ADDENDUM NO. 1

February 2, 2024

Carmel High School Existing Natatorium Re-Roof
520 E. Main Street
Carmel, IN 46032

TO: ALL BIDDERS OF RECORD

This Addendum forms a part of and modifies the Bidding Requirements, Contract Forms, Contract Conditions, Specifications, and Drawings dated December 17, 2021, by Fanning Howey. Acknowledge receipt of the Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of Pages ADD. 1-1and attached Fanning Howey Addendum No. 1 dated January 31, 2024, consisting of: Replacement Specification 07 54 00 Thermoplastic Membrane Roofing.

A. **SPECIFICATION SECTION 01 12 00**

B. 3.03 BID CATEGORIES

A. Bid Category No. 16 – Existing Natatorium Re-Roof

Replace Section 07 54 00 Thermoplastic Membrane Roofing in its entirety.

A D D E N D U M N O. 1

Carmel High School Natatorium Additions

Existing Natatorium Re-Roof

Project No. 220014.00

Carmel Clay Schools
Carmel, Indiana

Index of Contents

Addendum No. 1, 1 item, 1 page
Revised Project Manual Section: 07 54 00 – Thermoplastic Membrane Roofing

Date: January 31, 2024

FANNING/HOWEY ASSOCIATES, INC.
ARCHITECTS/ENGINEERS/CONSULTANTS

TO: ALL BIDDERS OF RECORD

ADDENDUM NO. 1 to Drawings and Project Manual, dated January 17, 2021 for Carmel High School Natatorium Addition, Existing Natatorium Re-Roof for Carmel Clay Schools, 5201 East Main Street, Carmel, Indiana 46033; as prepared by Fanning/Howey Associates, Inc., Indianapolis, Indiana.
This Addendum shall hereby be and become a part of the Contract Documents the same as if originally bound thereto.

The following clarifications, amendments, additions, revisions, changes, and modifications change the original Contract Documents only in the amount and to the extent hereinafter specified in this Addendum.

Each bidder shall acknowledge receipt of this Addendum in his proposal or bid.

NOTE: Bidders are responsible for becoming familiar with every item of this Addendum. (This includes miscellaneous items at the very end of this Addendum.)

RE: ALL BIDDERS

ITEM NO. 1. REVISED PROJECT MANUAL SECTION

A. Section 07 54 00 – Thermoplastic Membrane Roofing has been revised, dated 1/31/24, and are included with and hereby made a part of this Addendum.

END OF ADDENDUM

SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. ***Adhered thermoplastic membrane roofing system.***
      a. Low slope, ~~steep/vaulted slope, and curved vaulted.~~
      ~~b. Snow guards~~
   2. Substrate board.
   3. Vapor retarder/Barrier.
   4. Roof insulation.
   5. Cover board.
   6. Walkways.

B. Related Sections include the following:
   1. Division 05 Section "Steel Decking" for furnishing acoustical deck rib insulation.
   2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   4. Division 07 Section “Roof Specialties” for roof edge terminations.
   5. Division 07 Section "Manufactured Roof Expansion Joints."
   6. Division 07 Section "Roof Accessories” for roof hatches.
   7. Division 07 Section "Joint Sealants" for sealants not directly associated with roofing.
   8. Division 22 Section "Facility Storm Drainage Piping" for roof drains.

1.3 REFERENCES

A. American Society of Civil Engineers: Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.

B. American Society of Testing and Materials (ASTM)
   1. ASTM C168 – Standard Terminology Relating to Thermal Insulation.
   2. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   3. ASTM C209 – Methods of Testing Insulating Board, Structural and Decorative.
   4. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   5. ASTM C1289 – Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   6. ASTM C1303 – Standard Test Method for Estimating the Long Term Change in the Thermal Resistance of Unfaced Closed Cell Plastic Foams by Slicing and Scaling Under Controlled Laboratory Conditions.
   7. ASTM D1079 – Standard Terminology Related to Roofing and Waterproofing.
   8. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   9. ASTM D2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
   10. ASTM D2842 – Standard Test Method for Water Absorption for Rigid Cellular Plastics.
   11. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   12. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials.
   13. ASTM E108 – Standard Test Methods for Fire Tests of Roof Coverings.

C. National Roofing Contractors Association (NRCA) – Roofing and Waterproofing Manual.

D. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA) – Architectural Sheet Metal Manual.

E. Underwriters Laboratories (UL) – Roofing Materials and Systems Annual Directory.

F. ANSI/SPRI WD-1: Wind Design Standard Practice for Roofing Assemblies.

G. ANSI/SPRI ES-1: Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.

H. National Fire Protection Association (NFPA): NFPA 241-Safeguarding Building Construction Operations.

I. Environmental Protection Agency (EPA): EPA Method 9045.

1.4 DEFINITIONS

A. Roofing Terminology: Refer to 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. Positive Drainage: The drainage condition in which consideration has been made during design for all loading deflections of the deck, and additional roof slope has been provided to ensure drainage of the roof area within 48 hours of rainfall, during ambient drying conditions.

C. Roof System: A system of interacting roof components generally consisting of a membrane, roof insulation and air or vapor retarder (if present) (not including the roof deck) designed to weatherproof a structure and improve thermal resistance.

D. Pool Environment: The pool environment for special coatings, materials, and treatments includes the competition pool space, pool deck, pool equipment room, pool storage rooms, spectator seating areas and adjacent spaces within the same enclosure. Room numbers as follows: N007, N012, N013, N018, N020, N021, N021A, N022, N027, N035, N036, N037, N039, N102, N104, N107, N109, N201, N202, N203, N204, ***and existing Natatorium.***

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct conference at Project site. A/E will schedule and conduct meeting. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner; A/E; 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.
10. Deviations from the project specifications or the approved shop drawings are not permitted without prior written approval by roofing membrane manufacturer, the Owner, and the A/E.

B. Sequencing
1. Work shall begin only after openings and penetrations are in place and adjacent work required for a complete tie-in is in place. This includes masonry with special attention being given to roof-to-wall transitions. Work shall not begin:
   a. Before the “Preinstallation Conference” has occurred
   b. Until conditions exist necessary for successful completion of roofing.
   c. Without presence and approval of manufacturer’s representative
2. Prior to and during application, all dirt, devices and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air or similar methods.
3. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.
4. After work on roof is started, no traffic will be permitted on the roof other than necessary for the roofing application and inspection. Materials shall not be piled on to the roof to the extent that design live loads are exceeded. Roofing materials shall not be transported over unfinished or finished roofing or existing roofs.
   a. Work shall begin at the furthest point from the designated spot where materials are shipped to the roof.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Submit specifications, installation instructions, and general recommendations from roofing materials manufacturer for type of roofing required. Include data substantiating that materials comply with requirements of this specification, inclusive of accelerated weathering data.
1. For insulation and roof system component fasteners, include copy of FM Approvals’ RoofNav listing, SPRI’s Directory of Roof Assemblies listing or manufacturer’s interpretation equivalent.
2. Storage and handling requirements and recommendations.
3. Roof Assembly letter from roof membrane manufacturer.

B. Shop Drawings: Submit to membrane manufacturer for review and comments before issuing to A/E. Include plans, elevations, sections, details, and attachments to other Work.
1. Layout and thickness of insulation, fastener type and length.
2. Perimeter and penetration details, including base flashings and membrane terminations.
3. Tapered insulation, including slopes.
4. Insulation fastening patterns for corners, perimeter, and field-of-roof locations.
5. Flashing Conditions: Show all roofing conditions, include location and type of all penetrations, including but not limited to drains, perimeter conditions, roof penetration conditions, expansion joints, etc. The shop drawings must be reviewed and approved by the roof system manufacturer to assure the completed installation will meet the manufacturer's warranty requirements.
6. Wind Uplift Securement: Provide roof plan(s) marked-up to indicate extent of roof corner and roof perimeter areas, inclusive of fastener spacing/density. This drawing must be reviewed and approved by the roof system manufacturer to assure the completed installation will meet the manufacturer's warranty requirements and the "Performance Requirements" listed in this specification.
7. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.

