CONSTRUCTION INVITATION FOR BID

RFP# AAHC 25-2

MILLER MANOR
STRUCTURAL REPAIR AND ROOF REPLACEMENT

ANN ARBOR HOUSING COMMISSION

Issue Date: Monday, March 10, 2025
Due Date: Wednesday, June 4, 2025, 3:00 p.m. (EST)

Issued By:

Ann Arbor Housing Commission
2000 S. Industrial Hwy
Ann Arbor, MI 48104

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SECTION I - GENERAL INFORMATION

A. OBJECTIVE

This Invitation for Bid (IFB) is being issued by the Ann Arbor Housing Commission (AAHC), a Michigan Public Body Corporate. This IFB is issued by the Ann Arbor Housing Commission, and a contract will ultimately be signed with a wholly owned subsidiary organization of the AAHC, called the Ann Arbor Housing Development Corporation (AAHDC). The purpose of this Invitation for Bid (IFB) is to select a firm to do renovations at Miller Manor. This will include structural reinforcement of the balconies, replacing the roof including increasing the roof insulation, changing the access door height, tuck-pointing the masonry as necessary, replacing the solar panels, and running two radon mitigation systems with two taps each.

B. QUESTIONS AND CLARIFICATIONS / DESIGNATED CONTACTS

All questions regarding this Invitation for Bid (IFB) shall be submitted via e- mail. Questions will be accepted and answered in accordance with the terms and conditions of this IFB.

All questions shall be submitted on or before May 22, 2025 at 3:00 p.m. (local time), and should be addressed as follows:

Scope of Work/Proposal Content IFB 25-2 Questions and shall be e-mailed to **Tom Pierce, Designated Contact, TPierce@a2gov.org**

Should any prospective bidder be in doubt as to the true meaning of any portion of this IFB, or should the prospective bidder find any ambiguity, inconsistency, or omission therein, the prospective bidder shall make a written request for an official interpretation or correction by the due date for questions above.

All interpretations, corrections, or additions to this IFB will be made only as an official addendum that will be posted to www.a2gov.org/housingcommission and it shall be the prospective bidder's responsibility to ensure they have received all addenda before submitting a proposal. Any addendum issued by the AAHC shall become part of the RFP and must be incorporated in the proposal where applicable.

C. PRE-PROPOSAL MEETING

A mandatory pre-proposal walk-through for this project will be held **at Miller Manor (meeting will begin in the Lobby).** During the meeting prospective bidders will have the opportunity to walk the property and ask questions**.** Administrative and technical questions regarding this project will be answered at this time. The pre- proposal meeting is for information only. Any answers furnished will not be official

until verified in writing by the Ann Arbor Housing Commission and posted at www.A2gov.org/Housingcommission. Answers that change or substantially clarify the proposal will be affirmed in an addendum.

Where:	**Miller Manor**
Date:	Wednesday, April 2, 2025
Time:	10:00 a.m.
Address:	727 Miller Ave. Ann Arbor, MI 48103

Parking: On-site parking is reserved for residents. There is street parking on Miner St.

D. PROPOSAL FORMAT

To be considered, each firm must submit a response to this IFB using the format provided in Section III. No other distribution of proposals is to be made by the prospective bidder. An official authorized to bind the bidder to its provisions must sign the proposal. Each proposal must remain valid for at least one hundred and twenty (120) days from the due date of this IFB.

Proposals should be prepared simply and economically providing a straightforward, concise description of the bidder's ability to meet the requirements of the IFB. Mistakes may be crossed out and corrected and must be initialed in ink by the person signing the proposal.

E. SELECTION CRITERIA

The contract will be awarded to the lowest responsive bidder. The AAHC reserves the right to contact the bidder to ask questions to clarify information in the bid.

F. SEALED PROPOSAL SUBMISSION

All proposals are due and must be delivered via email to Tom Pierce, TPierce@a2gov.org, on or before, June 4 at 3:00 p.m. (EST). Proposals submitted late or via facsimile will not be considered or accepted.

Each respondent must submit:

- **One (1) digital copy of the proposal as one file in PDF format**

Proposals submitted should be clearly marked: **"IFB No. AAHC 25-2 – Miller Manor Structural Repair and Roof Replacement"** and list the bidder's name and address.

All proposals received on or before the due date will be recorded on the due date. No immediate decisions will be rendered.

Bidders are responsible for submission of their proposal. Additional time will not be granted to a single prospective bidder. However, additional time may be granted to all prospective bidders at the discretion of the Ann Arbor Housing Commission.

Each person signing the proposal certifies that they are a person in the bidder's firm/organization responsible for the decisions regarding the fees being offered in the Proposal and has not and will not participate in any action contrary to the terms of this provision.

G. DISCLOSURES

Under the Freedom of Information Act (Public Act 442), the AAHC is obligated to permit review of its files, if requested by others. All information in a proposal is subject to disclosure under this provision. This act also provides for a complete disclosure of contracts and attachments thereto.

H. TYPE OF CONTRACT

A sample of the Contract is included as Attachment D. Those who wish to submit a proposal to the Ann Arbor Housing Commission should review this sample **a**greement carefully. The Ann Arbor Housing Commission will not entertain changes to its Contract

The Ann Arbor Housing Commission reserves the right to award the total proposal, to reject any or all proposals in whole or in part, and to waive any informality or technical defects if, in the Ann Arbor Housing Commission's sole judgment, the best interests of the Ann Arbor Housing Commission will be so served.

This IFB and the selected bidder's response thereto shall constitute the basis of the scope of services in the contract by reference.

I. COST LIABILITY

The AAHC assumes no responsibility or liability for costs incurred by the bidder prior to the execution of an Agreement. The liability of the AAHC is limited to the terms and conditions outlined in the Agreement. By submitting a proposal, the bidder agrees to bear all costs incurred or related to the preparation, submission, and selection process for the proposal.

J. DEBARMENT

Submission of a proposal in response to this IFB is certification that the Respondent is not currently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from participation in this transaction by any State or Federal

departments or agency. Submission is also agreement that the AAHC will be notified of any changes in this status.

N. PROPOSAL PROTEST

All proposal protests must be in writing and filed with the AAHC Executive Director within five (5) business days of the award action (Jennifer Hall, jhall@a2gov.org). The bidder must clearly state the reasons for the protest.

Any inquiries or requests regarding this procurement should be only submitted in writing to the Designated Contact provided herein. Attempts by the bidder to initiate contact with anyone other than the Designated Contact provided herein that the bidder believes can influence the procurement decision, e.g., Elected Officials, City Administrator, Selection Committee Members, Appointed Committee Members, etc., may lead to immediate elimination from further consideration.

O. SCHEDULE

The following is the schedule for this IFB process (subject to change).

Activity/Event	**Anticipated Date**
Pre-Proposal Meeting	April 2, 2025, at 10:00 PM (EST)
Written Question Deadline	May 22, 2025, at 3:00 PM (EST)
Addenda Published (if needed)	Week of May 26, 2025
Proposal Due Date	June 4, 2025, at 3:00 PM (EST)
Selection	Week of June 16, 2025
Expected AAHC Authorizations	Week of June 23, 2025

The above schedule is for information purposes only and is subject to change at the AAHC's discretion.

P. IRS FORM W-9

The selected bidder will be required to provide the Ann Arbor Housing Commission with an IRS form W-9.

Q. RESERVATION OF RIGHTS

1. The Ann Arbor Housing Commission reserves the right in its sole and absolute discretion to accept or reject any or all proposals, or alternative proposals, in whole or in part, with or without cause.
2. The Ann Arbor Housing Commission reserves the right to waive, or not waive, informalities or irregularities in terms or conditions of any proposal if determined by the Ann Arbor Housing Commission to be in its best interest.

3. The Ann Arbor Housing Commission reserves the right to request additional information from any or all bidders.
4. The Ann Arbor Housing Commission reserves the right to reject any proposal that it determines to be unresponsive and deficient in any of the information requested within IFB.
5. The Ann Arbor Housing Commission reserves the right to determine whether the scope of the project will be entirely as described in the IFB, a portion of the scope, or a revised scope be implemented.
6. The Ann Arbor Housing Commission reserves the right to select one or more contractors or service providers to perform services.
7. The Ann Arbor Housing Commission reserves the right to retain all proposals submitted and to use any ideas in a proposal regardless of whether that proposal is selected. Submission of a proposal indicates acceptance by the firm of the conditions contained in this IFB, unless clearly and specifically noted in the proposal submitted.
8. The Ann Arbor Housing Commission reserves the right to disqualify proposals that fail to respond to any requirements outlined in the IFB, or failure to enclose copies of the required documents outlined within the IFB.

R. ENVIRONMENTAL COMMITMENT

The Ann Arbor Housing Commission recognizes its responsibility to minimize negative impacts on human health and the environment while supporting a vibrant community and economy. The Ann Arbor Housing Commission further recognizes that the products and services the Ann Arbor Housing Commission buys have inherent environmental and economic impacts and that the Ann Arbor Housing Commission should make procurement decisions that embody, promote, and encourage the City of Ann Arbor's commitment to the environment.

The Ann Arbor Housing Commission encourages potential vendors to bring forward emerging and progressive products and services that are best suited to the City of Ann Arbor's environmental principles.

S. MAJOR SUBCONTRACTORS

The Bidder shall identify each major subcontractor it expects to engage for this Contract if the work to be subcontracted is 15% or more of the bid sum or over $50,000, whichever is less. The Bidder shall not change or replace a major subcontractor without approval by the Ann Arbor Housing Commission.

SECTION II - SCOPE OF WORK

Project design specifications are attached as Attachments A, B, and C.

A. SCOPE OF WORK

The project involves major exterior renovations to Miller Manor. As mentioned above, the specifics are in Attachments A, B, and C, but the following is a general outline of the scope of work.

1. Fabrication of steel support for all the exterior balconies. The fabricated panels shall include Unistrut on them for installation of radon stacks.
2. Tuck-pointing masonry as necessary.
3. Installation of the steel support panels.
4. Careful removal of existing solar panels for reuse on the lower roof.
5. Careful removal of all roof top units and reinstallation following the roof replacement.
6. Removal and replacement of the roof with either EPDM or modified bituminous roofing (bid both ways and to be determined).
7. Increase the roof insulation to a minimum of R-30. This will raise the roof height approximately 4 ½″
8. Install a new solar array similar to the existing system.

B. POST AWARD NEXT STEPS WITH SELECTED BIDDER

1. Visit the project site in May 2025 with AAHC staff and agree on a preliminary scope of construction.

2. Review any drawings, specifications, reports, etc. provided by AAHC staff on the proposed project.

3. Develop and agree on a final scope of construction together with the AAHC and the AAHC's engineer.

4. Apply for and obtain all necessary permits.

5. Perform all work necessary.

6. Ann Arbor Housing Commission staff will review all work prior to final sign off on invoices. Contractor to address all identified deficiencies in the work.

7. Contractor to provide final documentation for all time and materials. Ann Arbor Housing Commission will release any retainage held until the work is completed,

inspections are completed, and permits are closed.

C. REQUIREMENTS

1. Ability to work effectively with the AAHC's staff and residents with respect to any of the construction services required by the Ann Arbor Housing Commission.

2. Ability to work effectively with other City of Ann Arbor units and regulatory agencies.

3. The ability to function in a support role to the Ann Arbor Housing Commission.

D. STANDARD SPECIFICATIONS

As of the date of this IFB, all work performed under this Contract shall be performed in accordance with all applicable codes. This is subject to change and the codes enforced at the time of construction by the City of Ann Arbor will govern.

SECTION III - MINIMUM INFORMATION REQUIRED

PROPOSAL FORMAT

The following describes the elements that should be included in each of the proposal sections that will be used for evaluation of the proposals.

Bidders should organize Proposals into the following Sections:

A. Bid Form (Attachment F)
B. Legal Status of Bidder (Attachment E)
C. Other Attachments (Any Additional Documents if Applicable and Attachments H and I)

A. Bid Form

The proposal price shall include materials and equipment selected from the designated items and manufacturers listed in the bidding documents. This is done to establish uniformity in bidding and to establish standards of quality for the items named.

If the bidder wishes to quote alternate items for consideration by the Ann Arbor Housing Commission, it may do so under this Section. A complete description of the item and the proposed price differential must be provided. Unless approved at the time of award, substitutions where items are specifically named will be considered only as a negotiated change in Contract Sum.

Consideration of any proposed alternative items or time may be negotiated at the discretion of the Ann Arbor Housing Commission.

B. Attachments

Legal Status of Bidder (Attachment E) and any additional attachments shall be completed and included as attachments to the proposal submission. Major subcontractors shall also be identified as an attachment.

ADDENDA

If it becomes necessary to revise any part of the , notice of the addendum will be posted to the Ann Arbor Housing Commission's website www.a2gov.org/housingcommission for all parties to download.

Each bidder should acknowledge in its proposal all addenda it has received. The failure of a bidder to receive or acknowledge receipt of any addenda shall not relieve the bidder of the responsibility for complying with the terms thereof. The Ann Arbor Housing

Commission will not be bound by oral responses to inquiries or written responses other than official written addenda.

PROPOSAL EVALUATION

1. The Ann Arbor Housing Commission reserves the right to reject any proposal that it determines to be unresponsive and deficient in any of the information requested for evaluation.

2. The responsible bidder whose bid, conforming with all the material terms and conditions of the IFB, and has the lowest price will be considered the successful offeror. Should there be a tie in price, success will be determined randomly by drawing lots.

3. The Ann Arbor Housing Commission will not award any contract until the prospective contractor has been determined to be responsible. This determination shall be based on the following criteria:
    - Having adequate financial resources to perform the contract, or the ability to obtain them.
    - Being able to comply with the proposed performance schedule considering the bidder's other commitments.
    - Having a satisfactory performance record.
    - Having a satisfactory record of integrity and business ethics.
    - Having the necessary organization, experience, accounting and operational controls, and technical skills, or the ability to obtain them.
    - Having the necessary production, construction, and technical equipment and facilities, or the ability to obtain them.
    - Being otherwise qualified and eligible to receive an award under applicable laws and regulations, including not being suspended, debarred or under a HUD-imposed Limited Denial of Participation.

4. If deemed necessary, the committee will schedule an interview with the successful offeror for the sole purpose of determining if the successful offeror is responsible as described in paragraph 3 of this section.

5. The interview should include project team members expected to work on the project, but no more than six members total. The interview may consist of a presentation of up to thirty minutes (or the length provided by the committee) by the bidder, including the person who will be the project manager on this contract, followed by questions and answers. The committee may record the oral interviews.

6. If a prospective contractor is found to be non-responsible, a written determination of non-responsibility shall be prepared and included in the official contract file, and the prospective contractor shall be advised of the reasons for the determination.

7. Upon being determined responsible and upon the approval of the AAHC Board, the successful offeror will be awarded a fixed-rate lump sum contract. The successful bidder will be required to provide all insurance listed in the contract as well as a Performance Bond.

SECTION IV – ATTACHMENTS

Attachment A – Miller Manor Apartments Exterior Balconies Structural Repair

Attachment B – Miller Manor Apartments Roof Replacement

Attachment C – Solar Photovoltaic System

Attachment D–Radon Mitigation Minimum Specifications

Attachment E – Sample Contract

Attachment F – Legal Status of Bidder

Attachment G – Bid Form

Attachment H – City of Ann Arbor Declaration Non-Discrimination Ordinance

Attachment I – Living Wage Declaration of Compliance Form

Attachment J – Vendor Conflict of Interest Disclosure Form

Attachment K – City of Ann Arbor Non-Discrimination Ordinance Poster

Attachment L – Living Wage Poster

Attachment A

Miller Manor Apartments Exterior Balconies Structural Repair

PROJECT MANUAL

MILLER MANOR APARTMENTS EXTERIOR BALCONY STRUCTURAL REPAIRS

Prepared for:

The Ann Arbor Housing Development Corporation

OWNER REVIEW

Project No: 13774.001

Issue date: April 29, 2024

Prepared by:

SMITHGROUP

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DIVISION 11 - EQUIPMENT

NOT APPLICABLE

DIVISION 12 - FURNISHINGS

NOT APPLICABLE

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NOT APPLICABLE

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NOT APPLICABLE

DIVISION 21 - FIRE SUPPRESSION

NOT APPLICABLE

DIVISION 22 - PLUMBING

NOT APPLICABLE

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

NOT APPLICABLE

DIVISION 25 - INTEGRATED AUTOMATION

NOT APPLICABLE

DIVISION 26 - ELECTRICAL

NOT APPLICABLE

DIVISION 27 - COMMUNICATIONS

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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

NOT APPLICABLE

DIVISION 31 - EARTHWORK

NOT APPLICABLE

DIVISION 32 - EXTERIOR IMPROVEMENTS

NOT APPLICABLE

DIVISION 33 - UTILITIES

NOT APPLICABLE

DIVISION 34 - TRANSPORTATION

NOT APPLICABLE

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

NOT APPLICABLE

DIVISION 40 - PROCESS INTEGRATION

NOT APPLICABLE

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

NOT APPLICABLE

DIVISION 42 - PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

NOT APPLICABLE

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

NOT APPLICABLE

DIVISION 44 - POLLUTION CONTROL EQUIPMENT

NOT APPLICABLE

DIVISION 45 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

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DIVISION 46 - WATER AND WASTEWATER EQUIPMENT

NOT APPLICABLE

DIVISION 48 - ELECTRICAL POWER GENERATION

NOT APPLICABLE

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

1. G0.0 PROJECT COVER SHEET
2. A0.1 ARCHITECTURAL ABBREVIATIONS AND SYMBOLS
3. A1.1.1 SITE PLAN
4. A2.2.1 ROOF PLAN
5. A4.1.1 NORTH AND SOUTH ELEVATIONS
6. A4.1.2 EAST AND WEST ELEVATIONS
7. A4.1.3 ENLARGED PLANS
8. A4.1.4 ENLARGED ELEVATIONS
9. A5.1.1 TYPE A REPAIR DETAILS
10. A5.1.2 TYPE B REPAIR DETAILS
11. A5.1.3 TYPE C REPAIR DETAILS
12. A5.1.4 TYPE D REPAIR DETAILS
13. A5.1.5 TYPE E REPAIR DETAILS
14. A5.1.6 TYPE F REPAIR DETAILS
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16. A5.2.1 REFERENCE PHOTOS
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19. S5.1.2 TYPE B REPAIR DETAILS
20. S5.1.3 TYPE C REPAIR DETAILS
21. S5.1.4 TYPE D REPAIR DETAILS
22. S5.1.5 TYPE E REPAIR DETAILS

END OF DOCUMENT 000115

DOCUMENT 004322 - UNIT PRICES FORM

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: Miller Manor Apartments Exterior Balcony Structural Repairs.

