

F. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1inch deep, filled with elastomeric sealant concealed within joints.
   1. Fabricate all components with allowance for expansion at joints. Provide enlarged or oval holes at all piercing fasteners.

G. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

H. Form all sheet metal components (except corners) in longest practical length up to 10-feet maximum; true to shape, square, accurate in size, and free from distortion or defects detrimental to appearance or performance.

I. Fabricate corners on all sheet metal components (gravel guards, copings, cap flashings, etc.) to form one piece with minimum 18-inch and maximum 36-inch long legs.

J. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

K. Soldered Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

L. Unsoldered Seams: 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.

M. Hem exposed edges of metal 1/2-inch; miter and seam corners.

N. Fabricate vertical faces with bottom edge formed outward 3/4-inch at 30 degrees and hemmed to form drip.
   1. Where vertical height exceeds 8-inches, fabricate with stiffing grooves in accordance with SMACNA, unless specifically approved otherwise.

O. Form all sheet metal material to provide watertight joints:
   1. Unprotected Horizontal Surfaces (expansion joint covers, etc.): Standing seam or drive cleat joints.
   2. Vertical Surfaces (copings, cap flashings, gravel guards, etc.): Flat lock or cover and backer plate seams.

P. Miter all sheet metal corners and solder, weld, or fasten and seal all joints watertight:
   1. Prepainted metallic-coated steel sheet: Apply minimum 1/4-inch bead of sealant between connecting metal flanges and drill and fasten with rivets at 2-inches o.c.
   2. Stainless Steel: Solder joints watertight.
   3. Unfinished Galvanized Steel: Solder joints watertight.
   4. After soldering, remove flux. Wipe and wash solder joints clean.
   5. Install sealant so it will not be visible on the outside of joints.

Q. Fabricate elements complete with required connection pieces.

R. Fabricate all components with horizontal (flat) surfaces with built-in slope for drainage toward roof unless indicated otherwise.

S. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in 32-feet long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate

expansion joints, expansion-joint covers, and gutter accessories from the same metal as gutters.

1. Gutter Style: SMACNA designation A.
   a. Size: Designed to meet roof drainage area, rainfall intensity criteria, and downspout size and spacing.
   b. Supports: Minimum 1/8-inch x 1-inch Brackets and 0.1046 inch (12 gage) spacers at maximum 36-inches oc, staggered.
   c. Join sections with riveted and sealed or soldered joints.
2. Expansion Joints: Lap type.
   a. Spacing: Minimum twenty (20) feet, maximum fifty (50) feet between expansion joints.
3. Accessories: Wire ball downspout strainer.
4. Gutters with Girth up to 6-Inches: Fabricate from the following materials:
   a. Prepainted Metallic-Coated Steel: 0.022 inch (24-gage) thick.
5. Gutters with Girth 6-15 Inches: Fabricate from the following materials:
   a. Prepainted Metallic-Coated Steel: 0.028 inch (22-gage) thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Fabricated Hanger Style: SMACNA figure designation 1-35A.
2. Size: Designed to accept roof drainage area, rainfall intensity criteria, and downspout spacing.
3. Length: Minimum twenty (20) feet or required height, maximum fifty feet between expansion joints.
4. Joints: Sections with riveted and sealed or soldered joints.
5. Supports: 12 Gage straps at maximum 8-feet oc. All strap edges rolled or smooth.
6. Fabricate from the following materials:
   a. Prepainted Metallic-Coated Steel: 0.0217 inch (24-gage) thick.

C. Fabricate gutter and downspout accessories seal watertight.

D. Roof-Edge Flashing (Gravel Stop): Fabricate in 32-feet long sections. Furnish with 6-inch- wide, joint cover plates.
1. Joint Style: Butt, with 12-inch- wide concealed backup plate and 6-inch- wide exposed cover plates.
2. Fabricate with scuppers spaced at existing locations or where indicated on the roof plan, of dimensions required with 4-inch- wide flanges and base extending 4inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate roof edge flashing from the following material:
   a. Prepainted Metallic-Coated Steel: 0.022 inch (24-gage) thick.
4. Fabricate roof edge cleats from the following material:
   a. Metallic Coated (Galvanized or Galvalume) Steel: 0.028 inch (22-gage) thick.

E. Roof and Roof to Wall Transition; Roof to Roof Edge Flashing (Gravel Stop) Transition; and Expansion-Joint Cover: Fabricate from the following materials:
1. Prepainted Metallic-Coated Galvalume Steel: 0.022 inch (24-gage) thick.

F. Counterflashing: Fabricate from the following materials:

1. Prepainted Metallic-Coated Galvalume Steel: 0.022 inch (24-gage) thick.

G. Flashing Receivers: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (26-gage) thick.

H. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (26-gage) thick.

I. Soil Pipe Flashing: Fabricate from the following material:
   1. Lead: 4.0 lb/sq. ft., hard tempered.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Prepainted Metallic Coated Galvalume Steel: 0.022 inch (24-gage) thick.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Exposed to View (Unfinished) Galvanized Steel Components: Paint to match prepainted metallic-coated steel prior to installation:
   1. Clean: Comply with SSPC-1 - Solvent Wipe.
   2. Primer: Apply specified or finish paint manufacturer's recommended primer in accordance with manufacturer's instructions.
   3. Finish Coat: Apply powder coating or approved urethane enamel in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
   4. Verify membrane termination and base flashings are in place, sealed, and secure.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as recommended by SMACNA and as indicated on Drawings.

B. Underlayment: Install underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. Field measure site conditions prior to fabricating work.

B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Provide continuous cleats fastened not more than 12-inches on center. Anchor cleats with a minimum two fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.
   7. Do not use graphite pencils to mark metal surfaces.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Coat back side of stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
      a. Minimum Dry Film Thickness: 15-mils.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
   3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10-feet. Provide joints within 18- to 36inches

of all corners or intersections. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1inch deep, filled with elastomeric sealant concealed within joints.

E. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws; and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance:
   1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
   2. Stainless Steel: Use stainless-steel fasteners.

F. Seal joints as shown and as required with elastomeric sealant for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1inch into sealant. Form joints to completely conceal sealant. When the ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants (for Roofing)."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work.
   1. Do not solder pre-painted metallic-coated steel sheet.
   2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
   3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints where indicated and where necessary for strength.