~~***C. Delegated-Design Submittal: Indicate number of rows and spacing of rows for snow guards and clamps required at locations indicated in accordance with snow guard manufacturer's design. Submit design formulation. Indicate locations of diverters to protect penetrations.***~~

~~***1. Snow Retention System Calculations: Include calculation of number and location of snow guards based on snow load, roof slope, panel length and finish, and seam type and spacing.***~~

1.7 INFORMATIONAL/QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system and qualifies to receive manufacturer's 20 year, no-dollar-limit warranty (even if a lesser warranty is specified).

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of meeting performance requirements, including uplift resistance.
   2. Submit insulation fastening patterns for corner, perimeter, and field-of-roof locations to meet performance requirements.
   3. Submit an intent to warrant, executed by authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications, and conditions affecting the work and, and proposes to provide warranties as referenced herein without further stipulation.
   4. Submit a letter from the roof membrane manufacturer certifying the proposed roofing assembly, compatibility of materials and total R-value of insulation.

C. Qualification Data: For Installer and manufacturer.

D. Sample Warranty: Copy of manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting work.
   1. Contractor shall submit manufacturers approved "Pre-Installation Notice" (PIN) to A/E.

1.8 CLOSEOUT SUBMITTALS:

A. General: Closeout Submittals are to be submitted with O and M Manuals only. Do not submit with other ACTION and INFORMATIONAL Submittals.
   1. Maintenance Data: For roofing system to include in maintenance manuals.
      a. Roofing membrane manufacturer shall submit a Roof Maintenance and Inspection Manual with warranties and project closeout submittals. (Final payment will not be made until roof maintenance manual is submitted.)
      b. Roof Maintenance and Inspection Manual shall include:
         1) Cover letter recommending to the Owner that 2 roof maintenance inspections should be conducted per year.
         2) Table of Contents.
         3) Visual observation checklist indicating specific flashings and details to be observed. Include items such as base flashing seams, reglets and counterflashings, roof edge flashings, roof penetration flashings, roof curb flashings, boot flashings, roof drain areas, parapet wall flashings, copings, roof membrane seams, skylight flashings, etc. Applicable items shall be listed per project.
         4) Copies of "Project Record" roofing details.
         5) Roof plan indicating penetrations, detail locations, roof drains, and seams.
         6) Final inspection report.
   2. Warranties: Special warranties specified in this Section. When warranties are delivered to the Owner, a cover letter shall be included directing the Owner to inform (copy) the manufacturer as well as the Contractor, when reporting roofing problems, regardless of when they occurred during the warranty period, including any 'Punch List" items.
      a. Contractor shall submit manufacturers approved "Pre-Installation Notice" (PIN) to A/E.

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

1.9 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: A qualified manufacturer that is UL listed or listed in FM Approvals' RoofNav or listed in SPRI's Directory of Roof Assemblies for roofing system equivalent to that used for this Project.
   a. If details for any manufacturer's systems proposed in the Contract Documents are not acceptable to the Manufacturer, submit corresponding details proposed for the particular application, together with the Manufacturer's reasons for not accepting the conditions depicted in the Contract Documents. No alternate details will be considered without evidence of valid objections by the Manufacturer. All information must be submitted by the Manufacturer on the Manufacturer's letterhead and documentation. Installer submitted items are not acceptable.
   b. Manufacturer shall provide inspections. Inspections shall be a minimum of 8 hours per week and a minimum of 2 non-consecutive days when roofing assembly work is being done. Inspections shall be a minimum of 4 hours during any single project visit. These inspections do not include the roofing pre-installation meeting and the final roof inspection. Inspections shall be scheduled randomly with no prior notification and selection of the roofing manufacturer's inspector shall not be influenced by the roofing contractor's preferences.
      1) Manufacturer's inspector shall be a field technical inspector employed by the manufacturer not engaged in the sale of products. Inspector shall be experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and to determine installer's compliance with the requirements for the Project and the manufacturer's warranty certification.
      2) Manufacturer's inspector services shall include examination of substrates and conditions prior to membrane installation including verification of fastening of substrate to structure. Inspections shall also include observation of membrane installation, detailing, flashing, in progress work, and complete portions of the work.
      3) Manufacturer's inspector may not approve a roof installation as warrantable or acceptable if any current condition of the application of the new system does not meet the current published manufacturer's standards or submittals without review by A/E. The warrantability issue is part of the Contract Documents and does not take precedent over all contract requirements.
      4) Manufacturer's inspector after site visit shall provide a written report to the A/E and roofing contractor. Report shall indicate existing conditions on day of inspection, work occurring, observation of work, workmanship and materials stored at the project site. A minimum of 5 pictures of roofing work shall be included in the reports. Reports shall be submitted within 7 days of the site visit.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to install and receive a manufacturer's 20 year (or manufacturer longest period for specified product) no-dollar-limit warranty. Installer must verify this approval with a letter from manufacturer and supply letter even if a lesser warranty is specified.

a. The Contractor shall obtain from the roofing manufacturer copies of each roof inspection and furnish a copy to the A/E. The Contractor shall inform the roofing manufacturer, with regard to warranties, that warranties shall be issued, based upon the acceptance of the roofing work, and that deficiencies noted on inspection reports have been corrected. The manufacturer shall not refuse or restrict the provisions of its warranty, based upon deficiencies noted on inspection reports, especially any report that may not have been furnished to the A/E. Inspections shall be a minimum of 3 and scheduled randomly (no prior notification) and selection of the roofing manufacturer's inspector(s) shall not be influenced by the roofing subcontractor's preferences. The A/E will not approve final payment of roofing work until final and interim inspection reports and warranty are in hand. The A/E's representative shall accompany the manufacturer's inspector and Roofing Installer during final inspection prior to issuing manufacturer's warranty.

b. The roofing installer shall have on the job whenever roofing work is being done, a foreman/supervisor with a minimum 3 years experience in the type of roofing specified or the roofing manufacturer's technical field representative and provide adequate number of experienced workman regularly engaged in this type of work who are skilled in the application techniques of the materials specified.

3. Roofing and associated work shall be performed by a single firm called the "Installer" in this Section, so that there will be undivided responsibility for the specified performance of components parts including, but not limited to, the following (even through some parts may be subcontracted to others):
   a. Division 06 Section "Rough Carpentry": For wood insulation shops, wood nailers, and blocking required for installation of new roof and sheet metal.
   b. Division 07 Section "Sheet Metal Flashing and Trim."
   c. Division 07 Section "Roof Specialties."
   d. Division 07 Section “Roof Accessories”.

B. Source Limitations: Obtain components, including roof insulation and fasteners, for membrane roofing system from or approved by roofing membrane manufacturer in writing.

C. There shall be no deviations made from this specification or shop drawing without prior written approval of the A/E. Any deviation from the manufacturer’s installation procedures must be supported by a written certification on the manufacturer’s letterhead and presented for the A/E’s consideration.

1.10 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, and directions for storing and mixing with other components.

1. All materials delivered from manufacturers and suppliers should be carefully inspected at the time of delivery and examined during unloading. Manufacturers’ product labels should be intact. Any damaged or unsuitable material should be rejected. Material that has been exposed to weather in transit or storage should be examined carefully for deterioration and damage.

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.
2. Lids should be secured on cans of stored material.
3. Water-based materials such as asphalt emulsions, acrylic coatings and water-based adhesives should be protected from freezing.
4. Solvents, adhesives, and sealants should be stored at proper temperature. Read instructions contained on adhesive canister for specific storage instructions.
5. Store seam tapes and adhesives above 60 degrees F, unless otherwise recommended by manufacturer.

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.
   1. When moisture-sensitive materials are stored outside, they shall be placed on pallets or platforms that are raised off the ground or roof deck (at least 4 inches). Materials sensitive to moisture should be covered with water-resistant coverings that have been properly secured. Coverings that are “breathable,” such as water resistant canvas tarpaulins are preferred. Factory applied shrouds used for shipping alone are not acceptable. Cover top and sides of materials and secure cover. Remove wet products from project site.
      a. During inclement seasons, or extended periods (two weeks) it is suggested that moisture sensitive materials be stored in vans or enclosed areas protected from moisture or elevated humidity.
      b. Materials determined by A/E to be damaged or to have been subjected to adverse conditions shall be removed and replaced at contractor’s expense.
   2. Protect insulation against concentrated loads, and standing loads exerting a force in excess of 50 percent of the materials compressive strength.
   3. Do not expose foam core to excessive heat, sparks, or open flame.