C. Project Location: 727 Miller Avenue, Ann Arbor, Michigan 48104.

D. Owner: The Ann Arbor Housing Development Corporation.

E. Owner Project Number: _____.

F. Architect: SmithGroup.

G. Architect Project Number: 13774.001.

1.2 BID FORM SUPPLEMENT

A. This form is required to be attached to the Bid Form.

B. The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work.

1.3 UNIT PRICES

A. Unit-Price No. 1: Repoint Brick Mortar joint.
1. _____ dollars ($_____) per unit Linear Foot.

B. Unit-Price No. 2: Remove and Replace Existing Brick.
1. _____ dollars ($_____) per unit Each.

C. Unit-Price No. 3: Remove and Replace Existing Sealant.
1. _____ dollars ($_____) per unit Linear Foot.

D. Unit-Price No. 4: Install Helix Anchor.
1. _____ dollars ($_____) per unit Each.

E. Unit-Price No. 5: Install Control Joint.
1. _____ dollars ($_____) per unit Linear Foot.

1.4 SUBMISSION OF BID SUPPLEMENT

A. Respectfully submitted this ____ day of _____, <Insert year>.

B. Submitted By:_____(Insert name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

END OF DOCUMENT 004322

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Section 004322 Unit Price Form.

1.2 DEFINITIONS

A. Unit price is applicable during the duration of the Work as a price per unit of measurement for materials, equipment and installation for a portion of the Work added to or deducted from the Contract Sum if the scope of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement, Description and Payment: Refer to Schedule of Unit Prices below for methods of payment for unit prices.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Repoint Brick Mortar joint.
   1. Description: Work includes removing deteriorated and sound mortar to form joint for repointing.
   2. Unit of Measurement: Linear Foot .

B. Unit Price No. 2: Remove and Replace Existing Brick.
   1. Description: Work includes replacement brick and mortar.
   2. Unit of Measurement: Each.

C. Unit Price No. 3: Remove and Replace Existing Sealant.
   1. Description: Remove existing sealant, form or modify joint and prepare and install sealant.
   2. Unit of Measurement: Linear Foot

D. Unit Price No. 4: Install Helix Anchor.
   1. Description: At locations outside base bid work, install helix anchor in mortar joints to anchor face brick to CMU back up wall.
   2. Unit of Measurement: Each

E. Unit Price No. 5: Install Control Joint.
   1. Description: Form control joint in existing masonry and install sealant and backer.
   2. Unit of Measurement: Linear Foot

END OF SECTION

SECTION 040120.63 - MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repairing brick masonry, including replacing units.

1.2 UNIT PRICES

A. Refer to Section 012200 "Unit Prices" for replacement of brick and repointings not included in the base bid work.

1.3 PREINSTALLATION MEETINGS

1.4 Preinstallation Conference: Conduct conference at Project site. SUBMITTALS

A. Samples: Brick and mortar for initial selection and final approved samples.

B. Mortar mix design.

1.5 QUALITY ASSURANCE

A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: As required to complete brick masonry repair work.
   1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.

B. Concrete Masonry Unit: 8" x 16" Corner Concrete Block.

2.2 MORTAR MATERIALS

A. Prepackaged Mortar: Prepackaged bag mixes are allowed with prior approval of mix design and Sample.

B. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.

C. Mortar Sand: ASTM C 144.
   1. Exposed Mortar: Match size,texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
   2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

2.3 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Mixes: Repointing and setting mortars are similar.

2.4 Grout: Bag grout mix.

2.5 CMU COATING

A. Coating: Thorolastic by Sika, owner to select color.

PART 3 - EXECUTION

3.1 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Support and protect remaining masonry that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole bricks as possible.
   1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
   2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.

F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.

G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.

H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
   1. Maintain joint width for replacement units to match existing joints.

I. Lay replacement brick with mortar in completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
   2. Rake out existing damaged mortar in areas adjacent to areas of replaced brick and repoint concurrent with laying replacement brickWhen mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
   3. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.2 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of structural-steel components.
   1. Prepare erection drawings, complete with all necessary plans, elevation and sections, to indicate Column Type and each column location on building elevation views.
   2. Indicate on details of all pieces, principal column grid lines where members are located.
   3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   4. Include setting drawings and direction for installation of anchor rods and other anchorages embedded in concrete.
   5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

1.3 INFORMATIONAL SUBMITTALS

A. Sequence of structural steel erection utilizing elevation views.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength bolt-nut-washer assemblies.
   4. Welding filler metals and fluxes.
   5.
   6. Galvanizing.
   7. <Insert product>.

1.4 QUALITY ASSURANCE

A. Require fabricator shall maintain an agreement with an independent testing agency to conduct periodic in-plant inspection at the fabricator’s plant, at a frequency that will assure fabricator’s quality conformance equivalent to AISC-Certified Plan, Category STD. Submit certificate from independent testing agency upon request.

B. Employ a steel erector who has had 5 years of successful experience in erection of structural steel and is able to furnish evidence of erector’s ability, facilities, proficiency of erector’s personnel and completed projects.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

4. Do not store material on structure that might cause distortion, damage or overload to members or supporting structures. Repair or replace damaged materials or structures as directed by the Architect.

1.6 COORDINATION

A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.7 PROJECT CONDITIONS

A. Measurements:
1. Make such field measurements as are necessary to lay out the Work properly.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Plate and Bar: ASTM A 36/A 36M (345) (345).

2.2 BOLTS, CONNECTORS, ANCHORS AND ACCESSORIES

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
1. Finish: Mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Mechanically deposited zinc coating.

D. Unistrut, 12 gage solid strut channel, P-3300.

E. Threaded Rods: ASTM A 36/A 36M (345).
1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: (ASTM F 436M)ASTM A 36/A 36M] carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.3 PRIMER

A. Galvanizing Repair Paint: ASTM A 780.

2.4 FABRICATION

A. Structural Steel: Fabricate and assemble columns in shop. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. All provisions of AWS D1.1 apply to welds.
4. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

B. High Strength Steel Bolting.
1. Joints subjected to fatigue load with reversal of loading direction.
2. Joints installed in oversized holes.
3. Joints that utilize slotted hole except those with applied load normal to long dimension of the slot.
4. Joints in which slip at the faying surface would be detrimental to the performance of the structure.
5. Joints in which fastener pretension is required in the governing code or specification.
6. Joints subjected to load reversal.

7. Joints subjected to fatigue load with no reversal of loading.
8. Joints with ASTM A325 or F1852 bolts subjected to tensile fatigue. Joints with ASTM (5) A490 bolts that are subjected to tension, or combined shear and tension, with or without fatigue.
   a. ST joints are permitted for all other application and should be used whenever possible.
   b. Mixing of A325 and A490 bolts of same diameter should be avoided to assure that bolts are installed in proper locations.
   c. Do not use A490 bolts larger than one inch diameter in SC joint as torque required to install these is beyond the commonly available wrenches.
   d. Coordinate and indicate on drawing joint types.
9. Shop install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM A325 or A490 Bolts• • for type of bolts and type of joint as indicated.
   a. Snug tightened joints (ST): Bearing type connections based on allowable stresses with threads included in shear plane (Type N). Faying surfaces and surfaces adjacent to bolt heads and nuts shall be free of dirt and other foreign material.

C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces.
2. Baseplate Holes: Cut, drill or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Safeguard against warpage and distortion during galvanizing in accordance with ASTM A384.
2. Where welding is required after galvanizing, conform to AWS D19.0 “” Welding of Zinc Coated Steel. Perform welding in well-ventilated area.

B. Install Unistrut to face of column prior to galvanizing entire assembly.
1. On bolts, nuts, and washers: ASTM B695, Class 50.
2. Galvanizing Repair paint: ASTM A780.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Owner may engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel fabricator and erector present, elevations of bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements prior to fabrication.
1. Prepare shop drawings based on a survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
2. Coordinate storage of structural steel on site with owner.
3. Coordinate erection of structural steel with fabricator and owner.
4. Use the elevation views to create sequence of erection.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Comply with OSHA 29 CFR 1926, and all state, city and municipal laws for steel erection.

C. In planning the method of erection, make full allowance for obstructions encountered which may result from work performed by other trades as well as the operations of the Owner.

D. In planning the method of plumbing the structure, make allowance for temperature difference between time of erection and mean operating temperature of structure when completed. Take into account differential temperature effects on column lengths in plumbing when tall frames are subjected to strong sun exposure on one side.

E. Furnish and deliver to the job site anchor rods (bolts), and templates for setting the anchor rods (bolts).
1. Any special erection considerations that are required by design such as shores, jacks or load that must be adjusted during erection, etc.

F. Base Bearing and Leveling Shims : Clean concrete and masonry-bearing surfaces prior to setting shims.

G. Set plates for structural members on shims as required.

H. of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

I. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

J. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

K. Splice members only where indicated.

L. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

M. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to inspect high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.

1.2 UNIT PRICES

1.3 Refer to Section 012200 "Unit Prices" for replacement of damaged joint sealant not included in the base bid work.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Provide the following upon request:
   1. Qualification Data: For qualified Installer.
   2. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section. Mockups can become part of permanent installation if approved.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer (5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing in accordance with ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Colors of Exposed Joint Sealants: **As selected by Architect/Owner's representative from manufacturer's full range**.

2.2 SILICONE JOINT SEALANTS

A. Sealant JS-S1 - Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide products from the following table that has a validation certificate from the Sealant, Waterproofing and Restoration Institute (SWRI).

			Substrate Primer Required: Yes/No/Test			
Manufacturer	Product	Manufacturer Rated Movement Capability (CLASS)	Mortar*	Anod. Alum.	Uncoated Glass	Other**
Dow Inc.	Dowsil 791	± 50%	Yes	Test	No	Test
Dow Inc.	Dowsil 795	± 50%	No	Yes	No	Test
Dow Inc.	Dowsil 756 SMS	± 50%	No	Yes	No	Test
Sika Corporation	Sikasil 295	± 50%	Yes	Test	No	Test
Momentive Performance Materials, Inc.	Silpruf SCS2000	± 50%	Yes	Test	No	Test
Momentive Performance Materials, Inc.	SCS9000 Silpruf NB	± 50%	Yes	Test	No	Test
Pecora Corporation	864	± 50%	Yes	Test	No	Test
Pecora Corporation	895	± 50%	Yes	Test	No	Test
Tremco Incorporated	Spectrem 3	± 50%	Yes	Test	No	Test
Tremco Incorporated	Spectrem 4-TS	± 50%	Yes	Test	No	Test

Table Notes:
* Indicates substrates with a cement component, such as concrete, that require use of a primer.
** Indicates that other substrates shall be tested for adhesion to determine if a primer will be required.

2.3 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin)Type O (open-cell material)Type B (bicellular material with a surface skin)or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated] and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
      a. .
      b. .

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

C. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces. Water-based tooling agents are unacceptable.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

Attachment B

Miller Manor Apartments Roof Replacement

PROJECT MANUAL

MILLER MANOR APARTMENTS ROOF REPLACEMENT

Prepared for:

The Ann Arbor Housing Development Corporation

CONSTRUCTION DOCUMENTS

Project No: 15337.000

Issue date: October 11, 2024

Prepared by:

SMITHGROUP

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DOCUMENT 004322 - UNIT PRICES FORM

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: Miller Manor Apartments Roof Replacement .

C. Project Location: 727 Miller Avenue, Ann Arbor, Michigan 48104.

D. Owner: The Ann Arbor Housing Development Corporation.

E. Owner Project Number: _____.

F. Architect: SmithGroup.

G. Architect Project Number: 15337.000.

1.2 BID FORM SUPPLEMENT

A. This form is required to be attached to the Bid Form.

B. The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work.

1.3 UNIT PRICES

A. Unit-Price No. 1: Repoint Brick Mortar Joint.
1. _____ dollars ($_____) per unit Linear Foot.

B. Unit-Price No. 2: Remove and Replace Existing Brick.
1. _____ dollars ($_____) per unit Each.

C. Unit-Price No. 3: Remove and Replace Existing Sealant.
1. _____ dollars ($_____) per unit Linear Foot.

D. Unit-Price No. 4: Install Walking Pad (EPDM Roof System).
1. _____ dollars ($_____) per unit Each.

E. Unit-Price No. 5 : Install Walking Pad (Modified Bituminous Roofing System).
1. _____ dollars ($_____) per unit Each.

1.4 SUBMISSION OF BID SUPPLEMENT

A. Respectfully submitted this ____ day of _____, <Insert year>.

B. Submitted By:_____(Insert name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

END OF DOCUMENT 004322

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Section 004322 Unit Price Form.

1.2 DEFINITIONS

A. Unit price is applicable during the duration of the Work as a price per unit of measurement for materials, equipment and installation for a portion of the Work added to or deducted from the Contract Sum if the scope of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement, Description and Payment: Refer to Schedule of Unit Prices below for methods of payment for unit prices.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Repoint Brick Mortar Joint.
   1. Description: Work includes removing deteriorated and sound mortar to form joint and repoint. Refer to Specification Section 040120.63 for mortar used in repointing.
   2. Unit of Measurement: Linear Foot .

B. Unit Price No. 2: Remove and Replace Existing Brick.
   1. Description: Work includes removing existing brick and installing contractor supplied replacement brick.
   2. Unit of Measurement: Each.

C. Unit Price No. 3: Remove and Replace Existing Sealant.
   1. Description: Remove existing sealant, form or modify existing joint, prepare joint and install sealant.
   2. Unit of Measurement: Linear Foot

D. Unit Price No. 4: Install Walking Pad (EPDM Roof System).
   1. Description: At locations outside of base bid work, prep membrane and install similar base bid wallking pad.
   2. Unit of Measurement: Each

E. Unit Price No. 5: Install Walking Pad (Modified-Bituminous Roof System.
   1. Description: At locations outside of base bid work, prep membrane and install similar base bid walking pad.
   2. Unit of Measurement: Each

END OF SECTION

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction, including associated attachments, supports, bracing, etc., and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Replace: Detach items from existing construction, including associated attachments, supports, bracing, etc., and replace as indicated in the contract documents.

C. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

D. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

E. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property , for environmental protection, for dust controland, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's tenants' and building operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Selective demolition includes the removal and reinstallation of photovotaic panels, supports, ballast and wiring/conduits, etc,.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

B. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
2. Do not use cutting torches.
3. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
4. Dispose of demolished items and materials promptly.

B. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Protect items from damage during transport and storage.
3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
   1. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be[reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site[and legally dispose of them in an EPA-approved landfill].
   1. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   2. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 040120.63 - BRICK MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repairing brick masonry, including replacing units.

1.2 UNIT PRICES

A. Refer to Section 012200 "Unit Prices" for replacement of brick and repointings not included in the base bid work.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Samples: Brick and mortar for initial selection and final approved samples.

B. Mortar mix design.

1.5 QUALITY ASSURANCE

A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: As required to complete brick masonry repair work.
   1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.

B. Lintel: Hot-Dipped galvanized steel, size and thickness to match existing.

2.2 MORTAR MATERIALS

A. Prepackaged Mortar: Prepackaged bag mixes are allowed with prior approval of mix design and Sample.

B. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; white or gray, or both where required for color matching of mortar.

C. Mortar Sand: ASTM C 144.
   1. Exposed Mortar: Match size,texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
   2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

2.3 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Mixes: Repointing and setting mortars are similar.

C. Grout: Bag grout mix.

PART 3 - EXECUTION

3.1 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Support and protect remaining masonry that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole bricks as possible.
   1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
   2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.

F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.

G. Replace removed damaged brick with other removed brick in good condition, where possible, matching existing brick. Do not use broken units unless they can be cut to usable size.

H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
   1. Maintain joint width for replacement units to match existing joints.

I. Lay replacement brick with mortar in completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
   2. Rake out existing damaged mortar in areas adjacent to areas of replaced brick and repoint concurrent with laying replacement brickWhen mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
   3. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.2 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.

END OF SECTION

SECTION 055020 - FREESTANDING GUARDRAIL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof edge protection.

