SECTION 075553 - ELASTOMERIC PROTECTED MEMBRANE ROOFING

Do not use this section on Combustible Decks.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

EPDM, elastomeric roofing membrane.

Roof insulation.

Ballast.

* + - 1. DEFINITIONS
				1. Roofing Terminology: See ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

The definition below supersedes the definition in Section 014216 for Company Field Advisor.

* + - * 1. Company Field Advisor; An individual meeting the requirements of either subparagraph below:

An employee of the company producing or manufacturing the system (or the company which lists and markets the primary components of the system under their name) who is certified in writing by the company to be technically qualified in design, installation, and servicing of the required products, and has experience in the installation of the required products. Personnel involved solely in sales do not qualify.

An individual employed by an organization (other than the company producing or manufacturing the system), certified in writing by the company producing or manufacturing the system, that the individual is technically qualified in design, installation and servicing of the required products and is capable to act as company field advisor in their behalf, and has experience in the installation of the required products. Personnel involved solely in sales do not qualify.

* + - 1. PREINSTALLATION MEETINGS

Retain "Preinstallation Roofing Conference" paragraph below if Work of this Section is extensive or complex enough to justify a preinstallation conference. paragraph is recommended with or without a preliminary roofing conference.

* + - * 1. Preinstallation Roofing Conference: Conduct conference at Project site.

Retain subparagraphs below if required. If retaining, revise to include Project-specific requirements. Insert additional requirements to suit Project.

Meet with Director’s Representative, Director’s Representative's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

Review methods and procedures related to roofing installation, including manufacturer's written instructions.

Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

Review substrate requirements for conditions and finishes, including flatness.

Review structural loading limitations of roof deck during and after roofing.

Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

Review governing regulations and requirements for insurance and certificates if applicable.

Review temporary protection requirements for roofing during and after installation.

Review roof observation and repair procedures after roofing installation.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Waiver of Submittals: The “Waiver of Certain Submittal Requirements” in Section 013300 does not apply to this Section.
				5. Submittals Package: Submit the shop drawings, product data, samples, and quality control submittals specified below at the same time as a package. Partial submittals will not be considered.
				6. Product Data: For the following:

Submit the manufacturer’s specifications and application instructions revised, as necessary, to suit the requirements of the Contract Documents.

Catalog sheets, specifications, and installation instructions for each material specified.

Manufacturer’s Warranty: Sample copy of the membrane manufacturer’s 10 year warranty covering workmanship and materials.

* + - * 1. Sustainable Design Submittals:
				2. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

Use below with tapered insulation below membrane.

Submit an accurate layout of the tapered insulation showing the slopes to drains. Show cross section drawings illustrating the location and thickness of tapered insulation pieces, filler pieces, and base layer insulation.

* + - * 1. Samples:

Samples in subparagraphs below are examples only; retain if required.

Flashing material, of color required.

Aggregate ballast in gradation[ **and color**] indicated.

* + - * 1. Quality Control Submittals:

Fire Hazard Certification: Submit written certification that the roof system, including the specific insulation, has been tested in conjunction with the type of structural roof deck and roof slope applicable to the project and has achieved an Underwriters Laboratories Class A or B external fire resistance rating.

Acceptable Certification: Letter from Underwriters Laboratories, or a copy of the Underwriters Laboratories classification listing for the roofing system.

Material Certification: Letter from the roofing membrane manufacturer certifying that the insulation is approved for use with the roofing system.

Membrane Manufacturer’s Certification:

Submit a letter certifying that the manufacturer has been actively marketing the submitted system for a minimum of 5 years.

Submit the names and addresses of 10 previous roofing projects. Include the type and size of each project, and name and telephone number of a contact person at the project locations.

Installer’s Certification:

Letter from the membrane manufacturer certifying that the installer is licensed or approved to install the roof system.

Names, addresses, and telephone numbers of 3 buildings where the installer has installed EPDM sheet membrane roof systems that have had the manufacturer’s warranty issued. Include the types of EPDM systems installed, the manufacturer’s name, and the warranty number.

Letter certifying that the job foreman or crew chief and at least one other member of the roofing crew have installed at least 3 EPDM sheet membrane roof systems and are thoroughly familiar with all aspects of the installation.

* + - * 1. Contract Closeout Submittals:

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

Warranty.

* + - 1. QUALITY ASSURANCE
				1. Membrane Manufacturer’s Qualifications:

The manufacturer shall have been actively marketing an EPDM roof system in the United States for a minimum of 5 years.