I. Protect all membrane penetrations as indicated and as recommended in SMACNA and NRCA manuals.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Loosely lock straps to front gutter bead and anchor to roof deck.

3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24-inches apart.
4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
2. Connect downspouts to underground drainage system where available.
3. Provide opening at base of downspout (As detailed in the Drawings) to direct water away from building.
4. Set splash blocks under downspouts not connected to underground drainage system.

D. Splash Blocks: Install where downspouts discharge on low-slope roofs or onto grade.
1. Roof Discharge: Set on traffic pads compatible with roofing membrane.
2. Grade Discharge: Set on a bed of compacted fill.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated in drawings. If not indicated in Drawings, located expansion joints no greater than 50’ apart in any Gutter Section. Locate 2 downspouts for each 50’ section of gutter (min.). Lap joints a minimum of 4inches in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install starter and edge strips, and cleats before starting installation.
2. Strip in all sheet metal flanges the same day they are installed.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces specified in Part 1 and as indicated.
1. Backer Plates: Secure with fasteners suitable for substrate, 6-inches o.c. each face.
2. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 12-inch centers.
3. Apply 1/4-inch bead of sealant between each layer of metal at each edge.
4. Cover Plates: Hook front or exposed face of cover plate over drip edge.
5. Do not use mastic between sheet metal components.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4inches over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4inches over base flashing. Lap counterflashing joints a minimum of 4inches and bed with elastomeric sealant.

1. Sawcut new reglets where required.
   a. Provide bayonet style lap joints, minimum 4-inch overlap.
   b. Fill voids between wedges with backer rod.
   c. Seal receiver to vertical face of wall.
2. Secure in a waterproof manner by means of snap-in installation and sealant or plastic wedges and sealant.
3. Install surface mounted reglets true to lines and levels.
   a. Seal top of reglets with sealant.
   b. Secure in place with neoprene head screws at maximum 12-inches on center.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Install lead flashings at all soil pipe penetrations. Turn lead flashing down inside piping, being careful not to block vent piping with flashing.
2. Provide Penetration Seal System at all small penetrations not otherwise detailed.
   a. Clean roof surfaces to receive Penetration Seal Systems.
   b. Clean pipes and penetrating elements to remove plastic cement, bitumen, and other contaminants by wire brushing and scraping.
   c. Caulk around penetrating elements with curb adhesive.
   d. Apply beads of curb adhesive to flat side of first precast curb component. Place caulked curb onto roof surface to form half circle around penetrating element.
   e. Apply beads of curb adhesive to flat side and to scarf joints of second precast curb component. Place the second section of curb onto roof surface to form circle with first section. Press scarf joints together firmly and press both sections down.
   f. Apply continuous bead of curb adhesive around outside edge of curb at roof.
   g. Fill around penetrating element with pourable sealant to top of curb.
3. Pitch pans are not desired. Install only where specifically indicated or approved by Architect. Provide flanged umbrellas at all pitch pans.
   a. Fill with non-shrink grout to 1-inch from top of flange.
   b. Top with Pitch Pan Filler - Sealant Type ES-2.
4. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

F. Protect all membrane penetrations as indicated and as recommended in SMACNA and NRCA manuals.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION 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 as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 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 sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. 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.

3.9 SCHEDULE - MATERIALS

A. Exposed to View Components:
   1. One-Piece Flashing and Expansion Joint Terminations: Metallic coated steel sheet, powder coated. Colors as selected by Architect from manufacturer’s full line of colors.
   2. All Other Components: Metallic coated steel sheet, powder coated. Colors as selected by Architect from manufacturer’s full line of colors.
   3. Concealed from View Components, (Counterflashings, Expansion Joint Covers, Etc.): Stainless steel sheet.

B. Roof Penetration Flashings: Stainless steel sheet.

C. Rain Hoods and Umbrellas: Stainless steel sheet.

END OF SECTION 07 62 00

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
1. Roof curbs.
2. Equipment supports.
3. Pipe Supports/Hangers.

B. Related Requirements:
1. Section 06 10 55 "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
2. Division 07 low-slope roofing Sections for roofing accessories.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 REFERENCES

A. Aluminum Association (AA): Specifications for Aluminum Structures.

B. American Society for Testing and Materials (ASTM):
1. A 36: Carbon Structural Steel.
2. A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. A 153: Zinc Coating (Hot-Dip) Steel and Iron Hardware.
5. A 167: Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
6. A 240: Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
7. A 500: Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
8. A 653: Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process, Structural (Physical) Quality Property.
9. A 666: Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
10. A 755: Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
11. A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
12. A 792: Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
13. A 924: Steel Sheet, Zinc Coated, (galvanized) by the Hot-Dip process.

14. A 1011: Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
15. B 209: Aluminum and Aluminum-Alloy Sheet and Plate.
16. B 221: Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
17. C 920: Elastomeric Joint Sealants.
18. C 1289: Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
19. C 1311: Solvent Release Sealants.
20. D 638: Tensile Properties of Rigid Plastic.
21. D 226: Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
22. D 256: Determining the Izod Pendulum Impact Resistance of Plastics.
23. D 695: Compressive Properties of Rigid Plastic.
24. D 785: Rockwell Hardness of Plastics and Electrical Insulating Materials.
25. D 1003: Haze and Luminous Transmittance of Transparent Plastics.
26. D 2240: Rubber Property – Durometer Hardness.
27. D 2244: Color Tolerance and Calculation of Color Differences from Instrumentally Measured Color Coordinates.
28. D 4214: Evaluating the Degree of Chalking of Exterior Paint Films.
29. D 4397: Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.
30. D 4586: Asphalt Roof Cement, Asbestos-Free.
31. D 4802: Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

C. Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
   1. SP-58 Pipe Hangers and Supports, Materials, Design and Manufacture.
   2. SP-59 Pipe Hangers and Supports, Selection and Application.

D. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.

E. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA): Architectural Sheet Metal Manual.

F. Underwriters' Laboratories (UL):
   1. Fire Hazard Classifications.
   2. UL 793 - Standard for Safety Automatically Operated Roof Vents for Smoke and Heat.

1.4 SYSTEM DESCRIPTION

A. Manufactured Curbs: Engineered, prefabricated structural box curb assembly designed for installation onto roof deck or structural framing, capable of supporting weight of roof-mounted equipment without deformation. Include integral base plate, treated wood nailer and insulation.