1.2 SUBMITTALS

A. Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Drawings showing plans, location of guardrail, elevations, sections and details of components.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in good condition and adequately protected against damage as handrails are a finished product.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

1.5 WARRANTY

A. Warranty: Provide manufacturer's two (2) year warranty.

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, the following:
   1. Garlock Safety Systems - RailGuard 200 Fit-Rite Safety Rail
   2. Safety Rail Co. - Accu-Fit Rail System
   3. Leading Edge Safety - Ballasted Guardrail System
   4. Or Approved Equal.

B. Products shall be compatible with the existing roofing system manufacturer's requirements.

2.2 SYSTEMS

A. Roof Edge Protection: Provide freestanding guardrail system on roof, including pipe railings, uprights, bases, and fittings.
   1. Standards: System shall have top and mid rail in accordance with OSHA Standards - 29 CFR 1910.23 (a)(2).
   2. Structural Load: 200 lb, minimum, in any direction to all components in accordance with OSHA Regulation 29 CFR 1926.502.
   3. Height:
      a. Top Rail: 42 inches.
      b. Mid Rail: 21 inches.
   4. Layout: As indicated on Drawings.
   5. Mounting Bases: Gray iron material cast with receiver posts. Provide rubber pads on bottom of bases.
   6. Receiver Posts: Shall have a positive locking system into slots that allow rails to be mounted in any direction. Receiver posts shall have drain holes.

B. FINISHES
   1. Finish: Hot dipped galvanized.

C. FABRICATION
   1. Assemble components with joints tightly fitted and secured. Accurately form components to suit installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking, Cants, Nailers and Sleepers

PART 2 - PRODUCTS

1. Dress lumber, S4S, unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Rooftop equipment bases and support curbs.
   2. Wood Blocking, Cants, Nailers and Sleepers

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

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

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
   3. ICC-ES evaluation report for fastener.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 070150.19 - PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof tear-off.

1.2 MATERIALS OWNERSHIP

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

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Existing Membrane Roofing System: EPDM roofing membrane, roof insulation, ballast, walking paths and components and accessories above the concrete deck.

C. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.

D. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.4 QUALITY ASSURANCE

A. Reroofing Conference: Conduct conference at Project site.
1. Review methods and procedures related to roofing system tear-off and replacement including, but not limited to, the following:
   a. Reroofing preparation, including membrane roofing system manufacturer's written instructions.
   b. Existing roof drains and roof drainage during each stage of reroofing, and roof drain plugging and plug removal requirements.
   c. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   d. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
   e. Structural loading limitations of deck during reroofing.
   f. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.
   g. HVAC shutdown and sealing of air intakes.
   h. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
   i. Existing conditions that may require notification of Architect before proceeding.

B. Provide the following upon request:
1. 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. Submit before Work begins.

1.5 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
1. Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.

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

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

D. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
1. The results of an analysis of test cores from existing membrane roofing system are available for Contractor's reference.

2. Construction Drawings for existing roofing system are provided for Contractor's reference. Contractor is responsible for conclusions derived from existing documents.

E. Refer to Sheet S0.1 for limits of construction loads during reroofing.

F. 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.

G. Hazardous Materials: It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.1 TEMPORARY ROOFING MATERIALS

A. Design and selection of materials for temporary roofing are responsibilities of Contractor.

2.2 AUXILIARY REROOFING MATERIALS

A. General: Auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new membrane roofing system.

B. Metal Flashing Sheet: Metal flashing sheet is specified in Section 076200 "Sheet Metal Flashing and Trim."

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

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

C. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

D. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

3.2 ROOF TEAR-OFF

A. General: Notify Owner each day of extent of roof tear-off proposed for that day.

B. Remove and discard aggregate ballast from roofing membrane.

C. Remove and discard walking paths and accessories from roofing membrane.

D. Roof Tear-Off: Remove existing roofing membrane and other membrane roofing system components down to the deck.

3.3 DECK PREPARATION

A. EInspect deck after[tear-off of membrane roofing system.

3.4 EXISTING BASE FLASHINGS

A. Remove existing flashings where indicated and when being replaced.
1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain.

3.5 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

SECTION 075216 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing.
2. Roof Air Barrier/Vapor retarder.
3. Roof insulation.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F, measured at the mop cart or mechanical spreader immediately before application.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Refer to Sheet S0.1 for uplift requirements.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:
1. Sheet roofing materials, including base sheet roofing membrane sheet and flashing sheet, of color specified.
2. Roof insulation.
3. Walkway pads or rolls.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is approved for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain roof components from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

F. Provide the following upon request:
1. Qualification Data: For qualified Installer.
2. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
a. Submit evidence of complying with performance requirements.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
4. Field quality control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store 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.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.9 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.
1. Special warranty includes membrane roofing, base flashings, fasteners, substrate board, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the 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, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. SBS-Modified Bituminous Membrane Roofing:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
a. GAF.
b. Siplast, Inc.
c. Soprema.

B. Roofing Membrane Sheet: ASTM D6163, Grade S, Type I, SBS-modified asphalt sheet reinforced with glass fibers; smooth surface; suitable for application specified.

C. Granule-Surface Roofing Membrane Cap Sheet: ASTM D 6163, Grade G, Type I , SBS-modified asphalt sheet reinforced with glass fibers; granular surfaced; suitable for application method specified, and as follows:
1. Granule Color: Black.

2.2 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6163, Grade S, Type I , SBS-modified asphalt sheet reinforced with glass fibers; smooth surfaced; suitable for application method specified.

B. Granule-Surfaced Flashing Sheet: ASTM D 6163, Grade G, Type I, SBS-modified asphalt sheet reinforced with glass fibers; granular surfaced; suitable for application method specified, and as follows:
1. Granule Color: Black.

2.3 AUXILIARY ROOFING MEMBRANE 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.
2. Verify adhesives and sealants comply with the following limits for VOC content:
a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesives: 80 g/L.
f. PVC Welding Compounds: 510 g/L.
g. Other Adhesives: 250 g/L.
h. Single-Ply Roof Membrane Sealants: 450 g/L.
i. Nonmembrane Roof Sealants: 300 g/L.
j. Sealant Primers for Nonporous Substrates: 250 g/L.
k. Sealant Primers for Porous Substrates: 775 g/L.

B. Asphalt Primer: ASTM D 41.

C. Roofing Asphalt: ASTM D 312, Type III or IV as recommended by roofing system manufacturer for application.

D. Roofing Asphalt: ASTM D 6152, SEBS modified.

E. Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.

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

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

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

I. Metal Flashing Sheet: As specified in Section 076200 "Sheet Metal Flashing and Trim."

J. 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.

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

L. Metal Termination Bar: Manufacturer's standard, predrilled holes at 6 inched on center, stainless steel or aluminum bars, approximately 1" x 1/8" thick.
1. Anchors: Tapcon masonry screws.

M. Reinforced Fluid Applied Flashing:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Soprema; Alsan RS 230 Flash system.
b. Siplast; Parapro Flashing System

2.4 ROOF AIR BARRIER / VAPOR RETARDER

A. Existing Concrete Roof Deck Application:
1. Self-Adhering-Sheet Roof Air Barrier/Vapor Retarder: Polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 32-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer as recommended by vapor-retarder manufacturer.
2. Self-Adhering Sheet Roof Air Barrier/Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer as recommended by vapor-retarder manufacturer.

2.5 ROOF INSULATION

A. General:
1. Preformed roof insulation boards manufactured or approved by roofing manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 3, coated glass facer on both major surfaces.
1. Board Size: 4'-0" x 4'-0"
2. Thickness: Two layers minimum, total minimum thichness as indicated on drawings. Provide a minimum aged thermal resistance of R5 (deg. F.h.sf/Btu) per inch.

C. Tapered Insulation: Provide factory-tapered insulation boards with identical characteristics as base insulation fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes with identical characteristics as base insulation where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

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

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

C. Wood Nailer Strips: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."

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

E. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

F. Cover Board:
1. ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch, factory primed.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Georgia-Pacific Corporation; Dens Deck Prime.
2. ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/2 inch thick.
   a. Products: Subject to compliance with requirements, provide the following:
      1) USG Corporation; Securock.

G. Substrate Joint Tape: 6- or 8-inch- wide, coated, glass-fiber joint tape.

H. Sprayed Polyurethane Foam: One- or two-component, foamed-in-place, closed cell polyurethane foam, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less in accordance with ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam manufacturer.

2.7 WALKWAYS

A. Walkway Pads: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface or Polymer-modified, reconstituted rubber pads with slip-resisting textured surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 3/8 inch, minimum thickness.
1. Pad Size: 2' x 2'.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. 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.

C. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. and allow primer to dry.

3.3 ROOF AIR BARRIER/VAPOR-RETARDER INSTALLATION

A. Existing Concrete Roof Deck Application:
1. Self-Adhering-Sheet air barrier/ vapor retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

B. Completely seal air barrier/vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing.

C. Provide an air tight transition to the wall air barrier.

3.4 INSULATION INSTALLATION

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

B. 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.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. 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.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

E. 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.
   1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   2. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together. Tape joints if required by roofing system manufacturer.
   1. Ahere cover boards to resist uplift pressure at corners, perimeter, and field of roof.
   2. Apply insulation adhesive to underside, and immediately bond cover board to insulation.

3.5 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane system in accordance with roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
   1. Deck Type: C (concrete).
   2. Adhering Method: L (cold-applied adhesive).
   3. Base Sheet: One.
   4. Cap Sheet: One.
   5. Cap Sheet Surfacing Type: A (aggregate).

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

C. 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.

D. 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 BASE-SHEET INSTALLATION

A. Install lapped base-sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
   1. Mechanically fasten top of base sheet to substrate.
   2. Adhere to substrate in a uniform coating of cold-applied adhesive.

3.7 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing membrane cap sheet in accordance with 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. Adhere to substrate in cold-applied adhesive.
2. 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.

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

3.8 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates in accordance with roofing system manufacturer's written instructions, and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.

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

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing in accordance with roofing system manufacturer's written instructions.

E. Roof Drains: Set square metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend beyond edge of metal flashing onto field of roofing membrane per manufacturer. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
1. Install stripping in accordance with roofing system manufacturer's written instructions.

3.9 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads using units of size indicated in cold-applied adhesive per manufacturrer's written instructions.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and to prepare test reports.

B. Test Cuts: Test specimens will 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 in accordance with ASTM D 3617.
2. Test specimens will be examined for interply voids in accordance with 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 in accordance with roofing system manufacturer's written instructions.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

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

3.11 PROTECTING AND CLEANING

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

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

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

3.12 ROOFING INSTALLER'S WARRANTY

A. Roof contractor and manufacturer will submit warranty on letterhead containing at a minimum the following:

B. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Ann Arbor Housing Development Corporation.
2. Address: 2000 S. Industrial Drive.
3. Building Name: Miller Manor Apartments.
4. Address: 727 Miller Ave, Ann Arbor, MI .
5. Area of Work: <**Insert information**>.
6. Acceptance Date: <**Insert date**>.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: <**Insert date**>.

C. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

D. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

E. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. lightning;
   b. peak gust wind speed exceeding <**Insert wind speed**> mph;
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

F. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.
1. Authorized Signature: <**Insert signature**>.
2. Name: <**Insert name**>.
3. Title: <**Insert title**>.

END OF SECTION

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Adhered EPDM membrane roofing system.
2. Roof Air Barrier/Vapor retarder.
3. Roof insulation.

B. Related Requirements:
1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking
2. Section 070150.19 "Preparation for Re-Roofing" for recover board beneath new membrane roofing.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Refer Sheet S0.1 for uplift pressures.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.

C. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Walkway pads or rolls.
4. Termination bars.
5. Battens.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

B. Source Limitations: Obtain components including roof insulation for membrane roofing system from manufacturers approved by membrane roofing manufacturer.

C. Exterior Fire-Test Exposure: ASTM E 108, Class A ; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

D. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements for deck substrate conditions and finishes, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

F. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

G. Provide the following upon request:
   1. Qualification Data: For qualified Installer and manufacturer.
   2. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
      a. Submit evidence of complying with performance requirements.
   3. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
   4. Field quality-control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store 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.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.9 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.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of membrane roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, 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.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carlisle SynTec Incorporated.
      b. Elevate.
      c. Johns Manville.
   2. Thickness: 90 mils, nominal.
   3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
   1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, in accordance with application.

C. Protection Sheet: Epichlorohydrin or neoprene non-reinforced flexible sheet, 55- to 60-mil- thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Bonding Adhesive: Manufacturer's standard.

E. Seaming Material: Single-component, butyl splicing adhesive and splice cleanerorManufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film.

F. Lap Sealant: Manufacturer's standard, single-component sealant.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

I. Metal Termination Bar: Manufacturer's standard, predrilled holes at 6 inched on center, stainless steel or aluminum bars, approximately 1" x 1/8" thick.
   1. Anchors: Tapcon masonry screws.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

K. Reinforced Fluid Applied Flashing:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Soprema; Alsan RS 230 Flash system.

2.3 ROOF AIR BARRIER/VAPOR RETARDER

A. Existing Concrete Roof Deck Application:
1. Self-Adhering-Sheet Air Barrier/vapor retarder: Polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 32-mil- total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by air barrier manufacturer.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 3. coated glass facer on both major surfaces.
1. Board Size: 4'-0" x 4'-0"
2. Thickness: Two layers minimum,total minimum thickness as indicated on drawing to provide a minimum aged thermal resistance of R5 (deg. F.h.sf/Btu) per inch.

C. Tapered Insulation: Provide factory-tapered insulation boards with identical characterictersists as base insulation fabricated to slope of 1/4 inch per 12 inches.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes with identical characteristics as base insulation for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

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

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
4. Verify adhesives and sealants comply with the following limits for VOC content:
    a. Plastic Foam Adhesives: 50 g/L.
    b. Gypsum Board and Panel Adhesives: 50 g/L.
    c. Multipurpose Construction Adhesives: 70 g/L.
    d. Fiberglass Adhesives: 80 g/L.
    e. Contact Adhesives: 80 g/L.
    f. PVC Welding Compounds: 510 g/L.
    g. Other Adhesives: 250 g/L.
    h. Single-Ply Roof Membrane Sealants: 450 g/L.
    i. Nonmembrane Roof Sealants: 300 g/L.
    j. Sealant Primers for Nonporous Substrates: 250 g/L.
    k. Sealant Primers for Porous Substrates: 775 g/L.

C. Cover Board:
1. Glass-mat, water-resistant gypsum substrate, ASTM C 1177/C 1177M, 1/2 inch thick.
    a. Products: Subject to compliance with requirements, provide the following:
        1) Georgia-Pacific Corporation; Dens Deck primed
2. Cellulosic-fiber reinforced, water-resistant gypsum substrate ASTM C 1278/C 1278M, 1/2 inch thick.
    a. Products: Subject to compliance with requirements, provide the following:
        1) USG Corporation; Securock.

D. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

E. Sprayed Polyurethane Foam: One- or two-component, foamed-in-place, closed cell polyurethane foam, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less in accordance with ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam manufacturer.

2.6 ASPHALT MATERIALS

A. Roofing Asphalt: As recommended by roof membrane manufacturer.

B. Asphalt Primer: ASTM D 41.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. 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.

C. 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. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 ROOF AIR BARRIER/VAPOR-RETARDER INSTALLATION

A. Existing Concrete Roof Deck Application**.**
1. Self-Adhering-Sheet air barrier/vapor retarder: Prime substrate Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

3.4 INSULATION INSTALLATION

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

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

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, 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.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. 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.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

H. 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 in each direction. Loosely butt cover boards together.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing in accordance with membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

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

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing in accordance with manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
   1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing in accordance with manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

I. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

J. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

K. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition.

L. Adhere protection sheet over membrane roofing at locations indicated.

M. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition.

N. Adhere protection sheet over membrane roofing at locations indicated.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates in accordance with membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage Engage a qualified independent testing agency to perform inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

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

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

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

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

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

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Ann Arbor Housing Development Corporation**.**
2. Address: 2000 S. Industry Drive**.**
3. Building Name/Type: Miller Manor Apartments.
4. Address: 727 Miller Avenue, Ann Arbor, MI.
5. Area of Work: <**Insert information.**>
6. Acceptance Date: <**Insert date.**>
7. Warranty Period: <**Insert time.**>
8. Expiration Date: <**Insert date.**>

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    a. Lightning;
    b. Peak gust wind speed exceeding <**Insert wind speed**> mph;
    c. Fire;

d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. Vapor condensation on bottom of roofing; and
g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.
1. Authorized Signature: <**Insert signature**>.
2. Name: <**Insert name**>.
3. Title: <**Insert title**>.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

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

D. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1.3 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

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

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

1.5 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are 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 are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA Roofing Manual requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.2 SHEET METAL MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed.
   1. Nominal Thickness: 16 ga. .

2.3 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
   1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   2. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

B. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

C. Seams:
   1. 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 necessay for strength.

D. Stainless Steel Band Clamp: Stainless steel pipe clamps to secure rain collar and miscellaneous acessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

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

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
   1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated.
      a. Form joints to completely conceal sealant.

b. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters :
1. Reuse existing gutters. Join gutters with with riveted joints sealed with sealant.
2. Attach gutters at eave or fascia to firmly anchor them in position.
3. Provide end closures and seal watertight with sealant.

C. Downspouts:
1. Reuse existing downspouts. Provide hangers with fasteners designed to hold downspouts securely to walls.