The manufacturer shall have the technical expertise and qualified technical representatives to resolve questions or problems that may arise both during and after the Work is completed.

The manufacturer shall furnish the name, address, and telephone number of at least 10 previous projects of comparable size, scope, and complexity as the work of this Section.

The manufacturer must require that the roof system be installed by a licensed or approved applicator.

* + - * 1. Installer’s Qualifications: The application of the roofing system shall be performed by an Installer licensed or approved by the membrane manufacturer. The Installer shall have previously installed at least 3 EPDM sheet membrane systems for which the manufacturer’s warranty was issued.

Workers: The crew chief or foreman and at least one other member of the roofing crew shall have installed at least 3 EPDM sheet membrane roof systems and shall be thoroughly familiar with all aspects of the installation.

* + - * 1. Fire Hazard Classification: The EPDM sheet membrane roof system shall have an Underwriters Laboratories Class A or B External Fire Resistance rating, as determined by tests conducted in conformity with UL-790 (ASTM E 108).

The roof system, which includes a specific generic type of insulation and in some instances a specific name brand insulation, shall have been tested in conjunction with the type of structural roof deck and roof slope applicable to the project.

* + - 1. ROOFING MANUFACTURER’S COMPANY FIELD ADVISOR
				1. The manufacturer of the roofing system, issuing the final system guarantee on this roofing project, must supply a Company Field Advisor, as a technical representative, with the following minimum qualifications:

Five years of field experience on the same type of roofing system.

Ten projects where role was a Company Field Advisor; include contact names and phone numbers for each project.

Attendance at a roof specific instructional seminar within the last two years.

It is mandatory to discuss the use of the paragraph below with the Client, the Division of Construction, and perhaps the specified manufacturers, at project inception, particularly on downstate projects. There is a fee associated with the number of hours for a field advisor to be on a project. Include this additional cost in the project estimate beginning with the program estimate.

Edit number of days and hours below depending on size and complexity of project. Six days at 4 hours per day could work as a minimum for a simpler project. Six days or more, at more than 4 hours per day could work for a larger, more complex project.

* + - * 1. Secure the services of the Company Field Advisor for a minimum of<Insert Value> days at a minimum of <Insert Value>hours per day to inspect the workmanship of the roofing system installer.
				2. Company Field Advisor Duties and Responsibilities:

Become familiar with the Contract Documents and approved submittals prior to the pre-roofing conference.

Attend the pre-roofing conference and the beginning of the actual membrane installation for the purpose of:

Rendering technical assistance to the Contractor regarding installation procedures of the system.

Familiarizing the Director’s Representative with aspects of the system including inspection techniques.

Answering questions that might arise.

Edit remaining subparagraphs below to suit project complexity and need. Discuss appropriateness of subparagraphs with design Project Manager and the Division of Construction.

Attend each bi-weekly meeting.

Be objective, unbiased and impartial in each inspection, recommendation, conversation, action and written report.

Inspect and approve the existing substrate, flashing, blocking, and related materials as being acceptable for the installation of the roofing system.

Ensure proper fastening patterns and fastener sizes of wood blocking, insulation, edge flashing, and related components.

Immediately report non-compliant conditions, if any, to the Director’s Representative.

Provide to the Director’s Representative a written report, submitted prior to leaving the Project Site each day the Company Field Advisor is present. Each daily written report shall contain at a minimum:

Date of report and inspection.

Weather conditions at the start, middle, and end of the workday.

Work performed including Contractor activity, contractor crew size, supervisor’s name, area of activity, and progress and quality of the work as observed.

Discussions with Contractor regarding work anomalies and resolution.

Conditions that are not in compliance with the Contract documents.

Continue documenting non-compliance issues in subsequent reports until the issue has been resolved. Document resolution of non-compliance issues when resolved.

Report to the Director’s Representative in writing failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.

Confirm, after completion of the roofing work and based on the Company Field Advisor’s inspections and tests, that the Company Field Advisor has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
				2. Handle and store roofing materials, and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
				3. 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.
				4. Storage and Handling: Store materials in a dry, well-ventilated place protected from the weather.

Store volatile liquids in a separate storage building or trailer or remove from the site at the end of each workday.

Store volatile liquids at temperatures recommended by the manufacturer.

Store adhesives at temperatures between 60 degrees F and 80 degrees F.

* + - 1. PROJECT CONDITIONS
				1. Do not execute the Work of this Section unless the Director’s Representative is present, or unless they direct that the Work be performed during their absence.
				2. Environmental Limitations: Apply roofing within the range of ambient and substrate temperatures recommended by roofing system manufacturer. Do not apply roofing to a damp or wet substrate or when temperature is below 0 deg F.