D. Single-ply sheet materials may be stored as shipped with rolls laying horizontally or as recommended by manufacturer.
   1. When rolled materials are stored, the storage substrate should be swept to rid the surface of loose gravel, share objects and other debris that could damage the membrane material.
   2. Cover with tarps so moisture does not gather in the rolls. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weld ability.

E. Provide continuous protection of products during delivery, storage, handling, and application.

F. Do not store roofing materials in concentrated areas of roof deck.
   1. Stored material should be raised up off the roof surface out of any standing water.

G. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
   1. Average live loads on the roof during the work shall not exceed twenty pounds per square foot at any time.

H. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Closely follow precautions/instructions outlined on container or supplied by manufacturer/supplier.
   1. Liquid propane (LP) gas containers shall be in an upright position at all times.
      a. Comply with NFPA 58 "Standard for the Storage and Handling of Liquified Petroleum Gases" as well as appropriate publications of the National LP Gas Association.

1.11 FIELD CONDITIONS

A. Weather Condition Limitations
   1. Proceed with roofing and associated work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the requirements and with the recommendations of the roofing materials manufacturer.
      a. Proceed only when the Installer is willing to guarantee the work as required and without additional reservations and restrictions.
   2. Apply in dry weather on a dry deck only. Where rain or inclement weather occur during application, the Work shall stop and not resume until the weather has cleared and the deck is dry.

a. When membrane roofing materials are applied, entrapment of moisture should be prevented. Moisture in or on materials may cause membrane problems. If precipitation occurs before completely installing the roof membrane, the membrane surface in the immediate work area and the substrate should be dried or allowed to dry before work resumes.

3. Only as much roofing as can be made weathertight each day, including all flashing and detail work, shall be installed.
   a. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
4. Cold Weather
   a. When the outside temperature is below 40 deg F, certain combinations of temperature and humidity may cause condensation on the surface of solvent-based adhesives and primers. If this condition occurs, discontinue the application. When the ambient air conditions no longer cause condensation on adhesive surfaces and the membrane is clean and dry then re-apply additional adhesive or primer and proceed.
   b. The consistency of sealants, adhesives and primers will begin to thicken as the temperature drops. To minimize this, the following is recommended:
      1) Start work with sealants, adhesives and primers that have been stored between 60 and 80 deg. F. Insulated and heated boxes may be helpful.
      2) Complete test areas to determine if conditions will cause problems such as condensation with the application of the materials.
      3) Stop the operation or change to another warm container when material becomes too thick to properly apply.
   c. When the outside temperature is below 40 deg., installation of the roofing system may require additional application procedures, consult with manufacturer:
      1) Ensure that the roof surface is dry. Moisture, even trace amounts, may cause poor adhesion, and may lead to moisture entrapment within the roofing system.

B. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

C. The applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

D. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.

E. Membranes are slippery when wet or covered with snow, frost, or ice. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.

F. Construction Traffic: Construction site traffic from all trades should be limited to designated areas and walkways. Completed roof membranes are not suitable as work platforms or staging areas for other trades. If construction traffic is anticipated or inevitable, the use of temporary roofs can act as a sacrificial traffic surface, allowing for construction traffic and abuse until the primary weatherproofing membrane is installed.

1.12 WARRANTY

A. Special Total System Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, substrate board, vapor retarder, and other components of membrane roofing system, including metal work i.e. coping and roof edge-specialties.
   2. The warranty shall guarantee the roof membrane system at wind speeds up to 72 mph measured at 10 meters above ground.
   3. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
   4. Warranty Period: 20 years from date of Substantial Completion.
   5. Pro-rated System Warranties are not acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. The “Substitution Request Form” and complete technical data for evaluation must accompany requests for A/E’s approval. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacturer, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2,000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272 or the “Resistance to Foot Traffic Test” in Section 5.5 of FM 4470.

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

C. Roofing System Design: Provide a membrane roofing system that is listed on IBC ES-Reports or is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7 and also tested in accordance with FM 4474, UL 580, or UL 1897.
   1. Fire/Windstorm Classification: Calculations shall not result in a roofing design less than FM Class 1A-60 requirements.

D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and components materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
   1. Hail-Resistance Rating: SH.
   2. Where exact assembly of materials have not been classified with a RoofNav number, provide Manufacturer's interpretive equivalent RoofNav number for specified assembly and demonstrate assemblies compliance with wind uplift requirements included herein.

E. SPRI's Directory of Roof Assemblies Listing: Roof membranes, base flashings, and component materials shall comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical to that specified for this Project.
   1. Where exact assembly of materials have not been classified in the SPRI's Directory, provide Manufacturer's interpretive equivalent for specified assembly and demonstrate assemblies compliance with wind uplift requirements included herein.

F. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1987;
   1. Roof Areas: New Natatorium high sloped roof areas ***and existing Natatorium.***
      a. Field-of-Roof Uplift Pressure (Zone 1): 45.2 lbf/sq.ft
      b. Perimeter Uplift Pressure (Zone 2): 78.8 lbf/sq.ft.
      c. Corner Uplift Pressure (Zone 3): 116.4 lbf/sq.ft.
   2. Roof Areas: All other areas.
      a. Field-of-Roof Uplift Pressure (Zone 1): 45.1 lbf/sq.ft
      b. Perimeter Uplift Pressure (Zone 2): 75.7 lbf/sq.ft.
      c. Corner Uplift Pressure (Zone 3): 113.8 lbf/sq.ft.

G. Polyisocyanurate Insulation
   1. Compressive Strength: 20 psi min.
   2. Dimensional Stability – maximum dimensional change after installation (inches).
      a. Length: +/- 1/8
      b. Width: +/- 1/8
      c. Thickness: +/- 1/16
      d. Squareness: 1/16
      e. Flatness: 1/16
   3. Moisture Vapor Transmission: ASTM E96, <1 perm.
   4. Water Absorption: ASTM C209, <1 percent by volume.
   5. Flame Spread: ASTM E84, <50.
   6. Service Temperature: Minus 100 degrees to 250 degrees F.
   7. Smoke Developed: ASTM E84, <450.
   8. Acidity: EPA Method 9045, 6 pH minimum, 8 pH maximum.
   9. Aged R-Value per Inch: ASTM C177 and C518, 5.6 R.

H. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency, unless otherwise noted.

2.3 PVC ROOFING MEMBRANE

A. Low Slope PVC Sheet: ASTM D 4434, Type III, fabric reinforced.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. SureFlex PVC; Carlisle SynTec Systems.
      b. EverGuard PVC; GAF Materials Corporation.
      c. JM60PVC; Johns Manville, Inc.
      d. Sikaplan; Sika-Sarnafil Inc.
      e. MF/R-60 PVC; Flex Membranes International, Inc.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color:
   a. Provide White or gray at all low-slope applications, unless otherwise noted.

~~***B. Steep Slope/Vaulted/Curved PVC Sheet: ASTM D 4434, Type II or III, Grade I, 60 mil fabric reinforced membrane, with factory applied, minimum, 3 oz. felt backing.***~~

~~***1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:***~~

~~***a. Sika-Sarnafil Inc. G410 Feltback fiberglass reinforced membrane with a lacquer coating.***~~

~~***b. Flex Membranes International, Inc., Flex FB 60.***~~

~~***c. Carlisle Syntec Systems, 115 PVC***~~

~~***d. Johns Manville, Inc.***~~

~~***e. GAF Materials Corporation***~~

~~***2. Exposed Face Color: White***~~

C. Low ~~***and Steep Slope/Vaulted/Curved***~~ Ketone-Ethylene-Ester-Based Sheet Roofing (KEE): ASTM D 6754, KEE polymer shall be a minimum of 50 percent by weight of the polymer content of the sheet. Sheet shall be reinforced internally with a fabric. Physical properties shall conform to the following:
1. Thickness: 60 mils, nominal ~~***plus 3 oz. minimum felt backing***~~.
   a. Felt backing not required at low slope areas.
2. Thickness over fiber, minimum, mm (in.): 0.15 (0.006)
3. Manufacturers:
   a. FiberTite Systems, Seaman Corporation.
   b. Carlisle Syntec Systems, KEE HP
   c. Tremco
4. Exposed Face Color: White

2.4 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane, unless otherwise noted.