3.4 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.5 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in 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, as determined by Architect.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:
   1. Roof curbs.
   2. Equipment supports.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Delegated-Design Submittal:
   1. Provide delegated-design submittals for the following:
      a. Roof curbs.
      b. Equipment supports.
   2. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
   3. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

D. Samples: For each type of roof accessory and for each color and texture specified.

E. Samples for Initial Selection: For each type of roof accessory indicated with factory-applied color finishes.

F. Samples for Verification: Include Samples of each type of roof accessory to verify finish and color selection, in manufacturer's standard sizes.

G. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

1.3 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.
   4. Required clearances.

B. Qualification Statements: For manufacturer .

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories.

1.5 QUALITY ASSURANCE

A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in Michigan where Project is located and who is experienced in providing engineering services of the type indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage. Store roof accessories in accordance with manufacturer's instructions.

B. Store materials off ground in dry location and in accordance with manufacturer's instructions in well-ventilated area.

C. Store and protect roof accessories from nicks, scratches, and blemishes.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a registered design professional,to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Material properties indicated in this Section shall be considered as minimum properties.

C. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF CURBS

A. Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AES Industries, Inc.
   2. AES Sunoptics; Acuity Brands International, Inc.
   3. Air Balance; MESTEK, Inc.
   4. ATAS International, Inc.
   5. Conn-Fab Sales, Inc.
   6. Curbs Plus, Inc.
   7. Custom Solution Roof and Metal Products, a division of Colony Heating.
   8. Greenheck Fan Corporation.
   9. KCC Manufacturing.
   10. Lloyd Industries, Inc.
   11. LMCurbs.
   12. Louvers & Dampers, Inc.; Mestek, Inc.
   13. Metallic Products Corporation.
   14. Pate Company (The).
   15. Plenums of Florida Incorporated.
   16. RCS Fabrications Inc.
   17. Roof Products and Systems (RPS); Duravent Group.
   18. Roof Products, Inc.
   19. Thybar Corporation.
   20. Vent Products Co., Inc.

C. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

D. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

E. Steel: Zinc-coated (galvanized) steel sheet, minimum 0.052 inch thick.
   1. Finish: Mill phosphatized.
   2. Color: As indicated by manufacturer's designations.

F. Construction:
   1. Curb Profile: Manufacturer's standard compatible with roofing system.

2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
5. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
7. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
8. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to comply with wind-uplift requirements.
9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 EQUIPMENT SUPPORTS

A. Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, and integrally formed structure-mounting flange at bottom.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AES Industries, Inc.
2. Air Balance; MESTEK, Inc.
3. Conn-Fab Sales, Inc.
4. Curbs Plus, Inc.
5. Greenheck Fan Corporation.
6. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
7. KCC Manufacturing.
8. Lloyd Industries, Inc.
9. LMCurbs.
10. Louvers & Dampers, Inc.; Mestek, Inc.
11. Pate Company (The).
12. Plenums of Florida Incorporated.
13. Portals Plus; Duravent Group.
14. RCS Fabrications Inc.
15. Roof Products and Systems (RPS); Duravent Group.
16. Roof Products, Inc.
17. Thybar Corporation.
18. Vent Products Co., Inc.

C. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

D. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

E. Steel: Zinc-coated (galvanized) steel sheet, minimum 0.052 inch thick.
1. Finish: Mill phosphatized.
2. Color: As indicated by manufacturer's designations.

F. Construction:
1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide under top flange on side of curb, continuous around support perimeter.
5. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to comply with wind-uplift requirements.

6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.

2.4 METAL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheer complying with minimum ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality.
1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Powder Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A36/A36M, hot-dip galvanized in accordance with ASTM A123/A123M unless otherwise indicated.

C. Steel Tube: ASTM A500**/**A500M, round tube.

D. Galvanized-Steel Tube: ASTM A500**/**A500M, round tube, hot-dip galvanized in accordance with ASTM A123/A123M.

E. Steel Pipe: ASTM A53/A53M, galvanized.

2.5 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

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

F. Elastomeric Sealant: ASTM C920, elastomeric [polyurethane] [silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

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

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION, GENERAL

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

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.
1. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.3 INSTALLATION OF ROOF ACCESSORIES

A. Roof Curb: Install each roof curb so top surface is level.
1. Attach curbs to wood nailer on roof deck with wood screws.
2. Weld curbs to metal roof deck.
3. Bolt curbs to concrete roof deck with lead shield expansion type inserts through each pre-drilled hole with 3/8 inchcorrosion resistant steel bolts.
4. Anchor counter-flashing to wood nailer with lag screws and lead washers.

B. Equipment Support: Install equipment supports so top surfaces are level with each other.

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

3.4 CLEANING AND PROTECTION

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.

B. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone joint sealants.
2. Butyl rubber joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.3 QUALITY ASSURANCE

A. Provide the following upon request:
1. Qualification Data: For qualified installer.
2. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

C. Preinstallation Conference: Conduct conference at Project site to discuss type and color of sealant for each location, use of primer, masking off adjacent surfaces, and protection and cleanup procedures.

1.4 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: Selected by owner at pre construction meeting.

2.2 SILICONE JOINT SEALANTS

A. Sealant JS-S1 - Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
1. Products: Subject to compliance with requirements, provide products from the following table that has a validation certificate from the Sealant, Waterproofing and Restoration Institute (SWRI).

			Substrate Primer Required: Yes/No/Test			
Manufacturer	Product	Manufacturer Rated Movement Capability (CLASS)	Mortar*	Anod. Alum.	Uncoated Glass	Other**
Dow Inc.	Dowsil 791	± 50%	Yes	Test	No	Test
Dow Inc.	Dowsil 795	± 50%	No	Yes	No	Test

Substrate Primer Required: Yes/No/Test

Manufacturer	Product	Manufacturer Rated Movement Capability (CLASS)	Mortar*	Anod. Alum.	Uncoated Glass	Other**
Momentive Performance Materials, Inc.	SCS9000 Silpruf NB	± 50%	Yes	Test	No	Test
Pecora Corporation	864	± 50%	Yes	Test	No	Test
Pecora Corporation	895	± 50%	Yes	Test	No	Test
Tremco Incorporated	Spectrem 3	± 50%	Yes	Test	No	Test
Tremco Incorporated	Spectrem 4-TS	± 50%	Yes	Test	No	Test

Table Notes:
* Indicates substrates with a cement component, such as concrete, that require use of a primer.
** Indicates that other substrates shall be tested for adhesion to determine if a primer will be required.

2.3 BUTYL RUBBER JOINT SEALANTS

A. Sealant JS-B1 - Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
   a. Products: Subject to compliance with requirements,provide one of the following. Bostik, Inc.; Chem-Calk 300.
   b. Pecora Corporation; BC-158.
   c. Tremco Incorporated; Tremco Butyl Sealant.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces. Water-based tooling agents are unacceptable.
3. Provide concave joint, unless otherwise indicated.
4. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Retrofit roof drains.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Retrofit Roof Drain:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Zurn Plumbing Products Group; Specification Drainage Operation.
      d. Other, approved similar drainage product.
   2. Standard: ASME A112.6.4, for general-purpose roof drains.
   3. Body Material: #16 Gage Type 304 Stainless Steel.
   4. Dimension of Body: Nominal 14-inch diameter.
   5. Combination Flashing Ring and Gravel Stop: Not required.
   6. Flow-Control Weirs: Not required.
   7. Outlet: Bottom.
   8. Extension Collars: Not required.
   9. Underdeck Clamp: Not required.
   10. Expansion Joint: Not required.
   11. Sump Receiver Plate: Not required.
   12. Dome Material: Cast iron.
   13. Perforated Gravel Guard: Not required.
   14. Vandal-Proof Dome: Not required.
   15. Water Dam: Not required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains according to roof drain manufacturer's written installation instructions.
   1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

3.2 PROTECTION

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

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

END OF SECTION

SECTION 230100 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes basic requirements for divisions 22, 23, as well as applicable specification sections in division 26 (variable frequency drives).

1.3 QUALITY ASSURANCE

A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

B. Equipment Design
   1. Design equipment and accessories not specifically described or identified by manufacturer's catalog numbers in conformity with applicable technical standards and suitable for maximum working pressure, test pressure and temperatures required.

C. Equipment Installation
   1. Obtain manufacturer's printed installation instructions to aid in properly executing work of installing equipment whenever such instructions are available.
   2. Erect equipment in a neat and workmanlike manner. Align, level and adjust for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from arrangements indicated may be made, as approved.

D. Packaged Equipment
   1. Provide packaged equipment, where specified, which is completely factory assembled, including all mechanical and electrical components mounted on a common base or in a common enclosure with all piping, controls and wiring factory installed ready to be incorporated into the mechanical system.

E. Quietness of Operation
   1. Pumps, fans, motors and other equipment with moving parts have been especially selected for quietness of operation.
   2. For equipment other than that specified, submitted by the Contractor for approval, submit written statements from the manufacturer and the Contractor that said equipment is at least as quiet as that specified and include certified sound test data to support the claims made.

F. Vibration Isolation
   1. Vibration isolation devices for isolating equipment, ductwork and piping from the building structure are specified under Section 230548. Procure these devices from a single vibration materials manufacturer through a local representative. Furnish the local representative with copies of Shop Drawings of all equipment requiring vibration isolation and access to the Drawings that show the ductwork and piping that require vibration isolation.
   2. For equipment requiring factory installation of vibration isolators, furnish the equipment manufacturer with the identity of the supplier of the vibration isolation manufacturer selected for the Project. Submittals for equipment not equipped with the product of the vibration isolation manufacturer selected for the Project will be rejected.

G. Vibration Testing of Rotating Equipment
   1. Pumps
      a. Provide for the services of a qualified vibration consultant to take vibration velocity measurements on all base mounted pumps in accordance with ANSI HI1.4.6.
      b. Take measurements on the bearing caps of each pump with a driver 5 HP and larger in the vertical, horizontal and axial directions.
      c. Maximum allowable self-excited, total unfiltered vibration velocity: 0.0875 mm (3.5 mils) per second peak to peak. If the measured velocity exceeds this figure, determine the source of the vibration and make the necessary corrections to bring the velocity figure to within the specified maximum.

d. Submit on approved data sheets the vibration measurements for each pump along with the relevant charts and data from ANSI H19.6.4.

2. Fans
   a. Provide the services of a qualified vibration consultant to take vibration velocity measurements on all base mounted or suspended fans in accordance with AMCA 204-6.1.
   b. Take measurements on the bearing caps of each fan in the vertical, horizontal and axial directions.
   c. The following table, taken from AMCA 204, lists the fan application categories for the maximum allowable self-excited, total unfiltered, peak-to-peak vibration velocity.

	Fan Application Category	IN./S
2)	BV-1	0.60
3)	BV-2	0.30
4)	BV-3	0.20
5)	BV-4	0.15
6)	BV-5	0.10

   d. Apply Fan Application Category BV-3 for fan drivers 5 HP to 25 HP and BV-4 for fan drivers 30 HP and larger. Fans less than 5 HP do not require testing.
   e. If fan vibrations exceed the AMCA allowable levels for the specified vibration category, make the necessary corrections to bring the vibrations to within the allowable levels.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 COORDINATION

A. Furnish one can of touch up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch up paint with other "loose and detachable parts" as covered in the General Requirements.Motor controllers.
   1. Use zinc rich paint on galvanized surfaces prior to providing finish coat.

B. Seal and firestop all penetrations of fire rated partitions.
   1. Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.6 REFERENCE TO DESIGN DRAWING STANDARDS

A. Maximum and minimum requirements
   1. Refer to equipment schedules for equipment identification number and corresponding area location, capacity, and design requirements.
   2. Where ever schedules or notes appear in the Contract Documents in which sizes and capacities of equipment are indicated or specified, provide equipment under the contract which meets the following requirements under operating conditions:
      a. The RPM, the outlet velocities, tip speeds and the NC ratings specified are the maximum that will be accepted.
      b. The cfm, the static pressure on fans, the gpm and the total head on pumps, are the minimum that will be accepted.

3. Motor horsepower ratings specified or shown: the minimum acceptable indicated; motor speeds: the maximum acceptable. If a motor is provided having a larger horsepower rating than specified, provide the associated increased wire, breaker, starter, fuses, overload protection, etc., at no additional cost. Provide the increased motor circuit in accordance with the "Motor Circuit Sizing Schedule" indicated. Do not provide increased motor horsepower which together add more than 5 percent to the load of an electrical distribution equipment item (i.e., Motor Control Center, Power Panel, etc.).

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section Division 01.

B. In addition to the general content specified under General Requirements, supply the following additional documentation.
1. Records of tests performed to certify compliance with system requirements.
2. Certification of inspections by regulatory agencies.
3. Valve schedules.
4. Lubrication instructions, including list/frequency of lubrication.

1.8 CERTIFICATIONS AND INSPECTIONS

A. Obtain and pay for all required installation inspections except those provided by the Architect/Engineer. Include copies of the certificates in the Operating and Maintenance Manuals.

1.9 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide 2 copies of O&M manuals in three ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. Provide an electronic PDF of the same material.
1. Prior to printing the O&M documents provide electronic PDF documents to the architect for approval. PDF documents shall be organized identical to the intended layout of the 3-ring binders. Provide digital bookmarks for each piece of equipment, similar to the indexed layout of the 3-ring binder.

B. In addition to the data indicated in the General Requirements, include the following information:
1. Copies of all approved shop drawings.
2. Manufacturer's wiring diagrams for electrically powered equipment.
3. Records of tests performed to certify compliance with system requirements.
4. Certificates of inspection by regulatory agencies.
5. Temperature control record drawings and control sequences.
6. Parts lists for manufactured equipment.
7. Valve schedules.
8. Lubrication instructions, including list/frequency of lubrication done during construction
9. Warranties.
10. Additional information as indicated in the technical specification sections.

1.10 TRAINING OF OWNER PERSONNEL

A. Instruct Owner personnel in the proper operation and maintenance of systems and equipment provided as part of this project; video tape all training sessions. Use hours indicated in individual specification sections. Where hours are not indicated within an individual specification section, include not less than 4 hours of instruction for each piece of equipment, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

1.11 RECORD DRAWINGS

A. In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-in Ceilings
1. Removable lay in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

a. Provide tagging system using colored dots for identifying where equipment is located above the ceiling. Coordinate coloring system with Owner.

2. Plaster walls and ceilings
   a. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations
   1. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
      a. 3M
      b. Hilti,
      c. Rectorseal,
      d. STI/SpecSeal
      e. Tremco
   2. General
      a. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.
      b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural and life safety drawings for identification of fire and/or smoke rated walls and floors.
      c. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

B. Non-Rated Penetrations
   1. Pipe Penetrations
      a. At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
   2. Duct Penetrations
      a. Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2".
      b. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 - EXECUTION

3.1 ERECTION, INSTALLATION, APPLICATION

A. Dimension and Design
   1. Provide apparatus and equipment of such dimensions and design as to be adapted to the arrangement of the installation and to fit within the limits of the space available.

B. Stand-off Brackets
   1. Provide insulated equipment, piping and duct work with stand-off brackets for attaching components to allow full insulation thickness.

C. Special Tools
   1. Provide tools required to operate, adjust, or make minor repairs to the equipment and install them in a wall mounted wood or metal case. Provide the case with a lock and two keys.

D. Standard Products
   1. Provide products and equipment that are essentially the standard product of the manufacturer. Where two or more units of the same product or type of equipment are required, provide these units as products of the same manufacturer.

2. Where the requirements of the Contract Documents exceed that of a manufacturer's standard product in terms of quality, performance or efficiency, the manufacturer shall make special provisions to ensure that the product proposed meets the requirements of the Contract Documents.

E. Substituted Items
1. Should a substitute item be offered and accepted and the substitute item requires services or utilities other than required by the item substituted for, provide those other services or utilities at no additional cost to the Owner.

F. Equipment Locations
1. Mechanical equipment and devices have been shown on the Drawings in the approximate location required for reasons of access, noise control or maintainability. Minor adjustments in location dictated by coordination with other work are permitted. Major relocations for reasons other than these are not to be made without specific written approval.

G. Interferences
1. Before proceeding with the installation of piping and ductwork, inspect the Contract Documents and determine that the location of the Work does not interfere with other work. In case of interference request clarification from the Architect in writing.

H. Holes Through Previously Constructed Walls and Floors
1. Cut holes for the passage of piping and ductwork through previously constructed walls and floors in a neat workman-like manner.
2. Make holes through floors and masonry walls by coring or saw-cutting the hole with minimum oversizing to allow for firesafing or caulking the peripheral space between the pipe or duct and the structure.
3. Make holes through gypsum board walls by sawing with minimum oversizing to allow for firesafing or caulking or for a flange or escutcheon to be placed in a manner to fill or cover the peripheral space between the pipe or duct and the wall.

I. Piping and Ductwork – Prohibited Locations
1. Do not run piping over electrical equipment such as transformers, switchgear and panelboards.
2. When possible, do not install piping and ductwork of any kind in Electrical Rooms, telecommunications rooms, or elevator equipment rooms, except that which serves these rooms.
3. If installing piping or ductwork in Electrical rooms cannot be avoided, maintain a clear space over the equipment and 36 inches in front of equipment from floor to ceiling.