Do not apply roofing in snow, rain, fog, or mist.

* + - * 1. Do not execute the Work of this Section unless the substrate is dry, free from debris and dust.
				2. Moisture Protection:

Cover, seal, and otherwise protect the roof and flashings so that water cannot accumulate or flow under the covered portions.

Use subparagraph below on rehabilitation work only.

Limit the removal of existing materials to areas that can be completely re-roofed or temporarily protected within the same day. At the discretion of the Director’s Representative, a watertight built-up vapor barrier may be acceptable temporary protection for a maximum of 48 hours.

* + - * 1. Do not smoke or use open flames near volatile materials.
			1. WARRANTY
				1. Warranty Extension: The one year period required by Paragraph 9.8 of the General Conditions is extended to 2 years for the Work of this Section. Refer to Supplementary Conditions.

Include 007306 Supplementary Conditions - Warranty Extension.

* + - * 1. Manufacturer’s Warranty: In addition to the 2 year period specified above, furnish the membrane manufacturer’s printed 10 year warranty for the Work of this Section. The warranty shall include but not be limited to, repair of leakage caused by defects in materials or workmanship. The monetary value of the warranty shall be at least equal to the original cost of the installation.
			1. MAINTENANCE MATERIALS FOR EMERGENCY REPAIRS
				1. Furnish to the Facility 25 sq. ft. of EPDM sheet membrane, one gallon of splicing cement, and 4 tubes of lap sealant. These materials will be used by the Facility for emergency repairs of the membrane. Include one set of the manufacturer’s printed instructions for installing the above items.
				2. Grease Guard Maintenance: Turn over to the facility grease guard manufacturer’s printed maintenance requirements.
1. PRODUCTS
	* + 1. SYSTEM DESCRIPTION

Use below with ballasted systems (1000 lbs./sq.).

* + - * 1. Protected System: Loose-laid membrane underlayment, EPDM elastomeric sheet membrane, extruded polystyrene insulation, ballast underlayment, and ballast.

Use below with cement faced insulation (450 lbs./sq.).

* + - * 1. Protected System: Loose-laid membrane underlayment, EPDM elastomeric sheet membrane, and latex cement faced extruded polystyrene insulation.
			1. MANUFACTURERS
				1. Source Limitations: Obtain roofing materials sheet flashings protection course and insulation from single source from single manufacturer.
			2. PERFORMANCE REQUIREMENTS
				1. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D3746 or ASTM D4272.

* + - * 1. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

Retain "Roofing System Design" paragraph below if roofing system is to be designed to withstand uplift pressure established by ASCE/SEI 7. Indicate dimensions of corners, perimeter, and field of roof on Drawings.

* + - * 1. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:

Corner Uplift Pressure: <**Insert lbf/sq. ft**. >.

Perimeter Uplift Pressure: <**Insert lbf/sq. ft. >.**

Field-of-Roof Uplift Pressure: <**Insert lbf/sq. ft.** >.

* + - * 1. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

Retain one option in "Fire/Windstorm Classification" subparagraph below based on windstorm classification of Project. FM Global Loss Prevention Data Sheet 1-28 multiplies the actual field-of-roof uplift pressure by a factor of 2 to obtain the factored pressure, the number that establishes the minimum FM Global approval rating. Verify availability of roofing systems that comply with these classifications. Other options for classifications increase in increments of 15 (e.g., Classes 1A-135, 1A-150, 1A-165, and higher). "Class 1A" signifies complying with ASTM E108, Class A fire performance for FM Approved Class 1 roof covers. For areas having three or more hailstorms annually, FM Global recommends roofing systems rated SH (severe hail) instead of MH (moderate hail).

Retain Class 1A-120 for downstate projects.

Fire/Windstorm Classification: [**Class 1A-90] [Class 1A-120**].

Hail Resistance Rating: **[MH] [SH**].

Retain "Energy Star Listing" paragraph below for roofs that must comply with the DOE's ENERGY STAR requirements. The DOE's ENERGY STAR "Roof Products Qualified Product List" is available in PDF at www.energystar.gov.

* + - * 1. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

Usually retain "Energy Performance" paragraph below for roofs that must comply with California Energy Commission's CEC-Title 24. Options are values required for low-slope roofs by prescriptive approach; revise if other values are required for building-envelope trade-off approach or whole-building performance approach. A list of products tested according to CRRC-1 with their test values is available in PDF at www.coolroofs.org.