B. Pipe Supports: Support all roof mounted piping with engineered, prefabricated, portable system designed for installation on roof without roof penetrations, flashings, or damage to roofing materials. Include bases, structural steel frames, and adjustable height pipe hangers or supports suitable for existing and proposed piping and conduits.

1.5 DESIGN REQUIREMENTS

A. Fabricate and install Roof Accessories to comply with NRCA recommendation that top of curb to top of roofing membrane be a minimum of 8-inches.

1.6 ACTION SUBMITTALS

A. Product List: Submit list of proposed Products and manufacturers, including all items specified in Part 2 – Products or otherwise required by the Work.

B. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

B. Samples: For each type of exposed factory-applied finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

C. Manufacturer's Installation Instructions: Include installation sequence, special instructions and precautions, and Material Safety Data Sheets (MSDS).

D. Certification: Provide current letter(s) on Company’s letterhead, signed by an authorized employee or corporate officer attesting to all following items:
   1. Qualifications: Certify and document items in Article on Quality Assurance, and;
   2. Products: Certify that selected products meet or exceed specified requirements:
      a. Quality Assurance/Control Data: Provide Design Data, Test Reports, Certificates, Manufacturer's Installation Instructions, and Manufacturer's Field Reports.
      b. Test Reports: Certified test reports or labeling agency file numbers indicating compliance with specified performance characteristics and physical properties.
      c. Manufacturer's Certification: Each product meets or exceeds specified requirements.

1.8 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record exact location of roof penetrations and any items installed but not visible after installation of roofing system or other Products.

B. Operation and Maintenance Data:
   1. Include complete instructions for normal maintenance and local contacts for service and spare parts.
   2. Include cleaning and stain removal methods and recommended cleaning materials, polishes, and waxes.

C. Warranty: Executed special warranty.

1.9 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacturer of products specified in this Section with a minimum of five years documented experience.

B. Applicator: Company specializing in installing the work of this Section with minimum three years documented experience and approved by the manufacturer.

C. Supervisor/Foreman: Individual that is a direct employee of Applicator Company experienced in using selected manufacturer’s Products.

D. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

E. Perform work in accordance with MSS SP-59.

F. Maintain one copy of each document accessible to site.

G. Pre-Installation Conference:
   1. Convene two weeks prior to commencing work of this Section, under provisions of Section 01 31 50 “Project Meetings.”
   2. Require attendance of parties directly affecting the work of this Section.
   3. Review conditions of installation, installation procedures, and coordination with related work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

B. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
   1. Protect from damage from sunlight, weather, excessive temperatures and construction operations.

1.11 FIELD CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Regulatory Requirements:

1. Conform to the International Building Code as amended by the City of Corpus Christi code for fire and wind loading requirements.
2. Provide certification of inspection confirming approval of by authority having jurisdiction.

C. Environmental Requirements:
1. Do not install Roof Accessories when chances for inclement weather exist or might occur before installation can be completed and accessories made weatherproof.
2. Maintain waterproof integrity of building during and after installation of Roof Accessories.

D. Existing Conditions: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings.
1. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
2. Allow for field tolerances if taking field measurements before fabrication is not possible.

1.12 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes, roof expansion joints or other construction elements.

B. Sequence work to allow installation of Roof Accessories that are mounted directly on roof deck during installation of new roofing system. Do not cut into new roofing system to retrofit Roofing Accessories unless specifically permitted by Architect.

C. Coordinate with installation of mechanical and electrical equipment, hardware, and assemblies to ensure Roof Accessories are properly located and in place to receive equipment installed by others.

1.13 WARRANTY

A. Warranty: Cover damage to Roof Accessories and substrates resulting from failure of Roof Accessories to perform as intended, including resist penetration of water. Include replacement of defective materials and labor.
1. Manufactured Curbs and Equipment Supports: Provide warranty on curbs against structural failure.
2. Pipe Support System: Provide warranty covering pipe bases against deterioration for same time period as roofing warranty.
3. Warranty Period:
   a. Pipe Support System: Same duration as Roofing System Warranty.
   b. Other Items: 5 years from date of Substantial Completion.

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 PERFORMANCE REQUIREMENTS

A. Provide roof accessories that have been manufactured, fabricated and installed to withstand design loads from and to maintain performance criteria stated by manufacturer without defects, damage or failure.

2.3 METAL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   1. Galvanized Steel Sheet: ASTM A 653, G90 coated and mill phosphatized for field painting.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, AZ50 coated.

B. Prepainted Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
   1. Galvanized Steel Sheet: ASTM A 653, G90 coated.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coated.
   3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
      a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:
         1) Humidity Resistance: 1000 hours.
         2) Salt-Spray Resistance: 1000 hours.

C. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and mill finish.

1. Factory-Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
3. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
    a. Color: To be selected by Architect from Manufacturer's Standard Colors.
4. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Acid-chromate-fluoride-phosphate conversion coating; Organic Coating: As specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
    a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils, medium gloss.
    b. Color and Gloss: As selected by Architect from manufacturer's full range.
5. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.
    a. Color and Gloss: As selected by Architect from manufacturer's full range.
6. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
    a. Color and Gloss: As selected by Architect from manufacturer's full range.

D. Aluminum Extrusions and Tubes: A STM B 221, alloy and temper recommended by manufacturer for type of use, mill finished.

E. Stainless-Steel Shapes or Sheet: ASTM A 240 or ASTM A 666, Type 304 or Type 316, No. 2D finish.

F. Steel Shapes: ASTM A 36, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.

G. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

H. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123.

I. Galvanized Steel Pipe: ASTM A 53.

2.4 MISCELLANEOUS MATERIALS

A. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).

B. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated per UL 972 with an average impact strength of 12 to 16 ft-lbf/in. of width when tested according to ASTM D 256, Method A (Izod).

C. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, not less than 1 inch thick.

D. Glass-Fiber Board Insulation: ASTM C 726, not less than 1 inch thick.

E. Polyisocyanurate Board Insulation: ASTM C 1289, not less than 1 inch thick.

F. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Polyethylene Sheet: 6-mil thick, polyethylene sheet complying with ASTM D 4397.

I. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

J. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

K. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

L. Sealant: of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

M. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized and heavy bodied for hooked-type expansion joints with limited movement.

N. Roofing Cement: ASTM D 4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.5 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Available Manufacturers:
      a. Custom Curb, Inc.
      b. LM Curbs.
      c. Pate Company (The).
      d. Thaler Metal Industries Ltd.
      e. ThyCurb; Div. of Thybar Corporation.
   2. Load Requirements: As required to support equipment weight.
   3. Material: Metallic-coated steel sheet, 0.079 inch thick.
   4. Factory-install continuous wood nailers 3-1/2 wide at tops of equipment supports.
   5. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
   6. Fabricate units to a minimum height of 12 inches above the new roof surface unless otherwise indicated.
   7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.6 ROOF MOUNTED PIPE / EQUIPMENT SUPPORTS

A. Pipe Support System and Hangers: Adjustable height, with bases, traffic pads, and manufacturer's recommended hardware for mounting on roof membrane, suitable for quantity of pipe runs and sizes, with EPDM end caps.
   1. Hot-dip galvanize completed assemblies. Stainless steel when framing is stainless steel.
   2. Fabricate to MSS SP-58 and MSS SP-69.
   3. Pipe Size 2-1/2-inch and Smaller: Single roller supports for piping subject to expansion and contraction; with 3-sided channels and pipe clamps.
   4. Pipe Size 3-inch and Larger: Rollers, clevis hangers or band hangers, to allow for expansion and contraction without movement of the bases.
   5. Available Manufacturers:
      a. Advanced Support Products, Inc.
      b. Mapa Products
      c. Miro Industries, Inc.
      d. Portable Pipe Hangers, Inc.
   6. Steel Framing: 12 gage minimum cold-rolled, hot dipped galvanized steel perforated channel sections equal to Uni-strut, Portable Pipe Hangers, or previously approved alternate.
   7. Bases: Black, injection molded, moisture resistant, chemical resistant, non-flammable high density polypropylene plastic, or manufacturer’s standard approved.
   8. Accessory Hardware: Hot dipped galvanized, clamps, bolts nuts and washers as required for a complete system.

9. Base Pedestal: 3000 PSI reinforced, pre-cast concrete pavers not less than four inches larger than pedestal base size.
10. Traffic Pad: Recycled elastomers vulcanized into pads, 3/8-inches thick; TufPad® manufactured by Rubber Products, Inc. or roof membrane traffic pads as specified in Division 07 Section " Styrene Butadiene Styrene (SBS) Modified Asphalt Bituminous Roofing."
    a. Size: Not less than four (4") inches larger in both directions pedestal base.
11. Support Height: As indicated or required for existing items to be supported.

B. Mechanical Units and Duct Supports: Same manufacturer as pipe supports, and suitable for item to be supported, including manufacturer's standard hardware for mounting to structure or structural roof deck.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent surfaces, including roofing system from damage during installation of Roofing Accessories.

B. Clean surfaces of roof to receive pipe support bases. Remove loose gravel, dirt, dust, oils, and other foreign materials from all roofs. Prime existing substrate or membrane with primer that is compatible with and acceptable roofing membrane manufacturer.

3.3 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Coordinate installation with adjacent Work such as roofing, sheet metal and other work to ensure creation of a complete weatherproof assembly. Anchor work securely to supporting structure, but allow for differential and thermal movement.

C. Install roof accessories to fit substrates and to result in watertight performance.

D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating acceptable to roofing membrane manufacturer or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

E. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

F. Equipment Support Installation:
1. Locate curbs and support framing where indicated or instructed by Owner's Representative.
2. Set equipment support so top surface of equipment support is level.

G. Roof Mounted Pipe / Equipment Support Installation:
1. Locate bases and support framing as indicated on shop drawings or as required for existing conditions. Completely support all piping, conduit, ducts, and equipment whether indicated or not.
   a. Do not use wood or wire to support items.
   b. Maximum Deflection: 1/240th of span.
   c. Maximum Load on Membrane: Two and one-half (2.5) pounds per square inch.
2. Set bases with adhesive in accordance with manufacturer's installation instructions and as acceptable to membrane manufacturer. Accurately locate and align bases.
3. Install support devices at spacings to support weight of piping and conduit, but in no case exceeding 10-feet on center.
4. Set framing posts into bases and assemble framing structure as indicated.
5. Use galvanized fasteners for galvanized framing and stainless-steel fasteners for stainless steel framing.

H. Seal joints with sealant as required by manufacturer of roof accessories.

3.4 FIELD QUALITY CONTROL

A. Site inspection will be performed under the provisions of Division 01 "General Requirements".

B. Provide manufacturer's field services under the provisions of Division 01 "General Requirements".

C. Request site attendance of Roof Accessory manufacturers during installation of the work if required to confirm compliance with instructions or for special or unusual conditions.

3.5 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 09 91 13 "Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.
   1. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products.
   2. Clean metal and glazing using non-abrasive materials and methods. Remove and replace work that cannot be successfully cleaned.
   3. Remove adhesive from supports, pipes and bases, and leave work in clean condition.