J. Offsets and Transitions
1. In general, most main offsets and transitions of piping and duct work are shown on the drawings in order to indicate approximate locations in plan and elevation where the systems are intended to be run.
2. The Contract Documents are not intended to serve as coordinated construction drawings showing all minor adjustments in locations and duct cross sections that are required for a fully coordinated installation that respects the work of all trades.
3. Fully coordinate the mechanical work within itself and with the work of other trades to ensure the avoidance of all interferences.

K. Lines and Grades
1. Construct Work in conformity with lines and grades as indicated.
2. Lay out the Work and be responsible for lines, elevations and measurements required for the installation of the Work.
3. Space axis lines within building on each floor level so that mechanical work may be laid out with metal tape measure having length of 30.5 meters (100 feet) maximum. The use of cloth tape for lay-out will not be permitted.
4. Use bench marks outside building from which lines and grades required for installation of mechanical work may be set.

L. Fan Inlet and Outlet Guards
1. Provide screen guards with rigid angle frames on fan inlet and outlet openings which are accessible to personnel.

3.2 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching requirements.

3.3 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations
   1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

B. Non-Rated Partitions
   1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.
   2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

C. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, kitchens/servery, janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

D. Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment stands.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Stainless Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. MIRO Industries.
   2. RectorSeal HVAC; a CSW Industrials Company.

B. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly-assembled on site.

C. Foot Material: Rubber or polypropylene.

D. Rails Material: Hot dip galvanized carbon steel.

E. Wind/Sliding Load Resistance: Up to 100 mph minimum.

2.4 MATERIALS

A. Aluminum: ASTM B221.

B. Stainless Steel: ASTM A240/A240M.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Framing System Installation: . Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.4 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use stainless steel pipe hangers and attachments for exterior environment applications.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   3. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

F. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Craftmark Identification Systems.
      c. Seton Identification Products.
   2. Material and Thickness: stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   3. Letter Color: White.
   4. Background Color: Black.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Craftmark Identification Systems.
   3. Seton Identification Products.
   4. <Insert manufacturer's name>.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   2. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
   3. At access doors, manholes, and similar access points that permit view of concealed piping.
   4. Near major equipment items and other points of origination and termination.
   5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   6. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:
   1. Refrigerant Piping: White letters on a safety-gray background.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Testing, adjusting, and balancing existing systems and equipment.
   3. Duct leakage tests.
   4. Control system verification.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.3 PREINSTALLATION MEETINGS

A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
   1. Minimum Agenda Items:
      a. The Contract Documents examination report.
      b. The TAB plan.
      c. Needs for coordination and cooperation of trades and subcontractors.
      d. Proposed procedures for documentation and communication flow.

1.4 ACTION SUBMITTALS

A. Sustainable Design Submittals:
   1. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB or TABB.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

1.6 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:
   1. TAB contractor recommended by contractor.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

C. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

D. Examine test reports specified in individual system and equipment Sections.

E. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

F. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

G. Examine operating safety interlocks and controls on HVAC equipment.

H. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Airside:
      a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
      b. Duct systems are complete with terminals installed.
      c. Volume, smoke, and fire dampers are open and functional.
      d. Clean filters are installed.
      e. Fans are operating, free of vibration, and rotating in correct direction.
      f. Variable-frequency controllers' startup is complete and safeties are verified.
      g. Automatic temperature-control systems are operational.
      h. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
   3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report artificial loading of filters at the time static pressures are measured.
   3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   4. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
   1. Measure airflow of submain and branch ducts.
   2. Adjust submain and branch duct volume dampers for specified airflow.
   3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
   1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   2. Measure inlets and outlets airflow.

3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

C. Electronically Communicated Motors in Terminal Units: Test for proper operation at airflows ranging from minimum to maximum. Incrementally increase minimum airflow as required until the fan static pressure is within the manufacturers specified range and stable operation is achieved. Record observations including terminal unit tag and final minimum airflow.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:
1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:
1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.9 VIBRATION TESTS

A. After systems are balanced and construction is Substantially Complete, measure and record vibration levels on equipment having motor horsepower equal to or greater than 15.

B. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
4. Verify calibration date is current for vibration meter before taking readings.

C. Test Procedures:
1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
4. Record CPM or rpm.
5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:
1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.
3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."
4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.10 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.11 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:
1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.12 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.

8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.13 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.
    j. Return airflow in cfm.
    k. Outdoor-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

F. Apparatus-Coil Test Reports:
1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

K. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

END OF SECTION

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:
   1. Outdoor, exposed supply and return.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Product Data: For adhesives, indicating VOC content.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.4 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.5 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534, Type II for sheet materials.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Aeroflex USA.

b. Armacell LLC.
c. K-Flex USA.

G. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 250 deg F for jacketed and between 35 deg F and 450 deg F for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Certainteed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

H. Mineral Wool Board: Basalt volcanic rock-derived fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 1100 deg F in accordance with ASTM C411. Comply with ASTM C612, Type III, unfaced.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Johns Manville; a Berkshire Hathaway company.
b. Owens Corning.
c. ROCKWOOL Technical Insulation.

2.3 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C921, Type I, unless otherwise indicated.

B. Metal Jacket:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.
2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

C. Self-Adhesive Outdoor Jacket (Asphaltic): 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with stucco-embossed aluminum-foil facing.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. MFM Building Products Corp.
b. Polyguard Products, Inc.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. 3M Industrial Adhesives and Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.
2. Width: 2 inches.

3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.5 SECUREMENTS

A. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   a. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.
      4) Nelson Stud Welding.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AGM Industries, Inc.
      2) CL WARD & Family Inc.
      3) Gemco.
      4) Midwest Fasteners, Inc.
      5) Nelson Stud Welding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents, unless otherwise approved by the engineer-of-record.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Do not field paint aluminum or stainless steel jackets.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Outdoor, exposed supply and return.

3.9 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Exposed, rectangular, supply-air duct insulation is one of the following:
   1. Glass-Fiber Board: 2 inches thick and 3 lb/cu. ft. nominal density.
   2. Mineral Wool Board: 2 inches thick and 4 lb/cu. ft. nominal density.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
   1. None.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
   1. Aluminum, Corrugated: 0.024 inchthick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
   1. Painted Aluminum, Stucco Embossed with 2-1/2-Inch- Deep Corrugations: 0.040 inch thick.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size, as well as ASTM standard designation, and maximum use temperature.

1.4 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.5 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Polyurethane Preformed Pipe: Rigid polyurethane core with NBR/PVC based elastomeric insulation collars. Insulation wrapped with an outer PVC jacket with overlapping tab system.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. K-Flex Insulation

F. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Manson Insulation Inc.

d. Owens Corning.
2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ-SSL.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.
1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Mon-Eco Industries, Inc.
e. Vimasco Corporation.
2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
5. Color: White.

2.4 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. Metal Jacket:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.
2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:
1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents, unless otherwise approved by the engineer of record.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

C. Install removable insulation covers at locations indicated. Installation conforms to the following:
1. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
2. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

3.6 INSTALLATION OF POLYURETHANE INSULATION

A. Install the insulation in strict accordance with the manufacturer installation instructions.

B. Assure the pipe is free of moisture prior to applying the insulation.

C. Utilize rigid core polyurathane at pipe supports. Seal rigid insulation to adjoining insulation to maintain vapor tight installation.

3.7 FINISHES

A. Do not field paint aluminum or stainless steel jackets.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.9 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction, Liquid, and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 2 inches thick.
      c. Polyurethane, Preformed with PVC jacket, 1 1/2" thick.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory applied jacket, install the field applied jacket over the factory applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. Aluminum, Stucco Embossed: 0.024 inch thick.

END OF SECTION

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipes, tubes, and fittings.
2. Joining materials.
3. Manual gas shutoff valves.
4. Rooftop pipe supports.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. An example includes rooftop locations.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Pipe and fittings.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Pipe Welding Qualifications: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping in accordance with requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide purging and startup of natural-gas supply in accordance with requirements indicated:
1. Notify Owner no fewer than two weeks in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.8 COORDINATION

A. Coordinate requirements for piping identification for natural-gas piping. Comply with requirements in Section 220553 "Identification of Plumbing Piping and Equipment."

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each product type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 54.

B. Minimum Operating-Pressure Ratings:
1. Piping and Valves: 100 psig minimum unless otherwise indicated.

C. Natural-Gas System Pressure within Buildings:
   1. Single Pressure: 0.5 psig or less.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

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

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
   1. CWP Rating: 125 psig.
   2. Threaded Ends: Comply with ASME B1.20.1.
   3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
   5. Service Mark: Valves NPS 1-1/4 to NPS 2 having initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
   1. CWP Rating: 125 psig.
   2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
   3. Service Mark: Initials "WOG" permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A.Y. McDonald Mfg. Co.
      b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      c. BrassCraft Manufacturing Co.; a Masco company.
      d. Perfection Corporation.
      e. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated.
   2. Body: Bronze, complying with ASTM B584.
   3. Ball: Chrome-plated bronze.
   4. Stem: Bronze; blowout proof.
   5. Seats: Reinforced TFE; blowout proof.
   6. Packing: Threaded-body packnut design with adjustable-stem packing.
   7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
   8. CWP Rating: 600 psig.
   9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.6 PIPE STANDS

A. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Miro Industries; Rooftop Support Products, or approved similar product.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping in accordance with NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for preventing accidental ignition.

3.3 INSTALLATION OF OUTDOOR PIPING

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

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

C. Pipe Stand Installation:
   1. Rooftop Pipe Support: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

3.4 INSTALLATION OF VALVES

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, aluminum, or copper connector.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
   1. Construct joints in accordance with AWS D10.12/D10.12M, using qualified processes and welding operators.
   2. Bevel plain ends of steel pipe.
   3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for corrugated stainless steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 PIPING CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas-appliance equipment grounding conductor of the circuit powering the appliance in accordance with NFPA 70.

B. Where installing piping adjacent to appliances, allow space for service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

3.8 PAINTING

A. Paint exposed, exterior metal piping, valves, and piping specialties, except components, with factory-applied paint or protective coating.
   1. Alkyd System: MPI EXT 5.1D.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Exterior alkyd enamel gloss.
      d. Color: Yellow.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Test, inspect, and purge natural gas in accordance with NFPA 54 and authorities having jurisdiction.
   2. Natural-gas piping will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.10 OUTDOOR PIPING SCHEDULE

A. Aboveground distribution natural-gas piping (2 inch to 3 inch) is to be one of the following:
   1. Steel pipe with wrought-steel fittings and welded joints.

B. Aboveground branch natural-gas piping (less than 2 inch) is to be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

3.11 ABOVEGROUND, MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 3 and smaller at service meter are to be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Refrigerant pipes and fittings.
2. Refrigerants.

B. The equipment with refrigeration circuits was installed in 2014. Michigan Air Products provided the equipment and confirmed the refrigerant is R-410A. Michigan Air Products can provide support as necessary for salvaging equipment and reinstalling t the completion of the roof replacement. The equpment submitted performance is as follows:

1.

Cooling Type	Entering Air (F)		Leaving Air (F)		Capacity (MBH)		Face Vel. (ft/min):
Split System Direct Exp. (DX)	Dry-bulb	Wet-bulb	Dry-bulb	Wet-bulb	Total	Sensible	
	80.0	77.0	71.0	66.9	130.1	88.0	388
DX Coil Model		Fins Per Inch	Rows Deep	Suction Temp. (F)	Liquid Temp. (F)	Superheat (F)	Refrigerant
DX38S02Q10-36x33-RH		10	2	45.0	110.0	8.0	R-410a

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.
1. Include pressure drop, based on manufacturer's test data, for the following:
a. Filter dryers.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: Type L or Type ACR (ASTM B 280).

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8/A5.8M.

E. Flexible Connectors:
1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.

4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Permanent Filter Dryers: Comply with AHRI 730.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Emerson Climate Technologies.
   b. Heldon Products; Henry Technologies.
2. Body and Cover: Painted-steel shell.
3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
4. Desiccant Media: Activated alumina or charcoal.
5. Designed for reverse flow (for heat-pump applications).
6. End Connections: Socket.
7. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
8. Maximum Pressure Loss: 2 psig.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arkema Inc.
   b. DuPont Fluorochemicals Div.
   c. Genetron Refrigerants; Honeywell International Inc.
   d. Mexichem Fluor Inc.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to removal of refrigerant pipe, document the pipe layout, sizes, and filter drier arrangement.

B. Refer to the drawings for the removal of refrigerant pipe, salvaging and storing equpiment, and reinstalling equipment after the roof replacement is complete. Install new refrigerant pipe and filter driers between the condensing units and make-up unit.

C. The insulaton used in the original istallation did not perform over time. Therefore, a different insulation type is required for the re-installation. Refer to the section 230719 - HVAC PIPING INSULATION for the new insulation requirement.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-134a, R407c and R-410a

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

3.3 VALVE AND SPECIALTY APPLICATIONS

A. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

3.4 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping adjacent to machines to allow service and maintenance.

D. Install piping free of sags and bends.

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

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

G. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

H. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels..

I. Slope refrigerant piping as follows:
1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Liquid lines may be installed level.

J. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

K. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install the following pipe attachments:
1. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

3.9 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Verify that compressor oil level is correct.

END OF SECTION

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Single-wall rectangular ducts and fittings.
   2. Sheet metal materials.
   3. Sealants and gaskets.
   4. Hangers and supports.

B. Related Requirements:
   1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design assignment indicated in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Sealants and gaskets.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" .

B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Construct ducts of galvanized sheet steel unless otherwise indicated.
   1. Duct dimensions indicated on the drawings are the inner duct dimensions.

C. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
   2. For ducts with longest side 36 inches or greater, use factory pre-fabricated, slide-on traverse flanged duct connection systems..
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ductmate Industries Inc.
      b. Nexus PDQ, a Division of Shilco Holdings, Inc.
      c. Ward Industries, Inc. a Division of Hart and Cooley, Inc.
   4. Pre-fabricated, manufactured flanged connectors shall be provided with:
      a. Steel materials matching duct construction.
      b. Roll-formed flanges. Add-on flanged duct connectors may be used with Architects / Engineers approval.
      c. Gage and shape to be in accordance with manufacturer's guidelines.
      d. Manufacturer's duct construction and reinforcement guidelines with independent leakage testing, deflection and seismic performance.
      e. Provide with manufacturer's installation criteria for fastener and cleat spacing.
      f. Minimum independent test leakage rated at 10" w.g., positive and negative.

5. Where specified for specific applications, all joints shall be welded.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for a specific application.
2. Where specified for specific applications, all joints shall be welded.

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Type: Hardcast or Polymer adhesives.
2. Application Method: Brush on.
3. Solids Content: Minimum 65 percent.
4. Shore A Hardness: Minimum 20.
5. Water resistant.
6. Mold and mildew resistant.
7. VOC: Maximum 75 g/L (less water).
8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
11. Sealant shall have a VOC content of 420 g/L or less.
12. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
13. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
14. Service: Indoor or outdoor.
15. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Flange Gaskets: Butyl rubber gaskets must comply with UL 723, ASTM E 84, and meet Mil-C 18969B and TTS-S-001657. Material shall meet LEED E.Q. 4.1, have "zero" VOC, and not contain vegetable oils, fish oils, or any other type vehicle that will support fugal and/or bacterial growth. Material shall be non-skinning, non-drying, and be able to withstand joint movement without cracking. All butyl rubber flange gaskets must be a minimum 3/16-inch by 5/8-inch, have a surface temperature range of minus 65 degrees F to 220 degrees F, and must be tested to withstand operating pressure up to 10-inch wg positive /negative.

2.5 HANGERS AND SUPPORTS

A. Utilize roof mount supports to support ductwork extending above roof.
   1. Manufacturers:
      a. Dura-Blok
      b. Miro
      c. MIFAB DSW
   2. General
      a. UV resistant.
      b. Designed specifically for installation on roof membranes to support the weight of the ductwork without damaging the membrane or compressing the roof insulation.

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

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

F. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

G. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. Paint ground surfaces to prevent future rust, color to match ductwork.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Paint all exposed duct sealing material to provided uniform appearance of ductwork, color to match ductwork.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes as specified on the drawings in the Static Pressure Classification for Duct Construction schedule on the drawings." and or in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

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

B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT CONSTRUCTION

A. Fabricate ducts with the materials indicated in Part 2, except as otherwise indicated and as follows:
   1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated by the Static Pressure Classification for Duct Construction schedule on the drawings.

B. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Mitered Type RE 4 without vanes.
      b. Velocity 1000 to 1500 fpm:
         1) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
      c. Velocity 1500 fpm or Higher:
         1) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

C. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Conical spin in.

END OF SECTION

SECTION 237416.11 - MAKE UP UNIT REINSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: New roof curbs for the make-up air handling units and stairwell exhaust fans:
   1. Roof curbs.

B. Reinstallation and start-up of salvaged make-up air unit and stairwell exhaust fans.

1.2 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.3 ACTION SUBMITTALS

A. Product Data: For each roof curb.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
   3. Include unit dimensions and weight.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

2.2 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
   1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
      a. Materials: ASTM C1071, Type I or II.
      b. Thickness: 2 inches.
   2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
      a. Liner Adhesive: Comply with ASTM C916, Type I.
      b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
      c. Liner materials applied in this location to have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

B. Curb Dimensions: Height of roof curb shall be established to maintain equipment base a minimum 6 inches above the inished roof elevation at the completion of the roof replacement.