* + - * 1. Energy Performance: Roofing system shall have an initial solar reflectance not less than [**0.70**] <**Insert value**> and an emissivity of not less than [**0.75] <Insert value**> when tested according to CRRC-1.
			1. ROOFING MEMBRANE
				1. EPDM Sheet Membrane: Unreinforced EPDM. UL Classified.

Tensile Strength: 1300 psi min, ASTM D 412.

Elongation: 300 percent min, ASTM D 412.

Tear Resistance, Die C: 125 lbs./inch minimum, ASTM D 624.

Water Absorption: + 3 percent max, ASTM D 471.

Ozone Resistance: No Cracks, ASTM D 1149.

Heat Aging (Accelerated): Minimum tensile strength 1200 psi, minimum Elongation 210 percent, ASTM D 573.

Brittleness Temperature: -40 degrees F, ASTM D 746.

Thickness: 45 mils (+ 10 percent).

* + - * 1. Sheet Flashing: Uncured Neoprene, or Uncured EPDM.
				2. Related Products: Membrane manufacturer’s bonding adhesive, splicing cement, lap sealant, water cut-off mastic, night seal, pourable sealer, splice joint cleaning agent and or wash primer, and all other products related to the sheet membrane system.
			1. UNDERLAYMENTS
				1. Membrane Underlayment:

Use below on all decks except steel.

Extruded Polystyrene Insulation Board:

Products: Subject to compliance with requirements, provide the following:

DuPont de Nemours Inc.; Styrofoam Brand Roofmate.

Owens Corning; Foamular 250.

Approved equivalent.

Minimum thickness: 3/4-inch.

Use below on steel decks.

Perlite Mineral Board Insulation: ASTM C 728, 1-1/2-inches thick.

Delete below with mortar faced insulation.

* + - * 1. Ballast Underlayment:

One hundred percent polyester water previous fabric with acrylic binder, weighing 3.5 oz sq. yd.

Products: Subject to compliance with requirements, provide the following:

 “Confil Fabric” by International Paper Co., 220 East 42nd St., NY, NY 10017.

Approved equivalent.

* + - 1. AUXILIARY ROOFING MEMBRANE MATERIALS
				1. Auxiliary materials recommended by roofing manufacturer for intended use and compatible with roofing membrane.

Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

* + - * 1. Expansion Joint Filler and Tube:

Expansion Joint Filler: Neoprene or polyethylene joint filler 25 percent wider than the width of the joint.

Expansion Joint Tube: 2-inch diameter polyethylene tube.

Use paragraph below for pitch pockets.

* + - * 1. Mortar: ASTM C 270, Type S.

Use paragraph below to repair existing vapor barrier or roofing membrane.

* + - * 1. Materials For Repair Of Existing Vapor Barrier or Roofing Membrane:

Asphalt Fiberglass Felt: Glass fiber mat coated with weathering grade asphalt, ASTM D 2178, Type IV.

Plastic Roof Cement: Fibrous, flashing grade; ASTM D 4586.

Use paragraph below to install new vapor barrier on concrete decks. Do not use on lightweight concrete fill.

* + - * 1. Materials For Built-Up Vapor Barrier:

Primer: Quick drying asphalt primer; ASTM D 41.

Bitumen: Steep asphalt; ASTM D 312, Type III.

Asphalt Fiberglass Felt: Glass fiber mat coated with weathering grade asphalt; ASTM D 2178, Type IV.

Use paragraph below to install new vapor barrier on gypsum decks and lightweight concrete fill decks.

* + - * 1. Materials For Built-Up Vapor Barrier:

Bitumen: Steep asphalt; ASTM D 312, Type III.

Asphalt Fiberglass Base Sheet: Glass fiber mat heavily coated with weathering grade asphalt, non-porous.

Asphalt Fiberglass Felt: Glass fiber mat coated with weathering grade asphalt; ASTM D 2178, Type IV.

Use paragraph below to install new vapor barrier on steel decks.

* + - * 1. Materials For Built-Up Vapor Barrier:

Laminated high strength kraft paper and asphaltic adhesive;

Products: Subject to compliance with requirements, provide the following:

Owens Corning; Permstop Vapor Retarder and Permstop Adhesive.

St. Regis, Sisalkraft Division.; Vaporstop 398 and Pyro-Kure Adhesive.

Approved equivalent.