C. Sheet Flashing: 60-mil thick EPDM, partially cured or cured, according to application.
1. Provide pressure-sensitive flashing, nominal 30 mil cured, pre-applied adhesive. Provide a minimum 6 inch wide roll to flash metal edging and seams where required herein.
2. Location: Where required by new work at existing EPDM membrane roofing.

D. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive, water-based bonding adhesive shall be utilized unless cold conditions require the use of solvent-based adhesives and their use is approved by A/E.

E. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer’s standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

F. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer’s standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

G. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
   1. Use only where indicated. In areas where metal counterflashing or surface mounted reglets are used they must be sealed with a sealant to prevent moisture migration behind the flashing.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals Corrosion Test, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
   1. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch and shall be approved for such use by the fastener manufacturer.
   2. Pullout Value: Fastener shall provide a minimum pullout of 450 pounds.
   3. Static Backout Resistance: Fastener shall provide a minimum static backout resistance of 10 inch pounds.
   4. Where fasteners will be in contact with wood treated with preservative chemicals, provide fasteners and anchorage with hot dip zinc coating of G90 complying with ASTM A153 or of Type 304 or 316 stainless steel.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.
   1. Water Cut-Off Sealant: Butyl-based, non-curing, non-hardening sealant.
      a. Manufacturers:
         1) Sika Corporation; Sikalastomer – 511.
         2) Schnee-Morehead; Acryl-R SM 5430.
         3) Edge Adhesives; Rubex Non-Skinning Butyl Sealant.
   2. Sealant: 1 or 2 component polyurethane-based sealant meeting ASTM C 920, Type S, Grade NS, Class 35, Use NT, M, A, G, and I. Manufacturer-approved primers are required. Color to match adjacent material.
      a. Manufacturers
         1) BASF; MasterSeal NP 1.
         2) Schnee-Morehead; Permathane.
         3) Sika Corporation; Sikaflex-1a.
   3. Sealant Primers: Sealant primer is a quick-drying solvent-based primer for priming joints and substrates before the application of sealants.
      a. Manufacturers
         1) BASF; Sonolastic Primer 733.
         2) Sika Corporation; Sikaflex Sealant/Admixture Primer.
         3) Schnee-Morehead; Primer.
   4. High Temperature Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O with a service temperature up to 300 degrees F. For use in through-penetration firestops.

K. Secondary Seal/Flexible Vapor Retarder: Continuous waterproof EPDM membrane ASTM D 4637, or Neoprene membrane within joint and attached to substrate on each side.
   1. Expansion joints

L. Thermal Insulation/Compressible Insulation: Mineral-fiber blanket, ASTM C 665, to fill space above secondary seal/flexible vapor retarder.
   1. Maximum flame-spread and smoke-development indexes of 25 and 50 respectivel, per ASTM E 84.
   2. Expansion joints.

M. Flexible Foam Rod: Closed-cell support foam in configuration indicated on Drawings.
   1. Expansion joints.

N. Splash Blocks: 16 inch square by 2 inch thick precast 5000 PSI concrete with mix added water-repellent additive and striated top finish.

~~***O. Snow Guards: Prefabricated, noncorrosive units designed to be installed with membrane roofing and complete with predrilled holes for anchoring.***~~

~~***1. Product: Alpine SnowGuards, No. 115-2 pipe System for membrane roofing.***~~

~~***a. Acceptable Manufacturers:***~~

~~***1) Sno Gem***~~

~~***2. Brackets: 600 Series Aluminum or stainless steel, No. 115 profile, spaced as required by manufacturer per Delegated Design requirements.***~~

~~***3. Base Plate: 11 gauge thick 304 stainless steel.***~~

~~***a. Where required by roofing manufacturer's details and installation instructions, provide compatible PVC coating.***~~

~~***4. Tubing: 6005-T5, 1 inch square and .120 inch wall thickness extruded aluminum.***~~

~~***5. Threaded Couplings: 6061-T6 aluminum.***~~

~~***6. End Caps: 302 stainless steel.***~~

~~***7. Ice Flags: 5052-H32 aluminum.***~~

~~***8. End Collars: 6061 T-6 aluminum shaft collars.***~~

~~***9. Fasteners: 302 or 304 stainless steel.***~~

~~***a. Fasteners shall be compatible with roof deck and strength should equal or exceed that of snow guard system.***~~

~~***10. All materials shall be provided with powder coat finish to match roofing material.***~~

~~***11. Drawings indicate minimum requirements for snow guards. Delegated-design submittal and snow retention system calculations shall be final determination of extents and location.***~~

P. Protection Sheet: An extra sacrificial layer of roofing membrane. Thickness shall be equal to or greater than thickness of field membrane.

1. Locations: Snow guard base plates, under splash blocks, under scuppers, and at downspouts terminating at another lower roof and other locations as indicated on Drawings.

2.5 SUBSTRATE BOARDS

A. Substrate Board (Thermal Barrier at High-Humidity Environments): ASTM C 1325, cement board, 7/16 – 5/8 inch thick manufactured of Portland cement, lightweight aggregate and glass mesh and able to withstand prolonged exposure to moisture.

1. Basis-of-Design: Dexcell Cement Roof Board; National Gypsum Company.
   a. Securock Brand Cement Roof Board; USG
2. Location: Over Pool Environment roof locations.

~~***B. Substrate Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate.***~~

~~***1. Manufacturers***~~

~~***a. DensDeck Prime with EONIC Technology; Georgia-Pacific Gypsum.***~~

~~***b. DEXcell FA; National Gypsum.***~~

~~***c. GlasRock Roof Board; Certainteed Corporation.***~~

~~***d. Securock UltraLight Coated Glass-Mat Roof Board; USG***~~

~~***2. Thickness: Provide 5/8 inch thick substrate for thermal barrier as part of fire-resistance rated roof system (as indicated on "Code Plans") and over acoustical deck.***~~

~~***3. Factory prime, where required by roofing system manufacturer for application indicated.***~~

~~***a. Coordinate face of facer material with vapor retarder adhesion requirements for fully adhered system.***~~

~~***4. Location: Acoustical deck areas and where indicated for non-pool environment areas.***~~

C. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck.

2.6 VAPOR RETARDER/BARRIER

A. Vapor Retarder/Barrier: Provide one of the following as recommended by membrane manufacturer for compatibility in roofing assembly and part of tested assembly indicated.
   1. Self-Adhering-Sheet Air and Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil-total thickness; maximum water vapor permeance rating of 0.1 perm and air permeability of less than 0.04; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
   2. Self-Adhering-Sheet Air and Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil total thickness; maximum water vapor permeance rating of 0.1 perm and air permeability of less than 0.04; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
   3. A 106 mil thick self-adhered SBS polymer modified bitumen vapor retarder/air barrier with a non-woven polyester mat reinforcement and fine mineral aggregate (sand) topside.
   4. Location: Over substrate board at Natatorium (Pool) and existing Natatorium (pool) roof areas.