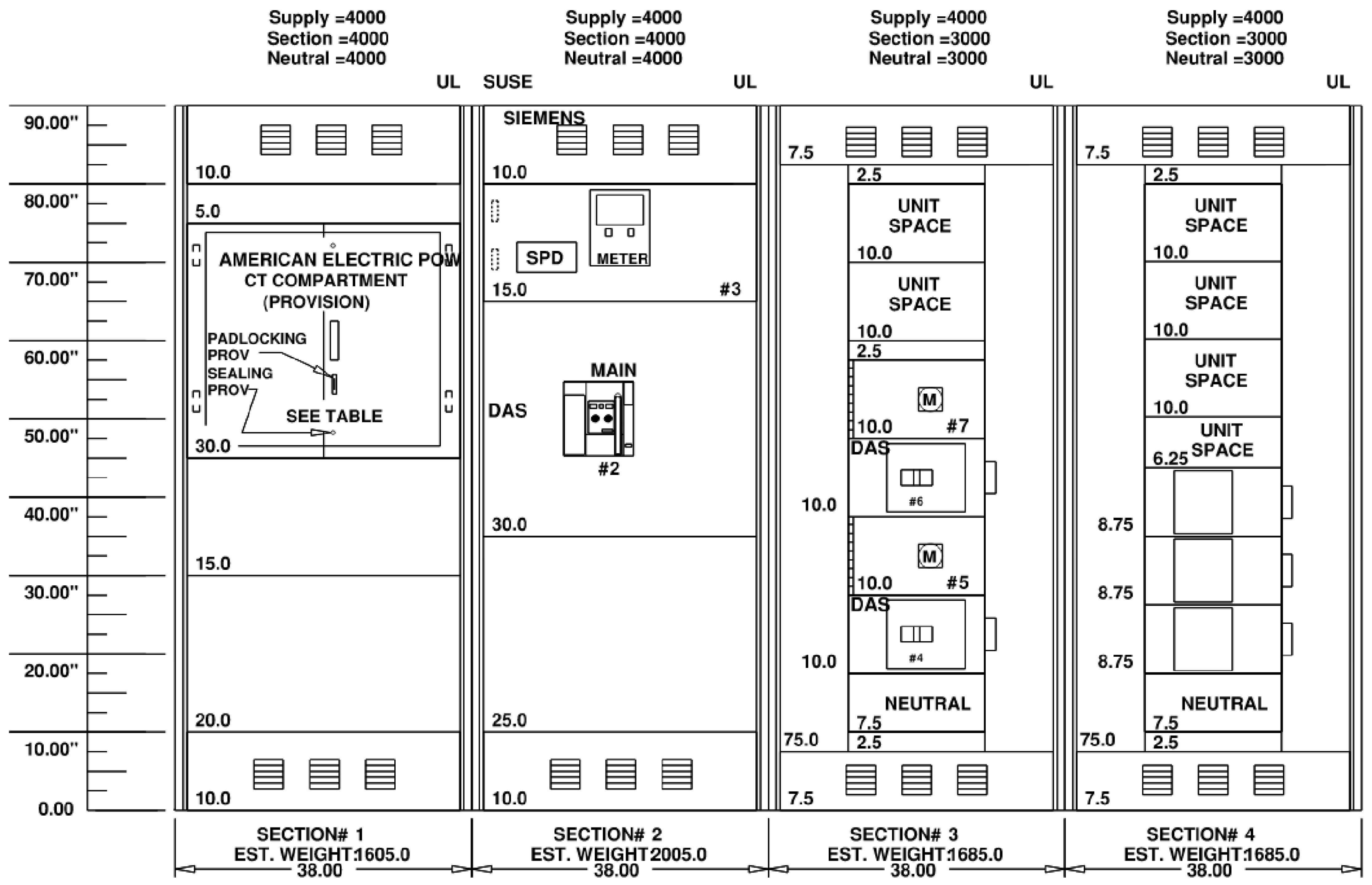
B. Remove all construction debris, packaging, unused fasteners, adhesives, and other installation materials from project site and dispose of legally.

C. Reclean as necessary to prevent damage. Protect completed work from damage and deterioration and inspect immediately before final acceptance of project.

3.7 PROTECTION

A. Do not permit traffic over unprotected roof surfaces.

END OF SECTION 07 72 00



2 MAIN SWITCHBOARD ELEVATION
SCALE: NTS

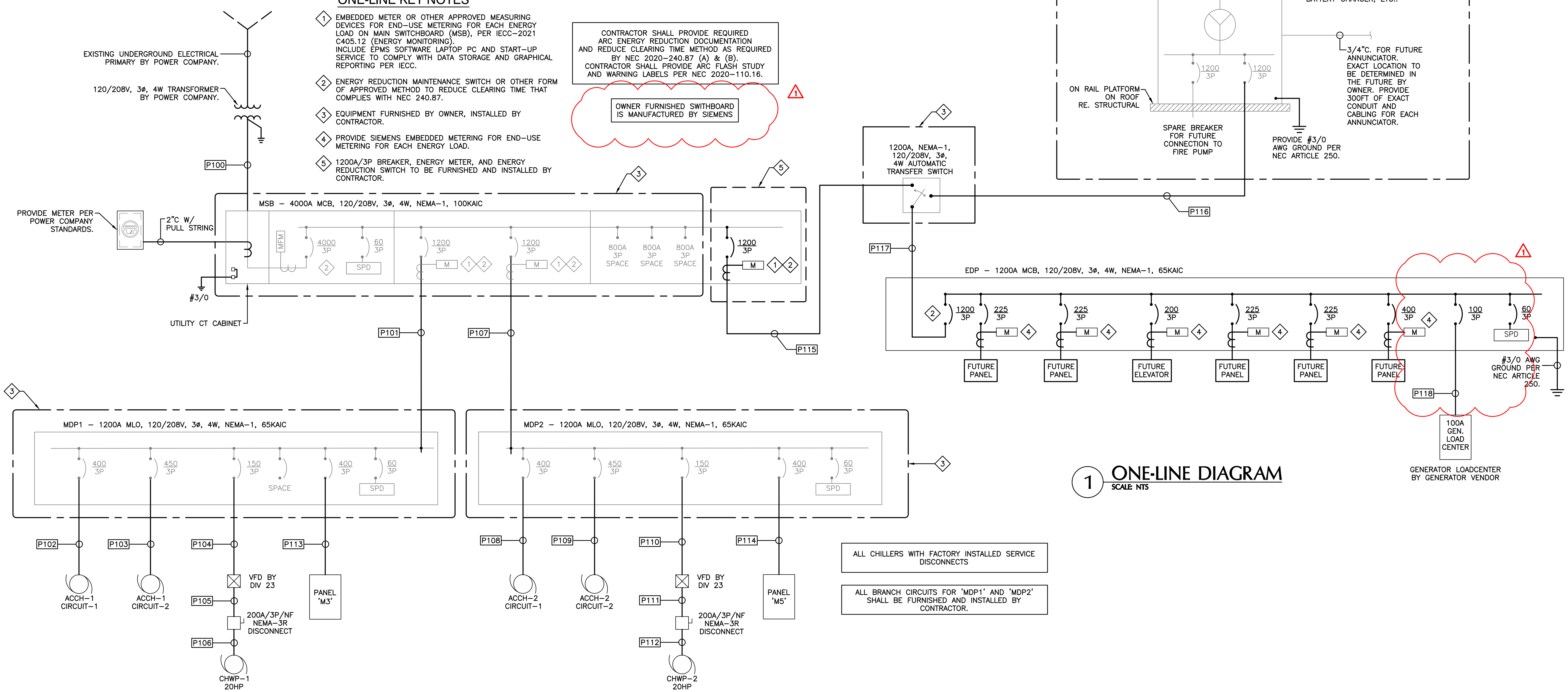
ESTIMATED ELECTRICAL LOAD			120/208V, 3ø, 4W
DESCRIPTION	CONNECTED LOAD	DEMAND FACTOR	NEC DEMAND
LIGHTING	245	125%	306
RECEPTACLES	720	NEC 220–44	720
KITCHEN EQUIPMENT	0	NEC 220–56	0
H.V.A.C.	452160	100%	452160
LARGEST MOTOR	26730	125%	33413
MOTOR LOAD	26730	100%	26730
MISC. SINGLE PHASE LOADS	4200	100%	4200
TOTAL VOLT–AMPERS	510785		517529
517529 VA / (208V*1.732)	=	1436.5	AMPS