* + - * 1. Pipe Flashing: Membrane manufacturer’s cured premolded EPDM pipe boot and compression clamp.
				2. Grease Guards: Grease containment system consisting of an extruded anodized aluminum frame and 3-inch thick, 3 layer absorbent filter, deflection cap flanges, and miscellaneous accessories, sized 48 inches larger than the exhaust curb; grease guard by Facilitec Corporation, Elgin, IL 60123; (800) 284-8273, or equal.
			1. FASTENERS
				1. Sheet Membrane and Sheet Flashing Fasteners:

Concrete or Masonry Surfaces: Hardened masonry nails or drive pins thru 1-1/4-inch sheet metal discs.

Sheet Metal Surfaces: Hardened, self-tapping, #10 sheet metal screws thru 1-1/4-inch sheet metal discs.

Wood Surfaces: “Cap Nail” annular ring roofing nail with one-inch diameter or square solid cap, by Simplex Nails Inc., Americus, Georgia.

Use below when there is no cap flashing.

* + - * 1. Compression Bar: 1-1/2 x 1/8-inch aluminum bar, or 1-1/2 x 1/16-inch galvanized steel bar, maximum length 10 feet, with holes 1/16-inch larger than fastener diameter predrilled at one foot centers. Form top of bar with 45 degree x 1/4-inch wide stiffener and caulking flange.

Use below to secure membrane to vertical surfaces. Coordinate with details.

* + - * 1. Anchor Bar: Membrane manufacturer’s metal or rubber bar.

Use below to fasten compression and anchor bar.

* + - * 1. Compression And Anchor Bar Fasteners:

Concrete or Masonry Surfaces: Hard aluminum alloy or stainless steel screws with 1/4-inch diameter plastic expansion shields, or 1/4-inch diameter aluminum hammer drive expansion anchors. Length as required to securely hold the bar tight against the wall surface.

Wood or Sheet Metal Surfaces: Hard aluminum alloy or stainless steel screw. Length as required to securely hold the bar tight against the wall surface.

Use below for pipe flashings.

* + - * 1. Compression Clamp: Stainless steel or cadmium plated steel worm drive clamp.

Do not use compression clamp on uncured neoprene or uncured EPDM.

* + - 1. ROOF INSULATION

Roofing system manufacturers may require use of their own insulations or limit approvals to some insulation manufacturers. Retain second option in first paragraph below if FM Global approval is required.

* + - * 1. Preformed roof insulation boards manufactured[ **or approved**] by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated[ **and that produce FM Approved roof insulation**].

Retain "Extruded-Polystyrene Board Insulation" paragraph below for extruded-polystyrene board insulation installed above the membrane of a protected membrane roofing system.

* + - * 1. Extruded-Polystyrene Board Insulation: ASTM C578, Type VI, 1.8 lb./cu. ft., with two or four edges rabbeted.

Products: Subject to compliance with requirements, provide the following:

DuPont de Nemours Inc.; Styrofoam Brand Roofmate.

Owens Corning; Foamular 400.

Approved equivalent.

Retain "Mortar-Faced, Extruded-Polystyrene Board Insulation" paragraph below for mortar-faced, extruded-polystyrene board insulation installed above the membrane of a protected membrane roofing system. No Ballast.

* + - * 1. Mortar-Faced, Extruded-Polystyrene Board Insulation: ASTM C578, Type VI, 1.8-lb/cu. ft. minimum density, with tongue-and-groove edges on long dimension, and latex-modified cement mortar topping, 3/8 inch thick, 4.5 lb./sq. ft.

Products: Subject to compliance with requirements, provide the following:

DuPont de Nemours Inc.; Styrofoam LG Brand Roofmate.

Approved equivalent.

* + - 1. INSULATION ACCESSORIES
				1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

Protection mats in "Protection Mat" paragraph below, sometimes called "filter fabrics" or "fabric mats," limit aggregate ballast movement and control insulation flotation in protected membrane roofing systems.

* + - * 1. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

Retain below if “Mortar-Faced, Extruded-Polystyrene Board Insulation” is used.

* + - * 1. Metal Securement System: Perimeter securement flashing and strapping fabricated from galvanized steel, a minimum of 0.031 inch thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.
			1. BALLAST
				1. Aggregate Ballast: Washed, crushed stone or smooth stone that withstands weather exposure without significant deterioration and does not contribute to membrane degradation; of the following size:

Size: ASTM C 136 sizing method, 1-1/2-inch aggregate ballast with the following restrictions: 50 percent must be retained by a 3/4-inch screen, 95 percent retained by a 1/2-inch screen and 98 percent retained by a 1/4-inch screen.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

Verify that roof openings and penetrations are in place, curbs are set and braced, and roof drain bodies are securely clamped in place.