B. Provide adhesive/primer supplied by air and vapor barrier manufacturer for adhesion to concrete or masonry surfaces.

~~***C. Vapor Retarder/Barrier Laminate Sheet: Polyethylene laminate, two layers, reinforced with cord grid, with maximum permeance rating of 0.06 perm.***~~
   ~~***1. Location: Over standard low slope and curved metal deck areas.***~~
   ~~***2. Manufacturers***~~
      ~~***a. Griffolyn Type – 65; Reef Industries.***~~
      ~~***b. DURA-SKRIM 6WW; Raven Industries.***~~
      ~~***c. WMP-VR; Lamtec Corporation.***~~
      ~~***d. PE-10; Sika-Sarnafil.***~~

~~***D. Auxiliary Materials***~~
   ~~***1. Tape: 4 inch wide self-adhesive pressure sensitive air barrier tape with flame spread index of 25 or less, smoke-developed index of 50 or less provided by or recommended by vapor retarder manufacturer for sealing seams and penetrations (i.e. curbs).***~~
   ~~***2. Pipe Flashings (with deck flanges): Sized to fit typical penetrations (i.e. water lines, gas lines, drain pipes, and vent pipes).***~~
   ~~***3. Butyl Tape: 1.5 inches to 2.0 inches wide 35 mil butyl tape used to seal the perimeter edge and penetrations through the air barrier.***~~

2.7 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
   1. Insulation must be manufactured by or approved in writing by membrane manufacturer for system specified. Insulation must meet requirements for manufacturers total system warranty requirements and comply with FM 4450 or UL 1256.

B. Polyisocyanurate Board Insulation: ASTM C 1289-11A, Type II, Class 2 Grade 2 min., coated polymer bonded glass fiber mat facer on both major surfaces. Facers shall be non-organic biological growth resistant. Provide Grade 3 when required by manufacturer to meet Performance and Warranty requirements.
   1. (LTTR) Thermal resistance of insulation shall be calculated as 5.6 per inch.
   2. Roof insulation assembly shall be a minimum thermal resistant value of R=20.
   3. Nominal total thickness**,** 4 inches minimum, unless otherwise noted.
      a. Bottom Layer: 2 inch, maximum.

~~***b. Thickness of board can be reduced to 1 inch or 1.5 inch over curved roof areas to better conform to curve and attachment method.***~~

4. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.

C. Tapered Insulation (Field-of-Roof): Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
   1. Polyisocyanurate Insulation
      a. Minimum Thickness: 1/2 inch at start of tapered sections, unless otherwise noted.
      b. Average Thickness: 4 inches, calculated using the Volumetric Average Thickness method.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
   1. Slope: 1/2 inch per foot, unless otherwise indicated on Drawings.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FM Approvals Corrosion Test, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer. The type of fastener shall be appropriate for the substrate to achieve maximum withdraw and anti-corrosion characteristics. The membrane manufacturer approved fasteners shall also meet the following requirements:
   1. FM 4470 SPRI Corrosion Test Procedure and Guidelines for Roofing Fasteners. To pass, the fasteners shall not accumulate more than 15 percent red rust after the "required number cycles" in the Kesternich cabinet.
      a. FM and SPRI recommended number, but in no case shall it be less than 15.
   2. Pullout Value: Fastener shall provide a minimum pullout of 450 lbs.
   3. Static Backout Resistance: Fastener shall provide a minimum static backout resistance of 10-inch pounds.
   4. Steel Deck
      a. Fasteners to have self-drilling tip. Fastener tip shall be capable of cutting steel deck material of 20 gauge thickness at point of steel deck segment overlap without damage to the fastener tip.
      b. Fasteners shall be installed in high flute of metal deck with a minimum of three-quarter inch (3/4 inch) penetration. Fasteners shall not extend past the bottom of the metal deck.

C. Insulation Adhesive: Insulation manufacturer’s recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Bead-Applied Insulation Adhesive: Insulation manufacturer’s recommended bead-applied, low-rise, multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
   2. Full-Spread Applied Insulation Adhesive: Insulation manufacturer’s recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: Provide one of the following coverboards as approved by roofing manufacturer for system specified:
   1. ASTM C 1177, glass mat, water resistant gypsum substrate (primed). Facers shall be non-organic biological growth resistant).
      a. Manufactures:
         1) DensDeck Prime with EONIC Technology; Georgia-Pacific Gypsum.
         2) DEXcell FA; National Gypsum.
         3) GlasRock Roof Board; CertainTeed Corporation.
         4) Securock UltraLight Coated Glass-Mat Roof Board; USG

2. Thickness: 1/4-inch minimum. Provide 1/2-inch thickness where required to meet assembly or warranty requirements.
3. Cellulosic-Fiber Board is not an acceptable substitute. Materials shall be non-organic and biological growth resistant.

E. Sprayed-Polyurethane Foam Sealant: 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 16/cu.ft. density; flame spread index for 25 or less according to ASTM E 162; with primer and non-corrosive substrate cleaner, if recommended by foam sealant manufacturer.
1. Provide single-component polyurethane sealant low-expansion sealing gaps less than 1/2 inch.
2. Provide one component foam for voids from 1/4 to 2 inches.
3. Manufacturers
   a. Dow Chemical Company
      1) Great Stuff Pro Gaps and Cracks; gap $\leq$ 1/2 inch
      2) Froth Pak Foam Sealant; gap $\leq$ 1/2 inch
   b. Convenience Products
      1) Home Seal; gap $\leq$ 1/2 inch
   c. FOMO Products
      1) Extreme; gap $\leq$ 1/2 inch
      2) Handi Foam; gap $\leq$ 1/2 inch
   d. Hilti Corporation
      1) CF810; gap $\leq$ 1/2 inch

F. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resistant, surface-textured walkway pads or rolls, approximately 30- to 39-inches wide by at least 0.072-inchthick, 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. Material manufacturers printed installation instructions are available for information and review.
2. Safety precautions and safety data sheets (SDS's) are available during application.
3. Specified materials and specified quantities, as verified by on-site inspection of product labels, are at the project site and are usually suitable for application (e.g., packaging not damaged, labels intact).
4. Materials are stored according to the manufacturers recommendations (e.g., proper temperature, covered, off ground, on pallets).
5. Equipment is in good working order and functioning properly.
6. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
7. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation and have been installed in areas to receive roofing.
   a. Verify existing fastening to comply with FM 1-49 requirement and enhance to secure as required.
   b. Replace deteriorated sections with new dimensional lumber of the same size.
8. Verify work required for complete tie-in is in place. This includes masonry with special attention given to roof to wall transitions.
   a. Verify that all counterflashing receivers, curbs, etc., are constructed in such a manner as to provide a minimum 8 inch base flashing height measured from the finished roof's surface to the top of the base flashing membrane.
9. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 05 Section "Steel Decking."

10. Drainage patterns for proper roof membrane installation have been identified.
11. Verify all surfaces are smooth and free of dirt, debris and incompatible materials and free of water, ice and snow.

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

3.2 PREPARATION

A. Review “Performance” and “Warranty” requirements with membrane manufacturer to ensure compliance before beginning roofing work.

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

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
1. Roof deck must be free of ponding water within 48 hours of rainfall. Use corrective measures to provide positive drainage.

D. 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.
1. When completion of flashings and terminations is not completed by the end of each workday, provisions must be provided to temporarily close the membrane to prevent water infiltration. Phased roofing is not acceptable.
2. Temporarily seal loose membrane edge down slope so that the membrane edge will not buck water. Caution must be exercised to ensure that membrane is not temporarily sealed near drains in such a way as to promote water migration below membrane.

3.3 APPLICATION, GENERAL

A. Application of the roofing products for installation shall be in accordance with the roofing material manufacturer's written instructions, for installation procedures and requirements not addressed in manufacturer’s written instructions comply additional requirements of the project specifications and drawings, including recommendations of NRCA, SMACNA, and SPRI. Material manufacturer's recommendations related to weather (temperature, moisture, and humidity), surface preparation, and shelf life must be observed.

B. Only install as much roofing as can be made weathertight each day, including all flashing work.
1. Where possible, roof membrane panels shall be installed in such a manner as to create water-shedding seams.

C. Dry Surfaces: All surfaces to receive new insulation, membrane, or flashings shall be thoroughly dry.
1. Metal deck surface to receive substrate board or insulation shall be thoroughly dry. Should surface moisture occur, the Contractor shall provide the necessary equipment to dry deck surface prior to application of roofing components.
a. This is acceptable for metal roof deck only. Drying of roofing components including substrate board, insulation, and cover boards is not acceptable. If any of these products have moisture in them, or have had moisture on them they shall be removed and replaced.
b. Roof decks shall be rigid, tight, dry, and clean of dust or debris. Now work shall start without testing of deck dryness at the beginning of each work day or period. It shall be the responsibility of the Contractor to maintain the deck in the proper and acceptable condition of application of the roof covering.
1) Installer shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages.