2.3 MATERIALS

A. Galvanized Steel: ASTM A653/A653M.

B. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

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

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
   1. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified with concrete.

B. Unit Support: Install unit level on structural steel supports. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Manufacturer representative contact:
      a. Michigan Air Products
   2. Complete installation and startup checks according to manufacturer's written instructions.
   3. Inspect for visible damage to unit casing.
   4. Inspect for visible damage to furnace combustion chamber.
   5. Inspect for visible damage to compressor, coils, and fans.
   6. Inspect internal insulation.
   7. Verify that labels are clearly visible.
   8. Verify that clearances have been provided for servicing.
   9. Verify that controls are connected and operable.
   10. Verify that filters are installed.
   11. Clean condenser coil and inspect for construction debris.
   12. Clean furnace flue and inspect for construction debris.
   13. Connect and purge gas line.
   14. Remove packing from vibration isolators.
   15. Inspect operation of barometric relief dampers.
   16. Verify lubrication on fan and motor bearings.
   17. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   18. Adjust fan belts to proper alignment and tension.
   19. Start unit according to manufacturer's written instructions.
      a. Start refrigeration system.
      b. Do not operate below recommended low-ambient temperature.
      c. Complete startup sheets and attach copy with Contractor's startup report.
   20. Inspect and record performance of interlocks and protective devices; verify sequences.
   21. Operate unit for an initial period as recommended or required by manufacturer.
   22. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
      a. Measure gas pressure on manifold.

b. Inspect operation of power vents.
c. Measure combustion-air temperature at inlet to combustion chamber.
d. Measure flue-gas temperature at furnace discharge.
e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

23. Calibrate thermostats.
24. Adjust and inspect high-temperature limits.
25. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
26. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
27. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
28. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.
29. Simulate maximum cooling demand and inspect the following:
    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
30. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.
31. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

END OF SECTION

Attachment C

SECTION 26 31 00 - SOLAR PHOTOVOLTAIC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Photovoltaic Panels and Arrays

B. Power Optimizers

C. String Inverters

D. Combiner/Disconnect

E. Photovoltaic Monitoring Equipment and Accessories

F. Photovoltaic Mounting Systems

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in photovoltaic panel or inverter systems with five years documented experience.

B. Installer: Equipment installer shall be NABCEP certified or be certified by photovoltaic inverter and panel manufacturers. Licensed electrical contractors with electrical apprenticeship documentation shall also be acceptable.

C. Operate, commission, and demonstrate seven (7) days of complete photovoltaic system operation prior to turnover to the Owner.

1. Refer to the Part 3 for system commissioning requirements.

1.3 REFERENCES

A. ANSI C62.41 - IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

B. IEEE 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

C. IEEE 929 - Recommended Practices for Utility Interface of Photovoltaic Systems.

D. IEEE 1547 - Standard for Interconnecting Distributed Resources with Electronic Power Systems.

E. IEEE 1547.1 - Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

F. NFPA 70 - National Electrical Code (NEC) Article 690 - Solar Photovoltaic (PV) Systems

G. UL 1703 - Standard for Flat-Plate Photovoltaic Modules and Panels

H. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

I. UL 1998 - Standard for Software in Programmable Components

1.4 SUBMITTALS

A. Submit product data for review and approval by engineer and owner.

B. Photovoltaic Panels: Include unit dimensions, weight, material construction, wattage, voltage, current, open circuit voltage, short circuit current, installation and maintenance information, and manufacturer voltage correction factor in information.

C. Photovoltaic Inverter: Include unit dimensions, weight, installation and maintenance information. Also include the following:

1. Input: DC voltage range, max current input.
2. Output: AC voltage range, total harmonic distortion, power factor, efficiency, maximum current output.
3. General: Power consumption, enclosure type, compliance with references.
4. Environment: Ambient temperature rating, cooling requirements.

D. Array Mounting Frame:

1. Calculations, drawings and installation details shall be designed and sealed by a Professional Engineer licensed in the state where the project is located experienced in solar mounting frame design and installation.
2. Design of support shall be performed for loading indicated in this specification and structural general notes.
3. Coordination drawing drawn to scale and coordinating the photovoltaic array with other systems and equipment in the vicinity for use in the development and layout of the mounting frame.
4. Clear indication of design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
5. Plan drawings and details shall be cross-referenced. Details provided are to clearly indicate attachment to structure, correctly representing the fastening requirements.

E. Roof mounted system certification letter, signed by contractor, that the roof adhesives, fasteners, hardware, and accessories are approved by manufacturers of both the roofing system and the photovoltaic system.

F. Provide list of certified installers with proof of certification.

G. Provide calculation of expected annual total kilowatt hours for proposed equipment and installation.

1.5 SPARE PARTS

A. Provide three (3) additional fuses of each type and size installed.

B. Provide one (1) additional inverter convection cooling fan for each inverter module.

C. Provide two (2) spare photovoltaic panels. Coordinate with owner to for delivery and storage

D. Provide one (1) spare microinverters.

1.6 DELIVERY, STORAGE, HANDLING

A. Store and protect products.

B. Store in warm and dry location or per manufacturer's requirements.

C. Handle per manufacturer's requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit data.

B. Include description of operation and servicing procedures, list of major components, recommended remedial and preventative maintenance procedures, and list of spare parts.

1.8 WARRANTY

A. Photovoltaic Panels and Array: Provide 20-year warranty for power production. Equipment shall maintain minimum 80% of the manufacturer-published wattage output rating for 20 years. Provide 5-year workmanship warranty.

B. Photovoltaic Inverter: Provide **20** year warranty of equipment and installation.

C. Include coverage for travel, parts, and service.

1.9 PRE-INSTALLATION CONFERENCE

A. Roof Mounted System: Conduct a pre-installation conference prior to commencing roof mounted system work. Minimum participants to include general contractor, roofing contractor, electrical contractor, and photovoltaic system installer. Minimum agenda items shall include:

1. Installation schedule.

2. Protocols to protect roof system and roof warranty.
3. Adhesive, fastener, accessories, and hardware approved to maintain roof system and photovoltaic system warranties.
4. Adhesive, fastener, accessories and hardware required to support photovoltaics systems on surfaces installed by others.

1.10 SYSTEM DESCRIPTION

A. Complete photovoltaic system rated 400 volt DC at STC including photovoltaic panels, inverter system, combiner/disconnects, metering, and reporting equipment. Systems shall be configured to produce 240/120 single phase 3 wire 60 Hz power. Refer to drawings for expected solar

B. The photovoltaic system shall include a metering system for total system power production and a reporting system to monitor individual components.

C. The photovoltaic system and inverter shall be configured as a grid inter-tie solar photovoltaic system. The individual inverters shall automatically de-energize their output to the building electrical system and disconnect from the photovoltaic panels upon loss of the utility electrical service. The photovoltaic inverter system shall remain disconnected until the electrical utility voltage has been restored.

D. Equipment shall be identified for use in solar photovoltaic systems.

E. Equipment, including wiring, fuses, circuit breakers, etc., used in any DC portion of the photovoltaic power system shall be listed for use 400 volt DC circuits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. VSun

B. Kyocera series

C. Mission Solar series

D. Or pre-approved equals

2.2 PHOTOVOLTAIC PANELS AND ARRAYS

A. Equipment Ratings: Submit product data for review and approval by engineer and owner including the following equipment ratings:

1. Maximum Rated Power (STC) Pmax (watts)
2. Operating Power Point Voltage Vmp (VDC)
3. Maximum Power Point Current Impp (A)

4. Maximum Open Circuit Voltage Voc (VDC)
5. Maximum Short Circuit Current Isc (A)
6. Nominal Operating Cell Temperature Conditions (NOCT) Pmax (watts)

B. Operating Environment Conditions:

1. Operating Temperature: -40 to 90°C
2. Wet location listed

C. Cell Material: Silicon-based solar cell construction with UV stabilized polymer. Provide with bypass diode technology for partial shading operation.

D. Panel Construction: Anodized aluminum frame with ground point and tempered glass cover.

E. Dimensions: Submit product data for review and approval by engineer and owner including panel dimensions (width depth, length) and maximum panel weight.

F. Panel Connections and Terminations:

1. Provide manufacturer's wiring and quick-connect terminations for series creation of module-strings installation of panels.
2. Provide manufacturer wiring to combiner boxes for parallel grouping of module-strings.
3. All exterior wire and terminations shall be listed sunlight resistant.

2.3 POWER OPTIMIZERS

A. Provide power optimizer modules mounted to back of panels to track MPPT and minimize losses from shading and uneven string lengths.

B. Minimum Efficiency: 98%

C. Maximum System Voltage: 1000 VDC

D. Operating Temperatures: -40 to 85°C

E. Protection Rating: IP68 / NEMA 6P

F. Power optimizer must have been tested with submitted photovoltaic panel.

2.4 COMBINER/DISCONNECT

A. Combination of combiner box and solar array disconnect in a single enclosure.

B. Load break switch rated 1000 VDC maximum with lockout provisions.

C. Fuse holders rated 30 amp maximum. Terminal blocks for each PV string.

D. Provide fused surge protective device (SPD) with visual status indicator series or approved equal.

E. Enclosure: NEMA 4X.

2.5 PHOTOVOLTAIC GRID TIE STRING INVERTERS

A. Inverter Manufacturers: Manufacturer and model must have been tested and be compatible with photovoltaic panel model. Model capacities may change number of inverters required and shall be agreed to during submittals.

1. Solar Edge
2. Or pre-approved equals

B. Equipment Ratings:

1. AC Output Power Rating for Inverter: See Site Estimates watt
2. Output Voltage:240V 1 phase
3. Power Factor: 1.0
4. Minimum CEC Efficiency: 97.5%
5. MPPT Operating Voltage Range: 150 to 600 VDC
6. Minimum number of MPPT tracker inputs: 2
7. Total Harmonic Distortion: Less than 5%
8. DC Voltage Ripple: Less than 5%
9. Enclosure: NEMA 3R

C. Operating Environment Condition:

1. Maximum ambient temperature: 113°F
2. Wet location listed

D. Inverter Technology: Transformerless Full DC/AC rectification, real sine-wave output with high frequency pulse width modulation PWM.

E. Internal Protection: Inverter shall measure utility voltage, current, and impedance. Loss of utility power shall cause inverter to shut down and disconnect its output to the AC bus and input from the DC bus. Inverter shall automatically reconnect to AC output bus and DC input bus upon return of utility source.

F. The inverter shall be constructed to not allow backfeeding from the electrical utility to the photovoltaic panels or DC input bus.

G. The inverter shall be cooled via a forced air cooling fan.

H. Inverters shall be provided with Ethernet connection for metering and recording system outputs.

2.6 METERING AND REPORT

A. Personal Computer Software: Provide manufacturer's software for metering and reporting on personal computer. The Electrical Contractor shall install and provide provision for custom initialization of the photovoltaic system software package.

B. Displayed and Recorded Data:

1. The following data shall be provided for each photovoltaic inverter and updated every 10 seconds.

    a. Power
    b. kWh today
    c. Total kWh
    d. Date
    e. Time

2. The following data shall be provided for the entire photovoltaic system:

    a. Power
    b. kWh today
    c. Total kWh
    d. Date
    e. Time
    f. kWh to utility today
    g. Total kWh to utility

3. The above information shall be recorded, logged, and compiled by the personal computer software for production and performance evaluation purposes.
4. Provide data reporting and recording of all manufacturers' standard reporting functions and data acquisition reporting.
5. Central inverter communications and monitoring for performance, trouble, and diagnostics. Input and output voltages, amperages, and power and fault alarms shall communicate to the gateway and designated users.

2.7 ARRAY MOUNTING

A. Basis of design is given so integrator can provide design and installation of an equivalent system that is compatible with the provided modules and structure. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. UNIRAC Large Array (U-LA) (Basis of Design)
2. DPW Direct Power and Water
3. **PROSOLAR**

B. Mounting system requirements Roof mounting system:

1. 35-degree tilt angle.
2. Wind load requirements: 120 mph and class for the application.
3. 30 pounds per square foot snow load.
4. Total System Weight: 5 lbs/sf
5. Provides four mounting supports for each panel in accordance with manufacturer's requirements.
6. Coordinate final dimensions with architectural drawings and existing conditions.
7. Provisions for mounting microinverters or power optimizers.
8. Structural aluminum members to be mill finish. All brackets and connections to be stainless steel.
9. Connect mounting system to electrode grounding system.

C. Provide complete solar array mounting system including rails, splices, fasteners, legs, clamps, standoffs, feet, and anchors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Photovoltaic cabling shall be installed in raceways separate from other building system cabling. Photovoltaic cabling shall be installed in conduit when located interior to the building.

B. The photovoltaic panels and arrays shall be configured in an open circuit, short circuit, or provided with an opaque covering to disable the array from producing electrical power during installation. Refer to the manufacturer's information for additional disabling requirements during installation.

C. Install fuses in all fuse holders and disconnects. Provide a label on the inside of each disconnect identifying the size, type, and model of each fuse installed.

D. Provide provisions to seal all exterior penetrations. All photovoltaic system roof penetrations shall be sealed by the roofing contractor at the expense of the photovoltaic system contractor.

E. DC Arc-Fault Circuit Protection: Provide PVAFCI arc-fault circuit interruption protection for DC branch circuits.

F. DC Shock Hazard Protection: Provide PVHCS hazard control system to limit electric shock potential to 80 volts or less post rapid shutdown initiation or per code.

G. Roof Mounted Systems:

1. Provide photograph and report documentation of the roof system condition prior to installing any roof mounted photovoltaic systems. Provide a copy of the report to the general contractor and roofing contractor.

2. Provide protective roof mats during the fabrication and installation of roof mounted photovoltaic systems to protect the roofing system.
3. Provide provisions for roofing contractor to seal roof penetrations, provide roof protection at ballasted rack and raceway supports, and other points of interface between the roof and photovoltaic system at the expense of the photovoltaic installer.
4. Provide provisions for the roofing contractor to repair any penetrations, wear, or general damage caused by installation of the photovoltaic system at the expense of the photovoltaic system installer.

H. Wire and Cable Schedule:

1. DC Distribution System:

a. Exterior: Photovoltaic panel manufacturer-supplied cabling with quick connects.
b. Interior: Copper, stranded conductor, 600 volt insulation, XLPE or EPR.
c. Underground or Wet Locations: Copper, stranded conductor, 600 volt insulation, XLPE or EPR.
d. Conductors shall be color coded as follows:

1) PV-: Black
2) PV+: Red
3) Ground Bond: Green

2. Use no wire smaller than 10 AWG for DC wiring of the photovoltaic system.
3. Use 8 AWG for DC wiring of photovoltaic systems with distances between the photovoltaic panel and photovoltaic inverter greater than 100 feet.

I. Provide provisions for programming and initializing the system metering and reporting software per the Owner's requirements. The Contractor shall organize a meeting with the Owner to finalize the programming and user interfaces of the program software.

J. Install equipment per the manufacturer's recommendations.

3.2 LABELING

A. Label all photovoltaic system equipment as required by code.

B. Label ground fault indicators:

1. **"IN THE EVENT OF A GROUND FAULT INDICATION - THE NORMALLY GROUNDED CONDUCTORS MAY BE ENERGIZED AND UNDERGROUNDED"**

C. Label all AC-alternating current and DC-direct current disconnects of the

photovoltaic power system.

1. **"---PHOTOVOLTAIC SYSTEM DISCONNECT--- WARNING. ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION"**

D. The AC disconnecting means for each photovoltaic inverter shall be labeled with the following:

1. Operating Current:
2. Operating Voltage:
3. Maximum System Voltage:

E. Label DC raceways, cabling, junction boxes, and conduit bodies with adhesive markings and labels suitable for the environment:

1. Color: White capital letters on red background.
2. Label Text: PHOTOVOLTAIC POWER SOURCE.
3. Label intervals: Maximum 10 intervals or as required by code to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned.

F. Label DC system disconnect and power conversion equipment with the following:

1. Equipment type and contract documents designation of equipment.
2. Name of upstream equipment and location of the upstream equipment if it is not located within sight.
3. Nominal equipment voltage and rating.
4. Max DC Voltage.
5. Available fault current (from batteries if applicable).
6. Date of fault current study; refer to one-line diagram.

G. Label each electrical service location with rapid shutdown feature:

1. Label text: "SOLAR PV SYSTEM WITH RAPID SHUTDOWN. TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY."

H. Short Circuit Current: The interactive system point of interconnection shall be labeled at the disconnecting means with the following:

1. Maximum AC Output Operating Current:
2. Operating AC Voltage:

I. The building service entrance disconnect shall be clearly labeled to identify there is a photovoltaic system interconnection. The location of the interactive system disconnect shall be identified with a plaque reading: "WARNING - PHOTOVOLTAIC SYSTEM DISCONNECT LOCATED AT <**Insert**>."

J. Conductor Identification:

1. PV System DC circuit conductors shall be identified at all termination connections.
2. Identification shall include color coded shrink tube tagging, conductor colored insulation, or marking tape. Include +, POSITIVE, or POS identification style labeling in addition to color identification.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Check for damage and tight connections prior to allowing the photovoltaic panels to begin power generation.

C. Check for damage and proper operation of the photovoltaic inverters.

D. Verify operation of the metering and reporting system components. Adjust and update the graphical user interface for project specific conditions.