Cants, blocking, curbs, and nailers are required at edges of roof penetrations, area dividers, and terminations.

Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.

Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

* + - * 1. Testing Existing Roof Drains and Conductor Pipes: Before commencing with the Work, water test existing roof drains and conductor pipes and submit a written report to the Director’s Representative, indicating which drains or conductors, if any, are not operating properly. Repair of existing drains and conductors is not included in the Work. Repair Work (if any) may be accomplished by an Order on Contract.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. PREPARATION
				1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions.
				2. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

Cut open blisters so they lay flat. Where blisters will not lay flat, cut off raised or loose portions.

Use subparagraph below only when there are known wet areas of existing insulation. Coordinate with drawings.

* + - * 1. Where shown and directed cut open the existing roofing membrane and remove wet insulation. Fill the void left by the removals, with insulation to match the existing thickness.

If roofing system is not installed the same day, patch defective areas with 2 plies of fiberglass felt embedded in and coated with plastic cement. Extend the patch a minimum of 6 inches beyond the defect.

* + - * 1. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.
				2. 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.

Use paragraph below with existing roof removal to repair existing vapor barrier. All decks except steel.

* + - * 1. Patching Existing Vapor Barrier: Remove loose and/or deteriorated portions of the existing vapor barrier. Patch defective areas with fiberglass felt embedded in and coated with plastic cement. Extend the patch a minimum of 6 inches beyond the defect.
			1. INSTALLING VAPOR BARRIER

Use paragraph below for steel decks.

* + - * 1. Install one ply of kraft paper parallel to the flutes. Embed the kraft paper into a film of adhesive applied over the entire portion of deck that will come in contact with the kraft paper. Lap edges 2 inches and ends 6 inches and seal with adhesive. If vapor barrier is punctured repair immediately with additional kraft paper set in adhesive. Do not precede installation of insulation by more than 10 feet.

Use paragraph below for concrete decks.

* + - * 1. Apply asphalt primer to the concrete deck surface at the rate of one gallon per square before application of vapor barrier.

Install 2 plies of asphalt fiberglass felt shingle fashion. Lap plies 19 inches over each preceding ply.

Embed each ply in a solid mopping of hot steep asphalt applied at the rate of 20 lbs. per square. Broom in each ply to complete embedment.

Glaze coat the entire surface with hot steep asphalt applied at the rate of 20 lbs. per square.

Use paragraph below for gypsum decks and lightweight concrete fill.

* + - * 1. Install one ply of asphalt fiberglass base sheet on the entire deck surface. Lap edges and ends a minimum of 2 inches.

Adhere the base sheet to the deck with one-foot diameter spots of hot steep asphalt spaced 24 inches apart.

Over the base sheet install one ply of fiberglass felt. Lap edges and ends 2 inches.

Embed the felt in a solid mopping of hot steep asphalt applied at the rate of 20 lbs. per square. Broom the felts to complete embedment.

Glaze coat the entire surface with hot steep asphalt applied at the rate of 20 lbs. per square.

* + - * 1. Extend the vapor barrier at curbs, walls, and wood blocking to a height equal to the thickness of the insulation.

Unless approved otherwise by the Director’s Representative, follow immediately with the installation of the insulation and roofing membrane.

* + - 1. INSTALLATION OF MEMBRANE UNDERLAYMENT

Use below on all decks except steel.

* + - * 1. Install the underlayment board with the long joints running in a continuous straight line with end joints staggered. Butt edges and ends snugly. “Occasional” joint widths up to 1/8-inch will be allowed.

Use below on steel decks.

* + - * 1. Install the underlayment board with the long edges running in the same direction as the flutes of the steel deck with edge joints bearing on solid surface of the deck. Butt edges and ends snugly “Occasional joint widths up to 1/8-inch will be allowed.
				2. Discard boards with broken corners or warped boards.
			1. INSTALLATION OF FLASHING
				1. Flashing Roof Drains:

Use below for new work on cast drain bodies.

Apply the manufacturer’s water cut off mastic around the perimeter of the drain body. Embed the membrane into the mastic. Install the clamping ring and strainer.

Use below on reroofing with cast drain bodies.

Remove the existing clamping ring, coverstrips and lead flashing. Clean the contact area of the drain body down to bare metal. Apply the manufacturer’s water cut off mastic around the perimeter of the drain body. Embed the membrane into the mastic. Install the clamping ring and strainer.