D. All new and temporary construction, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or wind damage.

E. Temporary water stops shall be installed at the end of each day's work, and shall be removed before proceeding with the next day's work. Temporary water stops shall be constructed to withstand protracted periods of inclement weather. Water stops shall be compatible with all materials and shall not emit dangerous or incompatible orders.

F. The Contractor is cautioned that the roof membrane may be incompatible with certain substances. Such materials shall not come into contact with the roof membrane at any time. If such contacts occur, the material shall be cut out and discarded. The Contractor shall consult material manufacturer with respect to material compatibility precautions, and recommendations.

G. If any unusual or concealed condition is discovered, stop the work and notify the A/E immediately in writing.

H. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified.

I. Quality Control (During Application) Checklist
   1. Weather and job conditions are suitable for the application.
   2. Substrate is sufficiently dry and suitably prepared to receive the insulation and roof membrane.
   3. Insulation and cover boards, if applicable, are butted together, as required, with joints staggered and offset if more than one layer is being used.
   4. Insulation is firmly attached with specified type and number of fasteners, or embedded in adhesive to substrate or underlying insulation as specified.
   5. Temporary water cut-offs are installed at the end of each day’s work as required.
   6. Membrane sheets are installed to side laps and end laps that buck water are minimized.
   7. Perimeter membrane fastening complies with specifications and manufacturers’ requirements.
   8. Membrane flashings are installed along with each day’s completed roof area.
   9. In high-traffic areas, protection board is being used over newly completed membrane.
      a. Roof is not being abused by other trades.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate board in accordance with manufacturer’s recommendations. Long joints shall be in continuous straight lines, perpendicular to roof slopes with end joints staggered not less than 24 inches in adjacent rows.
   1. Tightly butt substrate boards together.
   2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   3. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturer's written instructions and as required to meet “Performance Requirements.”
      a. Support the two opposite sides of each board on steel deck flanges, as close as practical to the center of the flange with a minimum bearing width of 1 inch. Trim board edges if they veer off the flange center.

3.5 VAPOR RETARDER/BARRIER INSTALLATION

A. Vapor Retarder/Barrier Installation
   1. All surfaces must be clean, sound, dry, and free of loose materials or contaminants with as water, frost, ice, oil, and grease that would interfere with proper adhesion and compromise the performance of the product.

2. Apply air and vapor barrier from high to low points in a shingle fashion, so that the laps will shed water. Overlap edges by at least 2-1/2 inches. End laps should be staggered. Position membrane carefully so as to avoid fish-mouths and wrinkles. Immediately after installation, roll the membrane with a 100 pound roller wrapped in a resilient material.
    a. On steel decks install a 6 inch by 42 inch metal plate under the end lap to support the membrane between the steel flutes. Stagger the end laps by at least 12 inches.
3. Inspect all membranes for tears, punctures, fish-mouths, blisters, and voids due to misalignment at seams. Remove damaged membrane. Apply a new section of membrane extending at least 6 inches on to underlying adhered membrane on all sides. Firmly roll repaired area with a 2 inch hand roller to ensure a good seal.

B. Completely seal vapor retarder at terminations (perimeter), obstructions, and penetrations to prevent air movement into membrane roofing system.
    1. Turn vapor retarder up full extent of parapet wall conditions and seal on vertical surface ready for transition membrane application to wall air/vapor barrier product.
    2. Apply manufacturer's mastic to seal around penetrations, T-joints, and fishmouths. Use a trowel to mound the mastic around the penetrations to seal the opening. Do not apply mastic where it may come into direct contact with the membrane.

C. Vertical control/expansion joints through parapet walls shall be sealed with butyl tape or sealant prior to installation of the vapor retarder.

D. All surfaces to receive the vapor retarder shall be dry prior to installation.

~~***E. Loosely lay polyethylene and/or polyethylene film vapor retarder in a single layer over entire roof deck extending to roof edges and to adjacent walls. Turn vapor retarder film up any vertical walls or penetrations.***~~

~~***F. Side and end lap each sheet a minimum of 2 inches and 6 inches respectively.***~~

~~***G. Vapor retarder, loose lay polyethylene type, shall be positively sealed at all edges, penetrations and walls utilizing manufacturer's vapor retarder accessories.***~~
    ~~***1. Seal laps with continuous strip of tape recommended by the air barrier manufacturer.***~~
    ~~***2. Penetrations***~~
        ~~***a. Round Pipes: Seal with a pre-manufactured pipe boot or butyl tape to seal to pipe.***~~
        ~~***b. Curbs: Seal with butyl tape to seal to the side walls of the curb.***~~
    ~~***3. Roof Drains: Seal to exterior side of drain bowl with butyl tape.***~~
    ~~***4. Seal vapor retarder to the steel deck of roof edges with butyl tape. At edges of the deck where there are corrugations, the flutes on the top side of the roof deck shall be filled with spray foam insulation and then trimmed flush. The spray foam insulation shall provide a continuous surface where the vapor retarder can be sealed.***~~

3.6 INSULATION BOARD INSTALLATION

A. Comply with roofing system manufacturer's written instructions for installing roof insulation, including warranty requirements for installing insulation.
    1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
    2. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.

B. Roof Insulation – General: Lay in multiple layers. Edges shall be butted to provide moderate contact but not deformed or placed in surface compression. Neatly cut and fit insulation around projections and vertical surfaces. Edges shall be mitered at ridges and elsewhere to prevent open joints or irregular surfaces. Stagger end joints (6 inches) in adjoining courses of base course. Stagger joints in succeeding layers with joints of layer below.

1. Insulation shall be installed in multiple layers except a single layer may be used for one board width, around drains, if thickness at drain is 2-1/2 inches or less.
    a. No single layer of insulation shall exceed 2 inches. Other locations shall be made up of 2 or more layers with staggered joints in both directions.

C. Install tapered insulation under area of roofing to conform to slopes indicated. Tapered insulation combined with tapered saddles and drainage crickets shall achieve positive drainage. Tapered saddles at a 1/2 inch per foot slope shall be placed between drains, and crickets shall be placed on the up slope side of mechanical, skylight, and other curbs to provided positive drainage. Mechanical units should not restrict flow of runoff water.

1. Refer to NRCA Roofing and Waterproofing Manual – 2011, Figure 10-7, “Guide for Crickets and Saddles” and Figure, “Guide for "Crickets.”
2. Tapered insulation shall be installed between the bottom and top layer of flat stock insulation. This will prevent stepped transitions from occurring at the edge of tapered insulation boards.
3. Tapered insulation should originate at the valley line/low point of the roof in lieu of the center of the roof drains. The structure often causes the roof drains to be offset from the valley line/low point of the roof. Saddles/crickets shall provide positive slope towards drains and not allow ponding to occur in valley lines.
4. Use tapered insulation to provide a square sump centered on drains. 12 by 8 foot square sump centered on drains is preferred.
    a. 12 by 8 foot sump is preferred, where sump is not limited by penetrations.
    b. Do not field taper insulation.

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 or low-rise urethane adhesive.

1. Support the two opposite sides of each board on steel deck flanges, as close as practical to the center of the flange with a minimum bearing width of 1 inch. Trim board edges if they veer off the flange center.
2. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
3. Fill remaining gaps around projections, penetrations, and perimeter with low-rise urethane adhesive (foam), including but not limited to:
    a. Between perimeter of insulation boards and nailers.
    b. Between nailers and vertical walls.
    c. Between penetrations and insulation boards.
    d. Between voids in insulation boards, inclusive of roof system slope transition conditions.
4. All voids to be filled to match full thickness of insulation boards.
5. Provide urethane foam sealant produced or acceptable to the roofing system/installation system manufacturer.

E. Adhered Insulation over Metal Deck: Install each layer of insulation and/or cover board adhere to substrate by one of the following methods as approved by the membrane manufacturer.