3.4 SYSTEM COMMISSIONING

A. Provide system commissioning report.

B. Notify Architect/Engineer seven days prior to beginning final witness testing of the photovoltaic system.

1. The Electrical Contractor shall fully test the complete photovoltaic system prior to notifying the Architect/Engineer for final witness testing.

C. Test, measure, and record the following system values:

1. Date:
2. Time of test:
3. Testers:
4. Sun overcast conditions (full sun) (scattered clouds) (full cloud coverage).
5. Inverter:

a. DC input current:
b. DC input voltage:
c. AC output current:
d. AC output voltage:
e. Output power:

D. Performance Test of Interactive Inverter System:

1. Verify proper operation of the photovoltaic system. Verify the photovoltaic system is producing power and delivering it to the building electrical distribution system.
2. Simulate power outage of electrical utility by switching the main electrical service disconnect from "closed" to "open".
3. Verify that each individual photovoltaic inverter has stopped producing electrical energy and has disconnected itself from the photovoltaic panels and building electrical distribution system.
4. Simulate return of utility electrical power by switching the main electrical service disconnect from "open' to "closed".
5. Verify each photovoltaic inverter has reconnected to the photovoltaic panels and building electrical distribution system. Verify power delivery from the photovoltaic inverters to the building electrical distribution system.
6. Document any test failure, including reason for failure and corrective actions. Retest the photovoltaic system to complete satisfactory operation.

3.5 OWNER TRAINING

A. Provide Owner training.

B. Provide complete overview of the photovoltaic system to the Owner including:

1. System overview
2. System operation
3. Manufacturer maintenance instructions
4. System component locations
5. Operation of the metering and reporting components and software

C. Minimum Training Time:

1. Eight hours includes:

a. Four hours system components.
b. Four hours computer software operation.

END OF SECTION 26 31 00

Attachment D

Radon Mitigation Minimum Specifications

The Radon Contractor will be responsible for the installation of two Active Soil Depressurization (ASD) systems. The Radon Contractor will be responsible for the final design and all associated permitting costs for the ASD systems. The ASD systems will utilize mounting points that are integrated into the steel structural supports that consist of Unistrut welded to the supports at not more than 8' between supports. The ASD systems must be installed in accordance with AARST/ANSI RMS-MF 2018 and must maintain indoor radon concentrations below the EPA action level, currently <4.0 pCi/L, as verified by post-mitigation testing. All work is to be designed and performed by a Qualified Radon Professional and proper credentials must be submitted.

Components shall be as follows:

- ASD suction point seal: RadonAway 67104 or equivalent
- ASD Piping, Joint Materials and Connections: 3-inch SCH 40 PVC and 2-inch SCH 40 PVC, ASTM D2665; primer and cement, ASTM F656, ASTM D2564; connections, ASTM D5926; 3-inch gate valve (RadonAway 79192 or equivalent)
- ASD Fan and Couplings: RadonAway HS5500; 3-inch x 3-inch rubber couplings (RadonAway 79037 or equivalent); 2-inch x 2-inch rubber couplings (RadonAway 79020 or equivalent)
- ASD Discharge Point: 2-inch vent muffler (RadonAway 24002 or equivalent)
- ASD Pressure Monitor: 50.0-inch water column pressure monitor
- Sealants: polyurethane, ASTM C920 class 25 (or equivalent)
- Fire Protection (if necessary): 3-inch fire collar (RadonAway 76086 or equivalent)
- Hardware: appropriate hangers and fasteners necessary to meet installation requirements
- Labels: appropriate labels necessary to meet installation requirements

Post-mitigation testing is required by an independent third party that is certified to do radon testing in the State of Michigan. Credentials are required to be submitted. The post-mitigation test must demonstrate a level below the EPA action level, currently less than 4.0 pCi/L.

The Radon Mitigation Contractor must provide a written operation, maintenance, and monitoring program plan.

ATTACHMENT E

CONTRACT

BETWEEN

THE ANN ARBOR AFFORDABLE HOUSING CORPORATION AND

CONTRACTOR NAME

INTRODUCTION

This contract by and between the Ann Arbor Affordable Housing Corporation (hereinafter "AAAHC" or "the HC"), located at 2000 S. Industrial Highway, Ann Arbor MI 48104 and CONTRACTOR NAME (hereinafter ABREVIATED CONTRACTOR NAME IF APPLICABLE" or "the Contractor"), located at address, is hereby entered into this MONTH DAY, 20__.

Services pursuant to this contract **shall begin MONTH DAY, 20__, and shall end no later than MONTH DAY, 20__** unless otherwise extended, modified, terminated or renewed by the parties as provided for within this contract. Unless otherwise detailed herein, all references to "days" shall be calendar days (in the case that the last day referenced falls on a Saturday, Sunday or legal holiday, then the period of time shall be automatically extended to include the next workday). Also, whenever the term "herein" is referred to, such refers to this contract form, the appendices, and all listed attachments.

1.0 Definitions:

1.1 Housing Commission (HC): Any reference herein or within any appendix to the "Housing Commission" shall be interpreted to mean the same as the AAHC or its affiliated legal entity, the Ann Arbor Affordable Housing Corporation.

1.2 Purchasing Manager (PM): The HC purchasing manager, acting on behalf of the HC.

2.0 Services and Payment:

2.1 Scope of Services: [full, detailed scope of work placed in Appendix No. 1]. Said services shall be provided on the dates and times determined by the HC at the designated HC community and facilities.

2.3 Cost/Value of Services:

2.3.1 Contract Value: The current total Not-To-Exceed (NTE) value of this contract is: $_____. Any other services provided related to this contract must be as negotiated between Contractor and the AAHC.

Contractor exceeds the NTE amount at the Contractor's own risk. The Contractor is under no obligation to provide additional services that would cause the Contractor's fees to exceed the NTE amount without prior revision of this amount by written change order.

2.4 Renewal Options: There are no renewal options with this contract.

2.5 Time Performance: The Contractor will complete each assigned task as detailed within the executed Scope of Services.

2.6 Billing Method:

2.6.1 To receive payment for services rendered pursuant to this contract the Contractor shall submit a fully completed invoice for work previously performed to:

Ann Arbor Affordable Housing Corporation
HCaccountspayable@a2gov.org
Attn. Accounts Payable
2000 S. Industrial Hwy
Ann Arbor, MI 48104

2.6.2 At a minimum, the invoice shall detail the following information:

2.6.2.1 Unique invoice number;
2.6.2.2 Contractor's name, address and telephone number;
2.6.2.3 Date of invoice and/or billing period;
2.6.2.4 Applicable Purchase Order No.;
2.6.2.5 Brief description of services rendered, including applicable time frame, total hours being billed for each service at each detailed site, and at the approved rate (may be submitted in the form of a report or invoice);
2.6.2.6 If applicable, Task Order, approved by the HC Executive Director; and
2.6.2.7 Total dollar amount being billed.

2.6.3 The HC will pay each such properly completed invoice received on a **Net/30 basis**. Any invoice received not properly completed will not be paid unless and/or until Contractor complies with the applicable provisions of this contract.

3.0 HC's Obligations: The HC agrees to purchase the specific services detailed herein and:

1.1 Agrees to not assign work to the Contractor outside the scope of services without the prior written approval of the HC's Executive Director and the Contractor.

4.0 Contractor's Obligations: Contractor agrees to provide the specific services detailed herein:

4.1 Supervision and Oversight: Contractor shall be solely responsible for providing supervision and oversight to all of the Contractor's personnel that are assigned to the HC properties pursuant to this contract.

4.2 Qualified Personnel: Contractor warrants and represents that it will assign only qualified personnel to perform the services outlined herein and within the appendices. For the purposes of this contract, the term "qualified personnel" shall mean those

personnel that have been investigated, tested and trained in the manner described within this contract and, as proposed by the Contractor within its proposal or as provided by the Contractor during the Contractor's normal conduct of business. "Qualified Personnel" includes Contractor's employees, subcontractors, and agents.

4.2.1 The AAHC will have the right to require the Contractor to remove any personnel deemed incompetent, careless or otherwise objectionable, or any personnel whose actions or appearance are deemed inconsistent with the best interests of the AAHC. The decision of the HC will be final as to what constitutes incompetent or objectionable behavior.

4.2.2 All personnel employed by the Contractor will have the requisite skills to perform their designated tasks. Necessary training shall be performed at the Contractor's expense and untrained individuals will not be brought into the premises for so-called "ON THE JOB" training.

4.3 Compliance with Federal and State Laws: All work performed by the Contractor, pursuant to this contract, shall be done in accordance with applicable all Federal, State and local laws, regulations, codes and ordinances.

4.3.1 Iran Economic Sanctions Act: The Contractor certifies that it is not an Iran linked business as defined by the Michigan Iran Economic Sanctions Act (Michigan Compiled Laws §129.311-16).

4.4 Insurance Requirements:

4.4.1 The Contractor will secure and maintain during the term of the contract insurance from an insurance company authorized to do business in the State of Michigan that will protect Contractors and sub-contractors and the HC from all liability (public liability, personal injury and property damage) claims which may arise from operations under the contract.

4.4.1.1 The Contractor will furnish insurance certificates within seven (7) days of being notified of acceptance of his/her bid. Execution of this contract will not occur until evidence of all required insurance has been submitted and approved by the HC.

4.4.1.2 Failure to maintain the above-reference insurance coverage, including naming the HC as an additional insured (where appropriate) during the term(s) of this contract shall constitute a material breach thereof. The Contractor must cease work if any of the required insurance is canceled or expires.

4.4.2 The Certificate shall specifically name the ANN ARBOR AFFORDALBE HOUSING CORPORATION and the Ann Arbor Housing Commission as additional insured parties. **In the area for the listing of additional insured on the binder it must read: "The Ann Arbor Housing Commission, and Ann Arbor Affordable Housing Corporation, acting by and through the Ann Arbor Housing Commission."**

4.4.3 The Contractor shall not allow any work under the contract to be performed by a subcontractor unless evidence of similar insurance covering the activities of the subcontractor is submitted to and approved by the HC.

4.4.4 The limits of insurance shall not be less than the following:

4.4.4.1 Policy of General Liability Insurance, $1,000,000 per occurrence, $2,000,000 aggregate together with damage to premises and fire damage of $300,000 and medical expenses for any one person of $5,000 with a deductible not greater than $1,000.

4.4.4.2 Policy of Professional Liability Insurance or Errors & Omissions coverage, minimum of $1,000,000 each occurrence, general aggregate minimum limit of $2,000,000 with a deductible of not greater than $1,000, when applicable;

4.4.4.3 Automobile Liability coverage in a combined single limit of $1,000,000. For every vehicle utilized during the term of this contract, when not owned by the entity, each vehicle must have evidence of automobile insurance coverage with limits of no less than $50,000/$100,000 and medical pay of $5,000 with a deductible not greater than $1,000.

4.4.4.4 Worker's compensation coverage evidencing carrier and coverage amount required by the State of Michigan.

4.4.4.5 Insurance certificate(s)/endorsement(s) shall be delivered to the following person representing the HC:

ANN ARBOR AFFORDABLE HOUSING CORPORATION
FINANCIAL DEPARTMENT
HCAccountspayable@a2gov.org
734 794-6720
2000 S. Industrial Hwy
ANN ARBOR, MI 48104

4.5 Licensing: The Contractor shall also provide to the HC a copy of the required State of Michigan Business License. Failure to maintain this license in a current status during the term(s) of this contract shall constitute a material breach thereof.

4.6 Financial Viability and Regulatory Compliance:

4.6.1 If other than an individual/sole proprietor, Contractor warrants and represents that its corporate entity is in good standing with all applicable federal, state and local licensing authorities and that it possesses all requisite licenses to perform the services required by this contract.

4.6.2 Contractor agrees to promptly disclose to the HC any licensure suspension or revocation that adversely affect its capacity to perform this contract. Contractor's failure to immediately disclose such issue to the HC will constitute a material breach of this contract.

4.6.3 Contractor agrees to promptly disclose to the HC any change of more than 50% of its ownership and/or any declaration of bankruptcy that the Contractor undergoes during the term(s) of this contract. Contractor's failure to immediately disclose any change of more than 50% of its ownership and/or its declaration of bankruptcy shall constitute a material breach of this contract.

4.6.4 All disclosures made pursuant to this section of the contract shall be made in writing.

5.0 **Modification:** This contract shall not be modified, revised, amended or extended except by written addendum, executed by both parties.

6.0 **Severability:** If any provision of this agreement or any portion or provision hereof applicable to any particular situation or circumstance is held invalid, the remainder of this agreement or the remainder of such provision (as the case may be), and the application thereof to other situations or circumstances shall not be affected thereby.

7.0 Applicable Laws:

7.1 **Jurisdiction and Venue:** The laws of the State of Michigan shall govern the validity, construction and effect of this contract, unless said laws are superseded by, or conflict with, applicable federal laws and/or federal regulations. This contract will be binding upon the parties, their heirs, beneficiaries, and devisees of the parties hereto. The parties agree that Washtenaw County, Michigan is the appropriate forum for any action relating to this contract. This agreement may be executed in multiple counterparts which shall be considered binding.

7.2 **Interest of Contractor and the Housing Commission**: The Contractor promises that it has no interest which would conflict with the performance of services required by this contract. The Contractor also promises that, in the performance of this contract, no officer, agent, employee of the Commission, or member of its governing bodies, may participate in any decision relating to this contract which affects his/her personal interest or the interest of any corporation, partnership or association in which he/she is directly or indirectly interested or has any personal or pecuniary interest. This paragraph does not apply if all parties are in compliance with the provisions of Michigan Compiled Laws §15.323 and 24 CFR PART 85.36(b), as applicable.

8.0 Notices:

8.1 All legal notices submitted to the HC by the Contractor pursuant to this contract shall be in writing via email, facsimile or other electronic means and delivered to the attention of the following person representing the HC:

ANN ARBOR HOUSING COMMISSION
ATTN: EXECUTIVE DIRECTOR
JHALL@A2GOV.ORG
2000 S. INDUSTRIAL HWY
ANN ARBOR, MI 48104
Ph. 734-794-6720
Fax 734-996-3018

8.2 All legal notices submitted to the Contractor pursuant to this contract shall be in writing via email, facsimile or other electronic means and delivered to the attention of:

ENTITY NAME
EMAIL
ADDRESS LINE 1
ADDRESS LINE 2
Ph. xxx-xxx-xxxx

Fax xxx-xxx-xxxx

9.0 Breach and Retention of Records: The HC and the Contractor each agree to comply with the following provisions:

9.1 Remedies for Contractor Breach: Pertaining to contract-related issues, it is the responsibility of both the HC and the Contractor to communicate with each in as clear and complete a manner as possible. If at any time during the term of this contract the HC or the Contractor is not satisfied with any issue, it is the responsibility of that party to deliver to the other party communication, in writing, fully detailing the issue and corrective action the HC has the right to issue unilateral addendums to this contract, but the Contractor does not have the same right). The other party shall, within 30 days, respond in writing (the HC reserves the right, if conditions warrant, to require the Contractor to respond in a shorter period of time). HC shall, at a minimum, employ the following steps in dealing with the Contractor as to any performance issues:

9.1.1 If the Contractor is in material breach of the contract, the HC may terminate the contract for cause. Such termination must be delivered to the Contractor in writing and shall fully detail the cause of and justification for the termination.

9.1.2 Prior to termination, the HC may choose to warn the Contractor, orally or in writing, of any non-compliant or unsatisfactory performance. Such written warning may include giving the Contractor a certain period of time to correct the deficiencies or potentially suffer termination. If the Contractor does not agree with such action, the Contractor shall have ten 10 days to dispute or protest, in writing, such action; if the Contractor does not do so within the 10-day period, it be deemed to accept and agree with the HC's position on the issue. The written protest must detail all pertinent information pertaining to the dispute, including justification detailing the HC's alleged incorrect action(s).

9.1.3 After termination, if the Contractor does not agree with the HC's justification for the termination, the Contractor shall have 10 days to dispute, in writing, such action; if the Contractor does not do so within the 10-day period, it shall be deemed to accept and agree with the HC's position on the issue. The written protest must detail all pertinent information pertaining to the dispute, including justification detailing the HC's alleged incorrect action(s).

9.1.4 The response to any protest received shall be conducted in accordance with Section No. 4.0 of this document.

9.2 Reporting: The parties hereby agree to comply with any reporting requirements that may be detailed herein.

9.3 Copyrights/Rights in Data: The HC has unlimited rights to any data, including computer software, developed by the Contractor in the performance of the contract.

9.4 Access to Records: Access to any books, documents, papers, and records of the contractor which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

9.5 **Retention of Records:** Retention of all required records for three years after HC make final payments and all other pending matters are closed.

9.6 **Contractor Certification:** The Contractor hereby assures and certifies that it will comply with all of the applicable requirements of the foregoing sections 10.0-10.6, as the same may be amended from time to time.

10.0 Additional Considerations:

10.1 **Non-Escalation:** Unless otherwise specified within a Request for Proposal or Quote document, the unit prices reflected on the contract shall remain firm with no provision for price increases during the term of the contract.

10.2 **Funding Restrictions and Order Quantities:** The HC reserves the right to reduce or increase estimated or actual quantities in whatever amount necessary without prejudice or liability to the HC, if:

10.2.1 Funding is not available;
10.2.2 Legal restrictions are placed upon the expenditure of monies for this category of service or supplies; or
10.2.3 The HC's requirements in good faith change after award of the contract.