Secure the clamping ring with the existing bolts. Provide bolts to match existing to replace bolts damaged or broken during the Work.

Use below for sheet metal drains.

Set the sheet metal roof drain over the membrane. Strip in the flanges of the drain with sheet flashing. Extend the flashing a minimum of 6 inches beyond the flanges. Splice the flashing to the drain flanges and to the roof membrane. Apply lap sealant at exposed edges.

* + - 1. INSTALLATION OF BASE FLASHING
				1. Install base flashing at terminations of roofing according to manufacturer's written instructions.
				2. Temporary Flashings: Provide a temporary waterproof seal at membrane edges, penetrations, drains unless complete flashings are installed immediately (same working day) following the membrane application.

Smooth surfaces of masonry and concrete walls, and parapets usually require priming.

* + - * 1. Prime substrate with asphalt primer if required by manufacturer.
				2. Installing Uncured Neoprene or Uncured EPDM Base Flashing:

Complete the splice between the flashing and the roof membrane before bonding flashing to vertical surfaces. Extend the splice on to the roof surface a minimum of 3 inches beyond fasteners.

Apply bonding adhesive to flashing sheet and to the substrate. Roll the flashing into the adhesive.

Work the flashing tightly into intersections of vertical and horizontal surfaces. Cut out and patch bridging or gaps in excess of 1/4-inch.

At inside and outside corners fold the membrane around the corner so there are no breaks or holes in the membrane. At outside corners lap the adjacent flashing sheet a minimum of 2 inches, at inside corner, lap the adjacent flashing sheet a minimum of 3 inches.

Nail the flashing across the top edge 12 inches o.c.

Apply lap sealant at splice edges.

Use below when roof membrane forms its own flashing.

* + - * 1. Installing EPDM Roof Membrane As Base Flashing:

Apply bonding adhesive to the membrane and to the substrate. Roll the membrane into the adhesive.

Work the membrane tightly into intersections of vertical and horizontal surfaces. Cut out and patch bridging or gaps in excess of 1/4-inch.

Do not wrap the membrane around inside and outside corners. Form the corners with sheet flashing.

Secure the membrane at the vertical and horizontal intersection with the membrane manufacturer’s anchor bar placed over the membrane and secured one foot o.c.

Strip in the anchor bar with 6-inch wide sheet flashing centered over the bar and spliced to the EPDM roof membrane.

Nail the membrane across the top edge 12 inches oc.

Apply lap sealant at splice edges.

Revise dimensions in first paragraph below if required. Verify minimum and maximum height limits with manufacturers if required.

* + - * 1. Extend flashing sheet up walls or parapets a minimum of 8 inches above insulation and 6 inches onto roof deck.
				2. Install termination bars and mechanically fasten to top of flashing sheet at terminations and perimeter of roofing.

Use below when no cap flashing.

* + - * 1. Installing Compression Bar:

Where base flashing does not terminate beneath a cap flashing, seal the top edge as follows:

Set the top one inch of the flashing in water cut off mastic.

Install a continuous metal compression bar over the flashing and secure one foot o.c.

Apply a bead of lap sealant along the top edge.

* + - 1. INSTALLATION OF ROOFING MEMBRANE
				1. Install the membrane with the minimum number of field formed joints. Use the largest size factory formed sheet as is practicable.

If possible, start at high point of the roof and work towards the low point. Lap sheets so the flow of water is not against the edges of the sheet.

Position the membrane so it is free of buckles or wrinkles. Do not stretch the membrane. Lay the sheets with a minimum 4-inch lap.

Allow the membrane to relax for a minimum of 1/2 hour before securing or splicing.

Work the membrane tightly into intersections of vertical and horizontal surfaces. Cut out and patch bridging or gaps in excess of 1/4-inch.

Use below with sheet metal gravel stops.

At gravel stops turn the membrane over the front edge of the nailer. Temporarily secure the membrane to the wood nailer until the gravel stop and edge strip are installed.

Use below with extruded cant type gravel stops.

At gravel stops extend the membrane over the edge of the water dam, terminate the membrane at the base of the vertical portion of the water dam.

Use one of the next three subparagraphs below coordinate with details.

At parapet walls, intersecting building walls, and equipment and skylight curbs, secure the membrane to wood nailers. Nail the membrane 8 inches oc.

Use above with horizontal nailers below membrane. Use below when membrane is secured to vertical surface.