1. Set each layer of insulation in an adhesive. Provide one of the following as recommended by manufacturer:
    a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
    b. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive.
2. Size: Boards installed in adhesive shall limited to 4 foot by 4 foot.
3. ***Location: Where substrate board and vapor retarder/barrier is indicated over new and existing Natatorium roof areas.***

~~***F. Mechanically Fastened and Adhered Insulation over Metal Deck: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.***~~

~~***1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.***~~

~~***a. Fasteners shall be installed in high flute of metal deck with a minimum of 1-inch penetration.***~~

~~***b. Fastener and plate setting shall be executed with an automatic setting device to ensure uniformity and correct setting torque.***~~

~~***2. Install subsequent layers of insulation and/or cover boards in one of the following methods:***~~

~~***a. Ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.***~~

~~***b. Full-spread insulation adhesive, firmly pressing and maintaining insulation in place.***~~

~~***3. Size: Restrict boards installed in adhesive to 4 foot by 4 foot.***~~

~~***4. Location: Over vapor retarder/barrier on standard metal deck.***~~

~~***5. Location: Over vapor retarder/barrier over curved metal deck.***~~

~~***a. At curved metal deck above main entrance, fully mechanical fastened insulation is permitted if required by curve of roof.***~~

3.7 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
   1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   2. At internal roof drains, conform to slope of drain sump.
      a. Trim cover board so that water flow is unrestricted.
   3. Cut and fit cover board tight to nailers, projections, and penetrations.
   4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
      a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
      b. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

B. If required by manufacturer or tested assembly, install slip sheet over cover board and immediately beneath roof membrane.

3.8 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. In addition, the corner and perimeter areas shall have enhanced fastening in accordance with FM1-29. Unroll roofing membrane and allow to relax before installing.
   1. Install sheet according to ASTM D 5036.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel, A/E, and testing laboratory representative, if required.

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

D. Bonding Adhesive: Apply bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
   1. The membrane adhesive shall be installed per the membrane manufacturer's requirements. Note: Differing insulation facers require specific application methods and quantities of adhesives. Water-based adhesives should be utilized (unless cold conditions require the use of solvent-based adhesives); inclusive of manufacturer's required fasteners and additional fastener requirements as required to meet performance requirements.
      a. Conversion to the solvent-based adhesive shall be only with permission from the A/E.
      b. Bidder is cautioned to include the type of bonding adhesive that the membrane manufacturer will warrant based on the conditions under which the roof will be installed.

E. Fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing. The roofing membrane shall be secured to nailers.
   1. Membrane shall be secured at the perimeter of each roof level, roof section, expansion joint, curb, skylight, interior wall, penthouse, etc., at any angle change which exceeds 2 inches in one horizontal foot and at all other penetrations in accordance with manufacturer’s details.
   2. Terminate membrane under a termination bar, metal fascia or coping, unless otherwise noted or approved as part of submittal process.
   3. Provide premolded accessories and corners, unless otherwise noted or approved as part of the submittal process.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible. Determine the direction of water drainage and the low point of the deck. The orientation of both ends and side laps shall be such that the direction of water flow (slope) changes to avoid backwater laps.
   1. Allow sufficient membrane to cover parapet walls and flashing details at roof edge.

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

H. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and not to void warranty of existing roof system, if applicable.

3.9 HOT-AIR WELDING OF SEAM OVERLAPS

A. General:
   1. All seams shall be hot-air welded. All membrane to be welded shall be clean and dry.
      a. All mechanics interceding to use hot-air welding equipment shall have completed a training course provided by either the membrane or welding equipment manufacturer prior to welding.
   2. Hot-air welding equipment shall be allowed to warm up as directed by manufacturer prior to welding.
   3. Seam overlaps shall be minimum 3 inches wide when automatic machine-welded and 4 inches wide when hand-welding, except for certain approved details.
      a. Width of membrane seams shall not be less than 1-1/2 inches regardless of seaming technique.

B. Hand-Welding
   1. The back edge of the seam shall be welded with a narrow, but continuous weld to prevent loss of hot air during the final welding.
   2. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to “flow”, the hand roller is positioned perpendicular to the nozzle and rolled lightly. For straight seams, the 1-1/2 inch wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch wide nozzle shall be used.

C. Machine Welding
   1. Machine welded seams are achieved by the use of approved automatic welding equipment. When using this equipment, all instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable general is recommended. No other equipment shall be operated simultaneously off the generator.
   2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation. Sealing of seams of overlapping adjacent roof membrane sheets, or overlap seams between flashing components and roof membrane sheets must be accomplished using hot air equipment specified by the membrane manufacturer for the specific membrane type, in strict compliance with roof membrane manufacturer's requirements and specifications. Width of membrane seams shall be not less than 1.5 inches regardless of seaming technique.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane. Following are guidelines for seam probing to identify cold welds, voids or other deficiencies:
      a. Allow seams to cool to ambient temperature before probing after approximately 30 minutes.
         1) Seams may be probed using tools such as a cotter key extractor that has been filled down, a blunted or dull awl or any round-tipped tool. Continuous probing will tend to sharpen the tip of the probe, so blunting the tip will need to be done on a regular basis.
      b. Draw the probing tool along the edge of the seam. Apply firm pressure to the seam, but not into the bottom membrane sheet. The tool will not penetrate the edge of a properly welded seam. Seams should be the specified width and free of voids.
      c. Mark deficiencies with a water-soluble marker.
      d. Probe repaired seams after they have cooled completely. If repair is acceptable, wipe off the marker.
   2. Test Cuts
      a. On-site evaluation of welded seams shall be made daily by the Contractor to ensure membrane seam weld quality. One inch wide cross-section samples of welded-seams shall be taken at least three times per day. Test cuts shall be taken at each start-up of welding equipment, midpoint, and at each completion of the welding process. Correct welds display failure from shearing of the membrane prior to separation of the weld. Weld quality is essential. Adjust equipment settings as necessary to assure quality welds. Based on test cut findings, appropriate membrane seam remedies must be instituted. All membrane test cut locations shall be documented and membrane test cut samples shall be labeled and provided with the required daily construction reports.
      b. Test cuts or seam samples may not represent the overall membrane seam construction. If test can or seam samples indicate defects, further sampling must be performed to establish the scope of corrective action.
      c. Additional test cuts of suspect membrane seams shall be taken at the direction of the A/E or manufacturer's representative.
      d. Each test cut shall be patched by Contractor at no additional cost to the Owner.
   3. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   4. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
   5. Where 3 or more membrane sheets overlap, the T-joints shall be treated with a handheld hot air seaming tool, or other methods as approved by the roof membrane manufacturer to ensure continued seam integrity at this point.

6. Caution: Where solvents are used to clean membrane seams, ensure presence of adequate safety and first aid information. Instruct welding operator as to appropriate amounts of heat to be used. Excessive solvent/heat will cause damage to roof membrane and certain types of insulation material. Minimize solvent dispersion of top of roof membrane.
    a. Voltage fluctuations and climate conditions will affect the temperature of the heat welding equipment and subsequent quality of the seam. Contractor must take all necessary precautions to ensure seal quality. Contractor shall continuously monitor seam quality.

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

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

3.10 BASE FLASHING INSTALLATION

A. General: All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of A/E and membrane manufacturer. Approval shall only be for specific locations and dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Contractor/Applicator's expense. Flashing shall be adhered to compatible dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

B. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
1. All flashing membranes should extend a minimum of 12 inches above roof level, unless otherwise noted. If in question, submit in writing (RFI) to A/E and membrane manufacturer's technical department for signed approval.

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

D. Flash penetrations and field-formed inside and outside corners with sheet flashing and hot-air weld into place.

E. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, covered by counterflashing. Do not tightly butt the termination bars or cross expansion joints with a solid bar.

G. Flashing
1. Walls, Parapets, and Curbs:
    a. Secure deck membrane at angle change before bonding the membrane to the vertical surface. Membrane must be fully adhered to vertical surfaces.
    b. Secure flashing membrane with fasteners in horizontal rows for additional securement when flashing height exceeds 30 inches or as required by the roof membrane manufacturer.
    c. All wood nailers exposed to the interior of the building shall be enclosed with 24 gauge, aluminum-zinc alloy-coated sheet steel.
2. Metal Edge Terminations: Approved by ANSI/SPRI ES-1
    a. The width of the perimeter wood nailer to which the metal edge is to be secured shall extend beyond the width of the metal edge deck flange.
    b. Secure the metal edge to the wood nailer as specified by the manufacturer.

c. All perimeter wood nailers shall be totally concealed by extending the deck membrane to completely cover the nailers and extend past the bottom edge of the nailers a minimum of 3/4 inch.
d. Prior to flashing, scrub the metal edge deck flange and membrane with splice cleaner to remove field contaminants.