10.3 Unless otherwise stated in a Request for Proposal or Quote document, all local, State or Federal permits which may be required to provide the services ensuing from award of this contract, regardless of whether they are known to HC or Contractor at the time of the proposal submittal deadline or the award, shall be the sole responsibility of the Contractor and any costs submitted by the Contractor in response to a Request for Proposal or Quote shall reflect all costs required by the Contractor to procure and provide such necessary permits.

10.5 **Taxes:** The Housing Commission is exempt from paying Michigan State Sales and Use Taxes and Federal Excise Taxes. A letter of Tax Exemption will be provided upon request. MI

10.6 **Government Standards:** It is the responsibility of the proposer to ensure that all items and services proposed conform to all local, State and Federal law concerning safety (OSHA and MIOSHA) and environmental control (EPA and City of Ann Arbor Pollution Regulations) and any other ordinance, code, law or regulation. Contractor shall be responsible for all costs incurred for compliance with any such possible ordinance, code, law or regulation. No time extensions shall be granted or financial consideration given to the Contractor for time or monies lost due to violations of any ordinance, code, law or regulations that may occur.

10.7 **Freight on Bill and Delivery:** All costs submitted by the proposer shall reflect the cost of delivering the proposed items and/or services to the locations(s) specified within the proposal.

10.7.1 Contractor agrees to deliver to the designated location(s) on or before the date as specified in the finalized contract. Failure to deliver on or before the specified date constitutes an event of default by Contractor. Upon default, Contractor agrees that the HC may, at its option, rescind this contract under the default clause herein and seek compensatory damages as provided by law.

10.8 **Backorders:**

10.8.1 The HC PM must be notified in writing by the Contractor within 10 days of any and all backordered materials and/or any incomplete services; and the estimated delivery date.

10.8.2 Unless otherwise stipulated in the contract, if any order will be delayed more than 10 days past the original agreed upon delivery date, the HC may at its option cancel the order, if, in the opinion of the HC PM, it is in the best interests of the HC to do so.

10.9 Work on HC Property: If the Contractor's work under the contract involves operations by the Contractor on HC premises, the Contractor shall take all necessary precautions to prevent the occurrence of any injury to persons or property during the progress of such work and, except to the extent that any such injury is caused solely and directly by the HC's negligence, shall indemnify the HC, and its officers, agents, servants and employees against all loss which may result in any way from any act or omission of the Contractor, its agents, employees, or subcontractors.

10.9.1 The Contractor shall be responsible for repairing any unintentional damage that the Contractor causes during the course of the Contractor's work. Such damages include, but are not limited to, ruts caused by machinery or breaking paving materials not included in this contract.

10.10 Official, Agent and Employees of the HC Not Personally Liable: No official, officer, employee, or agent of the HC in any way be personally liable or responsible for any covenant or agreement herein contained whether expressed or implied, or for any statement, representation or warranty made herein or in any connection with this agreement.

10.11 Sub-Contractors: Unless otherwise stated, the Contractor may not use any sub-contractors to accomplish any portion of the services described within the documents or the contract without the prior written permission of the HC PM.

10.12 Salaries and Expenses Relating to the Contractors Employees: Unless otherwise stated within the procurement documents, the Contractor shall pay all salaries and expenses of, and all Federal, Social Security taxes, Federal and State Unemployment taxes, and any similar taxes relating to its employees used in the performance of the contract. The Contractor shall comply with all Federal, State and local wage and hour laws and all licensing laws applicable to its employees or **other** personnel furnished under this agreement.

10.13 Attorney Fees: In the event that litigation is commenced by one party against the other in connection with the enforcement of any provision of this agreement, and the Contractor is the losing party, Contractor shall pay all of HC's court costs and other expenses of such litigation, including reasonable attorney fees. The attorney fees shall be taxed to the Contractor as costs of the suit, unless prohibited by law.

10.14 Independent Contractor: Contractor is an independent Contractor. Nothing herein shall create any association, agency, partnership or joint venture between the parties hereto and neither shall have any authority to bind the other in any way.

10.15 Waiver of Breach: A waiver of either party of any terms or condition of this agreement in any instance shall not be deemed or construed as a waiver of such term or condition for the future, or of any subsequent breach thereof. All remedies, rights, undertakings, obligations, and agreements contained in this agreement shall be cumulative and none of them shall be in limitation of any other remedy, right, obligation or agreement of either party.

10.16 Time of the Essence: Time is of the essence under this agreement as to each provision in which time of performance is a factor.

10.17 Limitation of Liability: In no event shall the HC be liable to the Contractor for any indirect, incidental, consequential or exemplary damages.

10.18 Indemnification:

10.18.1 The Contractor shall indemnify, defend, and hold the HC (and its officers, employees, and agents) harmless from and against any and all claims, damages, losses, suits, actions, decrees, judgments, attorney fees, court costs and other expenses of any kind or character, which are caused by, arise out of, or occur due to any failure of the Contractor to (1) abide by any of the applicable professional standards within its industry, or (2) comply with the terms, conditions, or covenants that are contained in this contract,
(3) comply with the "Michigan Industrial Insurance Act," or any other law, ordinance, or decree; or (4) ensure that the any sub-contractors abide by the terms of this provision and this contract; provided, however, that Contractor will not be required to indemnify the HC against any loss or damage which was specifically caused by the HC providing inaccurate information to the Contractor, failing to provide necessary and requested information to the Contractor, or refusal to abide by any recommendation of the Contractor.

10.18.2 The Contractor shall, at its own expense, defend the HC, its officers, employees, and agents, against any and all claims, suits or actions which may be brought against them, or any of them, as a result of, or by reason of, or arising out of, or on account of, or in consequence of any act or failure to act the consequences of which the Contractor has indemnified the HC. If the Contractor shall fail to do so, the HC shall have the right, but not the obligation, to defend the same and to charge all direct and incidental costs of such defense to the Contractor including attorney fees and court costs.

10.18.3 Any money due to the Contractor under and by virtue of this contract, which the HC believes must be withheld from the Contractor to protect the HC, may be retained by the HC so long as it is reasonably necessary to ensure the HC's protection; or in case no money is due, its surety may be held until all applicable claims have been settled and suitable evidence to that effect furnished to the HC provided, however, neither the Corporation's payments shall not be withheld, and its surety shall be released, if the Contractor is able to demonstrate that it has adequate liability and property damage insurance to protect the HC from any potential claims.

10.18.4 The Contractor shall provide that any contractual arrangement with a sub-contractor shall be in conformance with the terms of this Contract including the terms of this indemnity provision. The Contractor guarantees that it will promptly handle and rectify any and all claims for materials, supplies and

labor, or any other claims that may be made against it or any of its sub-contractors in connection with the contract.

11.0 Appendices:

11.1 The following noted documents are placed under each of the noted appendix and are a part of this contract:

Appendix No. 1: Scope of Work

Appendix No. 2: Contractor Certification of Asbestos-Free Product Installation

11.2 In the case of any discrepancy between this contract and any of the above noted documents, the requirement(s) listed within the body of this contract shall take precedence, then the requirement(s) listed within each appendix shall take precedence in the order they are listed above (i.e. the requirement(s) listed the lower listed item may not supersede any requirement(s) within a higher listed item), except as otherwise required by law.

11.3 Any document referenced herein that has not been attached is hereby incorporated herein by reference, and a copy of each such document is available from the HC upon written request.

12.0 CERTIFICATIONS:

The undersigned representatives of each party acknowledge by signature below that they have reviewed the foregoing and understand and agree to abide by their respective obligations as detailed herein:

By:_____ DATE:_____

FIRST LAST
TITLE
ENTITY
ADDRESS LINE 1
ADDRESS LINE 2
EMAIL
PHONE

By:_____ DATE:_____

Jennifer Hall, Secretary-Treasurer
Ann Arbor Affordable Housing Corporation
2000 S. Industrial Hwy
Ann Arbor, MI 48104
734-794-6721

Appendix No. 1: Full Scope of Work

Appendix No 2:

Employer/Employee/Tenant Notification

As required by the OSHA Regulation building and/or facility owners shall notify the following persons of the presence, location and quantity of ACM or PACM, at the work sites in their buildings and facilities. Notification either shall be inwriting or shall consist of a personal communication between the owner and the person to whom notification must be given or their authorized representative:

A. Prospective employers applying or bidding for work whose employees reasonably can be expected to work in adjacent to areas containing such material;

B. Employees of the owner who will work in or adjacent to areas containing such materials;

C. On Multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such material;

D. Tenants who will occupy areas containing such materials.

Please complete this form and return it to: _____

_____

I _____, representing and having authority for_____(company), hereby indicate and agree that a representative of the building/facility,_____(name), (title) has provided me information regarding the specific locations and materials that are asbestos-containing and which may be encountered or have the potential of being encountered during the course of activities involving _____(project name and/or number) in the above-mentioned building.

I expressly agree that neither I, nor any of my employees, agents, sub-contractors or other individuals or entities over whom I have any responsibility or control, will disturb asbestos-containing materials for the above- mentioned building. I further understand and agree that should I, my employees, agents, sub-contractors or other individuals or entities over whom I have control, encounter any material(s) suspected of containing asbestos, said material(s) shall not be disturbed without first notifying the office of the building/facility owner, and receiving written approval that such material(s) maybe disturbed.

_____
Print Name

_____
Signature

_____
Company

_____
Position

_____
Date

Contractor Certification of Asbestos-Free Product Installation

Name of building: _____

1. Contractor name and address:

_____
Name

_____
Street City State Zip

2. Brief scope of contracted activities:

_____

_____

_____

3. Certification statement:

I _____, representing and having authority for _____ _____(company), hereby certify that any and all products/materials which will be and/or have been installed or introduced into the above-mentioned building, _____ (project name and/or number) are asbestos free (or less than 1% asbestos by weight).

_____
Print Name

_____
Signature

_____
Company

_____
Position

_____
Date

ATTACHMENT F
LEGAL STATUS OF BIDDER

(The bidder shall fill out the appropriate form and strike out the other three.)

Bidder declares that it is:

* A corporation organized and doing business under the laws of the State of _____, for whom _____, bearing the office title of , whose signature is affixed to this Bid, is authorized to execute contracts.

NOTE: If not incorporated in Michigan, please attach the corporation's Certificate of Authority

• A limited liability company doing business under the laws of the State of _____, whom _____ bearing the title of _____ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

* A partnership, organized under the laws of the state of _____ and filed in the county of _____, whose members are (list all members and the street and mailing address of each) (attach separate sheet if necessary):

_____

_____

_____

_____

_____

* An individual, whose signature with address, is affixed to this Bid: _____ (initial here)

Authorized Official

_____ **Date** _____**,** 202_

(Print) Name _____ Title _____

Company: _____

Address: _____

Contact Phone ( ) _____ Fax ( ) _____

Email _____

ATTACHMENT G

BID FORM

Company: _____

Schedule of Pricing/Cost –

No.	Item Description	Price
1	Material	$
2	Labor	$
3	Permits	$
4	General Conditions/Other	$
5	Contractor's Fee	$

Base Bid $ _____

Voluntary Alternate # _____

Description:

Add/(Deduct) $ _____

_____

Name Title Date

ATTACHMENT H

CITY OF ANN ARBOR DECLARATION OF COMPLIANCE

NON-DISCRIMINATION ORDINANCE

CITY OF ANN ARBOR DECLARATION OF COMPLIANCE

Non-Discrimination Ordinance

The "non discrimination by city contractors" provision of the City of Ann Arbor Non-Discrimination Ordinance (Ann Arbor City Code Chapter 112, Section 9:158) requires all contractors proposing to do business with the City to treat employees in a manner which provides equal employment opportunity and does not discriminate against any of their employees, any City employee working with them, or any applicant for employment on the basis of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight. It also requires that the contractors include a similar provision in all subcontracts that they execute for City work or programs.

In addition the City Non-Discrimination Ordinance requires that all contractors proposing to do business with the City of Ann Arbor must satisfy the contract compliance administrative policy adopted by the City Administrator. A copy of that policy may be obtained from the Purchasing Manager

The Contractor agrees:

(a) To comply with the terms of the City of Ann Arbor's Non-Discrimination Ordinance and contract compliance administrative policy, including but not limited to an acceptable affirmative action program if applicable.

(b) To post the City of Ann Arbor's Non-Discrimination Ordinance Notice in every work place or other location in which employees or other persons are contracted to provide services under a contract with the City.

(c) To provide documentation within the specified time frame in connection with any workforce verification, compliance review or complaint investigation.

(d) To permit access to employees and work sites to City representatives for the purposes of monitoring compliance, or investigating complaints of non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the Ann Arbor Non-Discrimination Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Non-Discrimination Ordinance, obligates the Contractor to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract.

_____
Company Name

_____
Signature of Authorized Representative Date

_____
Print Name and Title

_____
Address, City, State, Zip

_____
Phone/Email Address

Questions about the Notice or the City Administrative Policy, Please contact:
Procurement Office of the City of Ann Arbor (734)
794-6500

ATTACHMENT I

LIVING WAGE DECLARATION OF COMPLIANCE FORM

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than $10,000 for any twelve- month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than $10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than $10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here [___] *No. of employees*_

The Contractor or Grantee agrees:

(a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as $16.43/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than $18.32/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

Check the applicable box below which applies to your workforce

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

(b) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every workplace or other location in which employees or other persons contracting for employment are working.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance and investigating complaints or non-compliance.

(e) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

Company Name	Street Address
Signature of Authorized Representative Date	City, State, Zip
Print Name and Title	Phone/Email address

ATTACHMENT J

VENDOR CONFLICT OF INTEREST DISCLOSURE FORM

Vendor Conflict of Interest Disclosure Form

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

Conflict of Interest Disclosure*	
Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest.	( ) Relationship to employee _____ ( ) Interest in vendor's company ( ) Other (please describe in box below)

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below:		
Vendor Name		**Vendor Phone Number**
Signature of Vendor Authorized Representative	**Date**	**Printed Name of Vendor Authorized Representative**

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500, procurement@a2gov.org

ATTACHMENT K

Non-Discrimination Ordinance Poster

CITY OF ANN ARBOR NON-DISCRIMINATION ORDINANCE

Relevant provisions of Chapter 112, Nondiscrimination, of the City of Ann Arbor Code are included below. You can reviewthe entire ordinance at www.a2gov.org/humanrights.

Intent: It is the intent of the City of Ann Arbor that no individual be denied equal protection of the laws; nor shall any individual be denied the enjoyment of his or her civil or political rights or be discriminated against because of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight.

Discriminatory Employment Practices: No person shall discriminate in the hire, employment, compensation, work classifications, conditions or terms, promotion or demotion, or termination of employment of any individual. No person shall discriminate in limiting membership, conditions of membership or termination of membership in anylabor union or apprenticeship program.

Discriminatory Effects: No person shall adopt, enforce or employ any policy or requirement which has the effect of creating unequal opportunities according to actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight for an individual to obtain housing, employmentor public accommodation, except for a bona fide business necessity. Such a necessity does not arise due to a mere inconvenience or because of suspected objection to such a person by neighbors, customers or other persons.

Nondiscrimination by City of Ann Arbor Contractors: All contractors proposing to do business with the City of Ann Arbor shallsatisfy the contract compliance administrative policy adopted by the City of Ann Arbor Administrator in accordance with the guidelines of this section. All City of Ann Arbor contractors shall ensure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon any classification protected by this chapter. All contractors shall agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of any applicable protected classification. All contractors shall be required to post a copy of Ann Arbor's Non-Discrimination Ordinance at allwork locations where its employees provide services under a contract with the City of Ann Arbor.

Complaint Procedure: If any individual believes there has been a violation of this chapter, he/she may file a complaint with the City of Ann Arbor's Human Rights Commission. The complaint must be filed within 180 calendar days from the date of the individual's knowledge of the allegedly discriminatory action or 180 calendar days from the date when the individual should have known of the allegedly discriminatory action. A complaint that is not filed withinthis timeframe cannot be considered by the Human Rights Commission. To file a complaint, first complete the complaint form, which is available at www.a2gov.org/humanrights. Then submit it to the Human Rights Commission by e-mail (hrc@a2gov.org), by mail (Ann Arbor Human Rights Commission, PO Box 8647, Ann Arbor,MI 48107), or in person (City of Ann Arbor Clerk's Office). For further information, please call the commission at 734-794-6141 or e-mail the commission at hrc@a2gov.org.

Private Actions For Damages or Injunctive Relief: To the extent allowed by law, an individual who is the victim of discriminatory action in violation of this chapter may bring a civil action for appropriate injunctive relief or damagesor both against the person(s) who acted in violation of this chapter.

THIS IS AN OFFICIAL GOVERNMENT NOTICE AND
MUST BE DISPLAYED WHERE EMPLOYEES CAN READILY SEE IT.

ATTACHMENT L
LIVING WAGE POSTER

CITY OF ANN ARBOR LIVING WAGE ORDINANCE

RATE EFFECTIVE APRIL 30, 2024 - ENDING APRIL 29, 2025

$16.43 per hour
If the employer provides health care benefits*

$18.32 per hour
If the employer does **NOT** provide health care benefits*

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than $10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

ENFORCEMENT

The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than $500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

* Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed $.50 an hour for an average work week; and the employer cost or contribution must equal no less than $1/hr for the average work week.

The Law Requires Employers to Display This Poster Where Employees Can Readily See It.

For Additional Information or to File a Complaint contact Colin Spencer at 734/794-6500