ONE-LINE KEY NOTES

1. EMBEDDED METER OR OTHER APPROVED MEASURING DEVICES FOR END-USE METERING FOR EACH ENERGY LOAD ON MAIN SWITCHBOARD (MSB), PER IECC–2021 C405.12 (ENERGY MONITORING). INCLUDE EPMS SOFTWARE LAPTOP PC AND START–UP SERVICE TO COMPLY WITH DATA STORAGE AND GRAPHICAL REPORTING PER IECC.
2. ENERGY REDUCTION MAINTENANCE SWITCH OR OTHER FORM OF APPROVED METHOD TO REDUCE CLEARING TIME THAT COMPLIES WITH NEC 240.87.
3. EQUIPMENT FURNISHED BY OWNER, INSTALLED BY CONTRACTOR.
4. PROVIDE SIEMENS EMBEDDED METERING FOR END–USE METERING FOR EACH ENERGY LOAD.
5. 1200A/3P BREAKER, ENERGY METER, AND ENERGY REDUCTION SWITCH TO BE FURNISHED AND INSTALLED BY CONTRACTOR.

CONTRACTOR SHALL PROVIDE REQUIRED ARC ENERGY REDUCTION DOCUMENTATION AND REDUCE CLEARING TIME METHOD AS REQUIRED BY NEC 2020–240.87 (A) & (B). CONTRACTOR SHALL PROVIDE ARC FLASH STUDY AND WARNING LABELS PER NEC 2020–110.16.

OWNER FURNISHED SWITBOARD IS MANUFACTURED BY SIEMENS



ALL CHILLERS WITH FACTORY INSTALLED SERVICE DISCONNECTS

ALL BRANCH CIRCUITS FOR 'MDP1' AND 'MDP2' SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR.

1 ONE-LINE DIAGRAM
SCALE: NTS

REVISIONS DATE	#
ADDENDUM #1 02/15/2024	1

NRG ENGINEERING
JOB #22159

10/06/2023
JOHN A. RODRIGUEZ III 90273
Stamp Date:

ONE-LINE DIAGRAM
CENTRAL PLANT IMPROVEMENTS
TEXAS A+M UNIVERSITY CORPUS CHRISTI
223 N. CHAPARRAL
CORPUS CHRISTI, TEXAS

PROJECT #: 22159
FILE NAME: CHAPARRAL
DRAFTING BY: CEG
CHECKED BY: JAR
DATE: MAY 12, 2023
SHEET NUMBER:
E7.1
SHT. No. of

Feb 15, 2024 – 6:07pm
22159_ELEC.dwg

Attachment A

PANEL ' EDP '

W/SPD — 1200 AMP, M.C.B., 120/208 V, 3ø, 4W, S/N, SURFACE, NEMA 1, 65 KAIC

CKT #	LOAD SERVED	LOAD	CONDUIT & WIRE SIZE	BKR SIZE	A	B	C	BKR SIZE	CONDUIT & WIRE SIZE	LOAD	LOAD SERVED	CKT #
1	SPD	–	#4 AWG	60/3	A			225/3	–	–	FUTURE PANEL 'E4A'	2
		–	#4 AWG			B			–	–		
		–	#4 AWG				C		–	–		
3	FUTURE PANEL 'L4'	–	–	225/3	A			225/3	–	–	FUTURE PANEL 'E4B'	4
		–	–			B			–	–		
		–	–				C		–	–		
5	FUTURE PANEL 'IT4'	–	–	225/3	A			200/3	–	–	FUTURE PASSENGER ELEVATOR	6
		–	–			B			–	–		
		–	–				C		–	–		
7	FUTURE PANEL EMR	–	–	400/3	A			100/3	PER ONE–LINE	8400	GENERATOR LOADCENTER	8
		–	–			B			PER ONE–LINE	8400		
		–	–				C		PER ONE–LINE	8400		
9	SPACE				A						SPACE	10
						B						
							C					

CONNECTED LOAD = 25200 VA — PHASE A = 8400 VA — PHASE B = 8400 VA — PHASE C = 8400 VA

PANEL ' MSB '

W/SPD — 4000 AMP, M.C.B, 120/208 V, 3ø, 4W, S/N, SURFACE, NEMA 1, 100 KAIC

CKT #	LOAD SERVED	LOAD	CONDUIT & WIRE SIZE	BKR SIZE	A	B	C	BKR SIZE	CONDUIT & WIRE SIZE	LOAD	LOAD SERVED	CKT #
1	SPD	–	#6 AWG	60/3	A			1200/3	PER ONE–LINE	–	ATS EDP	2
		–	#6 AWG			B			PER ONE–LINE	–		
		–	#6 AWG				C		PER ONE–LINE	–		
3	MDP1	131517	PER ONE–LINE	1200/3	A						800AMP SPACE	4
		130917	PER ONE–LINE			B						
		130917	PER ONE–LINE				C					
5	MDP2	85590	PER ONE–LINE	1200/3	A						600AMP SPACE	6
		85115	PER ONE–LINE			B						
		84870	PER ONE–LINE				C					

CONNECTED LOAD = 648926 VA — PHASE A = 217107 VA — PHASE B = 216032 VA — PHASE C = 215787 VA

PANEL ' MDP1 '