3. Expansion Joints:
   a. Secure the deck membrane on both sides of expansion joints with reinforced universal securement strip. Refer to expansion joint details for proper securement details.
4. Roof Drains:
   a. During the flashing operation, drain openings shall be protected against debris, etc. Prior to roofing activities, A/E,, and Roofing Contractor shall jointly review the roof drainage system to ensure proper drainage.
   b. Provide a smooth transition from the roof surface to the drain-clamping ring. Prepare the substrate around each roof drain to avoid membrane bridging (Minimum 12 inch) at the sump area and possible distortion at the drain clamping ring.
   c. The mating surfaces between the clamping ring and drain base shall be clean and have a smooth finish.
   d. Located field splices at roof drains at least 6 inches outside the drain sump.
   e. Cut the membrane so it extends approximately 1 inch beyond the attachment points of the drain damping ring.
      1) Under no circumstances shall the hole in the membrane restrict water flow or be smaller than the drain tube.
   f. The seal between the membrane and the drain base shall be provided using Water Cut-Off Mastic under compression.
   g. Remove all existing flashing, cement, and lead in preparation for the membrane seal (application of Water Cut-Off Mastic).
   h. All bolts and/or clamps shall be in place to provide compression on the Water Cut-Off Mastic.
   i. Upon completion of roofing activities, check drain pipe to ensure that drain line is free of obstruction. Any obstructions shall be removed.
5. Vent Pipes: Preformed flashing sleeves.
   a. Flash pipes with Molded Pipe Flashing where their installation is possible.
      1) Use stainless steel clamps to seal at top.
   b. Molded pipe flashing shall not be cut and patched; deck flanges shall not overlap or be installed over angle changes.
   c. Where Molded Pipe Flashing cannot be installed, apply field fabricated pipe seals using flashing sheet.
      1) Never use a wrap around detail or molded pipe flashing on a hot or warm penetration.
6. Penetration (Pipes, Conduits, etc.)
   a. Flash pipes with molded pipe flashing where their installation is possible.
      1) Use stainless steel clamps to seal at top.
      2) Mold pipe flashing shall not be cut and patched; deck flanges shall not overlap or be installed over angle changes.
      3) Where molded pipe flashing cannot be installed, apply field fabricated pipe seals using uncured flashing.
      4) Never use a wrap around detail or molded pipe flashing on a hot or warm penetration.
   b. Flexible penetration (electrical and braided cable, etc.): Pre-molded and filed-fabricated must not b installed around flexible pipes or conduits. Flexible penetrations must be installed in a sheet metal gooseneck or other boxed out structure.
   c. Penetration packets are required at the following locations:
      1) Rigid pipes with an outside diameter less than 1 inch.
      2) Clusters of pipes.
      3) Unusual shapes, e.g., structural beams, channels, or angles.

7. Mechanical Units and other Raised Curbs:
   a. Sheet metal counterflashing shall be installed to cover the top edge and overlap the upper portion of membrane base flashings unless the integral flange of the curb mounted with adequately covers the top of the membrane flashing.
      1) Provide a 4-inch coverage of roof flashings with counterflashings.

~~***3.11 SNOW GUARD INSTALLATION***~~

~~***A. Provide snow guards (snow retention devices) per snow guard manufacturer's shop drawings along the bottom edge of all roof areas with simulated standing seam roof profile.***~~
   ~~***1. Provide appropriate blocking or support ferrulle hardware for attachment of baseplate to roofing assembly as required to support loading and comply with performance requirements.***~~
   ~~***2. Provide details avoiding discontinuing roof insulation over the interior of the building.***~~
   ~~***3. Provide flashing patch, membrane in color to match field of roofing, as required to flash in snow guard base plate and assembly per roof manufacturer's installation details.***~~

3.12 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
   1. Install walkways at all traffic concentration points such as roof hatches, access door, and roof top ladders.
   2. Install walkway one full width of flexible walkway around serviceable rooftop equipment.

3.13 SPLASH BLOCK INSTALLATION

A. Position protection sheet so that when splash block is set in place under downspout, sheet extends a minimum of between 3 and 6 inches beyond edges of splash block.

B. Adhere sheet to top surface of thermoplastic membrane roofing and hot air weld edges.

C. Set splash block as indicated under downspout.

3.14 DAILY WATERSTOP/TIE-INS

A. Provide waterstops/tie-in at all terminations of daily work.
   1. Remove embedded gravel/debris from surfaces.
   2. Width: 24 inches
   3. Adhere 12 inch or 18 inch wide membrane from exposed deck to existing roofing with a continuous application of tie-off mastic.
   4. Install “deadman” insulation filler at insulation staggers.
   5. Extend new roofing membrane at least 24 inches onto prepared area of adjacent existing roofing. Seal edge with 6 inch wide reinforcing membrane.
   6. Remove temporary connection at beginning of next workday by cutting membrane evenly along edge of existing roofing system. Remove “deadman” insulation fillers.

B. Temporary closures to ensure that moisture does not damage any complete section of the new roofing system are the responsibility of the roofing contractor. Completion of flashing, terminations, and temporary closures should be completed as required to provide a watertight condition. Any material contaminated by a temporary closure must be cut out and discarded prior to resumption of installation.

C. Measures shall be taken to ensure that water does not flow beneath the completed sections of the new membrane. Water cut-offs shall be provided on a daily basis and at the onset of inclement weather. Water cut-offs shall be removed prior to the resumption of work. The integrity of the water cut-offs is the responsibility of the roofing contractor. Any membrane contaminated by cut-off materials shall be removed before installation of the system continues.

3.15 FIELD QUALITY CONTROL

A. Inspection/Testing Agency: Owner will engage a qualified inspection and testing representative to inspect substrate conditions, surface preparation, workmanship, material storage, membrane application, flashings, protection, and drainage components, and to furnish reports to A/E through CM. Inspections shall also include but not be limited to the following:
   1. Inspection and testing representative will have the ability to recommend approval or rejection of work along with corrective measures required during the course of the Work.
   2. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   3. Notifying A/E, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   4. Submitting a certified written report of each test, inspection, and similar quality-control service to A/E, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

B. Contractor or Manufacturer’s Technical Representative shall photograph on-going construction during each day on-site. A minimum of 5 photographs shall be taken each day of on-site work ongoing, stored materials, special details, flashings, edge conditions and other activities documenting the installation of the roofing materials.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to A/E.
   1. Notify A/E 48 hours in advance of date and time of inspection.
   2. Owner’s inspection representative, CM and A/E must be present at final inspection to obtain “Substantial Completion” of roof by Contractor.

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

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

3.16 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 A/E and Owner.
   1. Protect existing membrane roofing system and new roof areas where continued construction traffic is anticipated.
      a. Lay protection sheet or mat over existing membrane then loose lay 1-inch minimum thick, polyisocyanurate insulation over sheet or mat and cover with loosely laid plywood or OSB panels.
      b. Protection sheet or mat: Provide a sacrificial layer of matching membrane sheet extending a minimum 6 inches beyond insulation in all directions or a 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.

B. Limit traffic and material storage to areas of roofing that have been protected.

C. 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 according to warranty requirements.

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

3.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect and maintain roofing system. Refer to Division 01 Section "Demonstration and Training."

B. Demonstration and Training: Provide a minimum of two hours of instruction, including but not limited to the following items:
   1. Review warranty requirements.
   2. Review Maintenance data.
   3. Review inspection procedures including:
      a. Where to look, e.g., roof access points, walkways, rooftop mechanical units, and litter.
      b. What to look for: cuts and punctures and compressed or crushed insulation.
      c. Remedial actions, emergency repair procedures.
      d. Preventative actions.

END OF SECTION 07 54 00