W/SPD — 1200 AMP, M.L.O, 120/208 V, 3ø, 4W, S/N, SURFACE, NEMA 1, 65 KAIC

CKT #	LOAD SERVED	LOAD	CONDUIT & WIRE SIZE	BKR SIZE	A	B	C	BKR SIZE	CONDUIT & WIRE SIZE	LOAD	LOAD SERVED	CKT #
1	SPD	–	#6 AWG	60/3	A			150/3	PER ONE–LINE	8910	CHWP–1 20HP	2
		–	#6 AWG			B			PER ONE–LINE	8910		
		–	#6 AWG				C		PER ONE–LINE	8910		
3	ACCH–1 CIRCUIT #1	37440	PER ONE–LINE	400/3	A			400/3	PER ONE–LINE	47247	PANEL 'M3'	4
		37440	PER ONE–LINE			B			PER ONE–LINE	46647		
		37440	PER ONE–LINE				C		PER ONE–LINE	46647		
5	ACCH–1 CIRCUIT #2	37920	PER ONE–LINE	450/3	A						SPACE	6
		37920	PER ONE–LINE			B						
		37920	PER ONE–LINE				C					

CONNECTED LOAD = 393351 VA — PHASE A = 131517 VA — PHASE B = 130917 VA — PHASE C = 130917 VA

PANEL ' MDP2 '

W/SPD — 1200 AMP, M.L.O, 120/208 V, 3ø, 4W, S/N, SURFACE, NEMA 1, 65 KAIC

CKT #	LOAD SERVED	LOAD	CONDUIT & WIRE SIZE	BKR SIZE	A	B	C	BKR SIZE	CONDUIT & WIRE SIZE	LOAD	LOAD SERVED	CKT #
1	SPD	–	#6 AWG	60/3	A			150/3	PER ONE–LINE	8910	CHWP–2 20HP	2
		–	#6 AWG			B			PER ONE–LINE	8910		
		–	#6 AWG				C		PER ONE–LINE	8910		
3	ACCH–2 CIRCUIT #1	37440	PER ONE–LINE	400/3	A			400/3	PER ONE–LINE	1320	PANEL 'M5'	4
		37440	PER ONE–LINE			B			PER ONE–LINE	845		
		37440	PER ONE–LINE				C		PER ONE–LINE	600		
5	ACCH–2 CIRCUIT #2	37920	PER ONE–LINE	450/3	A						SPACE	6
		37920	PER ONE–LINE			B						
		37920	PER ONE–LINE				C					

CONNECTED LOAD = 255575 VA — PHASE A = 85590 VA — PHASE B = 85115 VA — PHASE C = 84870 VA

PANEL ' M5 '

400 AMP, M.L.O, 120/208 V, 3ø, 4W, S/N, SURFACE, NEMA 1, 35 KAIC

CKT #	LOAD SERVED	LOAD	CONDUIT & WIRE SIZE	BKR SIZE	A	B	C	BKR SIZE	CONDUIT & WIRE SIZE	LOAD	LOAD SERVED	CKT #
1	ROOF DECK RECEP	720	#12 AWG	20/1	A						SPACE	2
3	ACCH–1 CNTR	600	#12 AWG	20/1		B					SPACE	4
5	ACCH–2 CNTR	600	#12 AWG	20/1			C				SPACE	6
7	DDC CONTROL PNL	600	#12 AWG	20/1	A						SPACE	8
9	5TH FLOOR LIGHT/RECP	245	#12 AWG	20/1		B					SPACE	10
11	SPACE						C				SPACE	12
13	SPACE				A						SPACE	14
15	SPACE					B					SPACE	16
17	SPACE						C				SPACE	18
19	SPACE				A						SPACE	20
21	SPACE					B					SPACE	22
23	SPACE						C				SPACE	24
25	SPACE				A						SPACE	26
27	SPACE					B					SPACE	28
29	SPACE						C				SPACE	30
31	SPACE				A						SPACE	32
33	SPACE					B					SPACE	34
35	SPACE						C				SPACE	36
37	SPACE				A						SPACE	38
39	SPACE					B					SPACE	40
41	SPACE						C				SPACE	42

CONNECTED LOAD = 2765 VA — PHASE A = 1320 VA — PHASE B = 845 VA — PHASE C = 600 VA

PANEL ' M3 '

400 AMP, M.L.O, 120/208 V, 3ø, 4W, S/N, SURFACE, NEMA 1, 35 KAIC

CKT #	LOAD SERVED	LOAD	CONDUIT & WIRE SIZE	BKR SIZE	A	B	C	BKR SIZE	CONDUIT & WIRE SIZE	LOAD	LOAD SERVED	CKT #
1	EXISTING	13680	#1 AWG	125/3	A			45/3	#8 AWG	4092	EXISTING	2
3	AHU	13680	#1 AWG			B			#8 AWG	4092	AHU	4
5	3RD FLOOR	13680	#1 AWG				C		#8 AWG	4092	2ND FLOOR	6
7	AHU LIGHT/RECP	600	#12 AWG	20/1	A				#1 AWG	14595	EXISTING	8
9	SPACE					B		125/3	#1 AWG	14595	AHU	10
11	SPACE						C		#1 AWG	14595	2ND FLOOR	12
13	SPACE				A				#1 AWG	13680	EXISTING	14
15	SPACE					B		125/3	#1 AWG	13680	AHU	16
17	SPACE						C		#1 AWG	13680	4TH FLOOR	18
19	SPACE				A			20/1	#12 AWG	600	AHU LIGHT/RECP	20
21	SPACE					B		20/1	#12 AWG	600	AHU LIGHT/RECP	22
23	SPACE						C	20/1	#12 AWG	600	AHU LIGHT/RECP	24
25	SPACE				A						SPACE	26
27	SPACE					B					SPACE	28
29	SPACE						C				SPACE	30
31	SPACE				A						SPACE	32
33	SPACE					B					SPACE	34
35	SPACE						C				SPACE	36
37	SPACE				A						SPACE	38
39	SPACE					B					SPACE	40
41	SPACE						C				SPACE	42

CONNECTED LOAD = 140541 VA — PHASE A = 47247 VA — PHASE B = 46647 VA — PHASE C = 46647 VA

NOTES: FIELD COORDINATE EXACT BREAKER SIZE FOR ALL AHU FROM EXISTING PANEL.

CONDUIT SCHEDULE

POWER

CABLE #	FROM – ORIGINATION	TO – DESTINATION	PURPOSE	VOLTAGE	ROUTE	QTY	SIZE	CONDUCTOR SIZE	GROUND
P100	AEP TRANSFORMER VAULT	SWITCHBOARD MSB	POWER	208V/3PH	UG	11	4"	500KCMIL	N/A
P101	SWITCHBOARD MSB	PANEL MDP1	POWER	208V/3PH	AG	4	3"	350KCMIL	#3/0
P102	PANEL MDP1	ACCH–1 (CIRCUIT #1)	POWER	208V/3PH	AG	2	2"	#3/0	#3AWG
P103	PANEL MDP1	ACCH–1 (CIRCUIT #2)	POWER	208V/3PH	AG	2	2–1/2"	#4/0	#2AWG
P104	PANEL MDP1	CHWP–1 (VFD)	POWER	208V/3PH	AG	1	2"	#1/0	#6AWG
P105	CHWP–1 (VFD)	CHWP–1 (DISCONNECT)	POWER	208V/3PH	AG	1	2"	#1/0	#6AWG
P106	CHWP–1 (DISCONNECT)	CHWP–1 (PUMP MOTOR)	POWER	208V/3PH	AG	1	2"	#1/0	#6AWG
P107	SWITCHBOARD MSB	PANEL MDP2	POWER	208V/3PH	AG	4	3"	350KCMIL	#3/0
P108	PANEL MDP2	ACCH–2 (CIRCUIT #1)	POWER	208V/3PH	AG	2	2"	#3/0	#3AWG
P109	PANEL MDP2	ACCH–2 (CIRCUIT #2)	POWER	208V/3PH	AG	2	2–1/2"	#4/0	#2AWG
P110	PANEL MDP2	CHWP–2 (VFD)	POWER	208V/3PH	AG	1	2"	#1/0	#6AWG
P111	CHWP–2 (VFD)	CHWP–2 (DISCONNECT)	POWER	208V/3PH	AG	1	2"	#1/0	#6AWG
P112	CHWP–2 (DISCONNECT)	CHWP–2 (PUMP MOTOR)	POWER	208V/3PH	AG	1	2"	#1/0	#6AWG
P113	PANEL MDP1	PANEL M3	POWER	208V/3PH	AG	2	2"	#3/0	#3AWG
P114	PANEL MDP2	PANEL M5	POWER	208V/3PH	AG	2	2"	#3/0	#3AWG
P115	SWITCHBOARD MSB	AUTOMATIC TRANSFER SWITCH	POWER	208V/3PH	AG	4	3"	350KCMIL	#3/0
P116	450KW GENERATOR	AUTOMATIC TRANSFER SWITCH	POWER	208V/3PH	AG	4	3"	350KCMIL	#3/0
P117	ATS	PANEL EDP	POWER	208V/3PH	AG	4	3"	350KCMIL	#3/0
P118	PANEL EDP	GEN. LOAD CENTER	POWER	208V/3PH	AG	1	1–1/2"	#2AWG	#8AWG

UG = UNDERGROUND
AG = ABOVE GROUND

CONDUIT SCHEDULE

CONTROL

REV #	CABLE #	FROM – ORIGINATION	TO – DESTINATION	PURPOSE	ROUTE	QTY	SIZE
0	C100	DDC CONTROL PANEL	ACCH–1	CONTROL	AG	1	1"
0	C101	DDC CONTROL PANEL	ACCH–2	CONTROL	AG	1	1"
0	C102	DDC CONTROL PANEL	CHWP–1	CONTROL	AG	1	1"
0	C103	DDC CONTROL PANEL	CHWP–2	CONTROL	AG	1	1"

UG = UNDERGROUND
AG = ABOVE GROUND

UTILITY TRANSFORMER SHORT CIRCUIT SCHEDULE

(assumes infinite availability)

Volt[L–L]	KVA	Z(%)	I[f]	M	Isc
208	500	1.24	1387.9	80.645	111928

FEEDER SHORT CIRCUIT SCHEDULE

FROM	TO	Volt[L–L]	#SETS	WIRE SZ	LENGTH	COND. TP	Isc(in)	C(total)	F	M	Isc
UT	MSB	208	11	500	40	P	111928	293766	0.1269	0.8874	99323
MSB	MDP1	208	4	350	210	S	99323	78816	2.2036	0.3121	31003
MSB	MDP2	208	4	350	210	S	99323	78816	2.2036	0.3121	31003
MDP2	M5	208	2	3/0	5	S	31003	25688	0.0502	0.9522	29520
MDP1	M3	208	2	3/0	180	S	31003	25688	1.8090	0.3560	11037

LIGHT FIXTURE SCHEDULE

TYPE	MANUFACTURER & CATALOG NO.	VOLTAGE	WATTS	LUMENS	TEMP	MOUNTED	DESCRIPTION
A	LITHONIA #CSS–L48–4000LM–MVOLT–40K–80CRI–IE7WCP–HC36M12	120	35	4300	4000K	CHAIN	4' LED STRIP W/EMERGENCY PACK NOTE#1
EX	LITHONIA #LHQM–LED–R–SD	120	4	700	–	SURFACE	EXIT/EMERGENCY LIGHT

NOTE #1: PROVIDE ACCESSORIE #HC36M12 FOR FIXTURE TYPE 'A' (FIXTURE SHALL HANG 10' FROM BOTTOM OF FIXTURE TO AFF)

REVISIONS DATE	#
ADDENDUM #1 02/15/2024	1

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10/06/2023
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JOSEPH A. RODRIGUEZ
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LICENSED PROFESSIONAL ENGINEER

Stamp Date:

PANEL SCHEDULES

CENTRAL PLANT IMPROVEMENTS

TEXAS A+M UNIVERSITY CORPUS CHRISTI
223 N. CHAPARRAL
CORPUS CHRISTI, TEXAS

PROJECT #: 22159
FILE NAME: CHAPARRAL
DRAFTING BY: CEG
CHECKED BY: JAR
DATE: MAY 12, 2023

SHEET NUMBER:
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SHT. No. of

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