At parapet walls, intersecting building walls, and equipment and skylight curbs, turn the membrane up the vertical surface. Secure the membrane at the vertical and horizontal intersection with the membrane manufacturer’s anchor bar placed over the membrane and secured to the vertical surface one foot o.c. Cut off the membrane flush with the top of the anchor bar.

Use below when roof membrane is used as the base flashing.

At parapet walls, intersecting building walls, and equipment and skylight curbs, turn the membrane up the vertical surface and terminate where shown on the Drawings. Secure the membrane at the vertical and horizontal intersection with the membrane manufacturer’s anchor bar placed over the membrane and secured to the vertical surface one foot o.c.

* + - * 1. Splicing EPDM Roof Membrane Lap Joints:

Splice side and end lap joints of the sheet membrane with the manufacturer’s inseam splicing tape and seam cover tape. Do not use splicing cement.

Mark the bottom sheet along the edge of the top sheet with a marking crayon.

Cleaning and Preparing the Lap Joint:

Remove dirt and dust. Detergent-wash the splice area where dirt has adhered to the membrane. Rinse with clean water and allow to dry thoroughly.

Solvent wash surfaces that will be in contact with inseam tape and cover tape with natural fiber rags soaked in the manufacturer’s recommended cleaning agent. Clean the splice area until the sheet is clean and black, with no streaks, and there is no trace of talc or foreign matter left in the splice area. Change rags frequently to avoid spreading the talc or dirt.

The solvent wash is mandatory and cannot be eliminated regardless of the manufacturer’s requirements.

Installing Inseam Splicing Tape:

Apply the manufacturer’s primer to surfaces that will be in contact with the inseam tape. Allow the primer to dry completely before completing the splice.

Position the tape on the bottom sheet with the edge aligned with the previously made markings. Roll the surface of the tape to insure good adhesion.

Fold the top sheet over the tape. Trim the sheet as necessary so that 1/4-inch of the tape is exposed.

Remove the release paper from the top surface of the tape and allow the membrane to contact with the tape as the paper is being removed.

Roll the surface of the splice to insure good adhesion.

Installing Cover Tape:

Apply the manufacturer’s primer to surfaces that will be in contact with the cover tape. Allow the primer to dry completely before completing the splice.

Apply the cover tape centered over the seam. Roll the tape into position while the release paper is being removed.

Adhere the tape to the underlying sheet so it is free of wrinkles, fishmouths and voids.

Roll the surface of the splice to insure good adhesion.

* + - * 1. Phasing of Membrane Installation:

At the end of each working day temporarily seal the loose edge of the membrane so that water does not flow beneath the covered portion. Spud off existing aggregate (if any) in the area to be sealed, remove dirt, dust, and foreign matter. Install the temporary seal using one of the following methods:

Apply a 12-inch wide application of hot bitumen over the area to be sealed. While hot, embed the EPDM membrane into the bitumen. Before the Work resumes cut off and discard portions of the membrane that have been embedded in the hot bitumen.

Apply the membrane manufacturer’s night seal over the area to be sealed. Embed the EPDM membrane into the night seal. Apply a continuous weight over the membrane and night seal. Before the work resumes cut off and discard all portions of the membrane that have been embedded in the night seal.

Install flashings as the membrane is being installed (same working day). If the flashing cannot be completely installed in one day, progress the installation until the flashing is in a watertight condition.

* + - * 1. Installing Pipe Flashing:

Wherever possible flash pipes thru the roof with the manufacturer’s premolded pipe flashing.

Cut the flashing to the proper diameter. Apply splicing cement to the bottom of the flashing and to the contact surface of the membrane. Apply water cut off mastic between the contact surface of the pipe and the flashing. Install the premolded flashing.

Install compression clamp around top of flashing. Apply lap sealant around the splice edge of the flashing flange.

Where premolded pipe flashings cannot be used, use field fabricated flashing.

Coat the pipe, the flashing sheets and the contact surface of the membrane with splicing cement.

Install a square shaped piece of flashing over the membrane. Turn the flashing up onto the pipe 1/2 inch.

Wrap a second piece of flashing around the pipe. Extend the flashing 1/2 inch onto the horizontal portion of previously installed flashing. Apply lap sealant at splice edges and at the top edge of the flashing.

Use below for conventional gravel stops.

* + - * 1. Installing Gravel Stop Flashing:

Install the gravel stop over the roofing membrane. Strip in the horizontal portion of the gravel stop with one strip of elastomeric flashing set in splicing cement. Extend the flashing from the front edge of the gravel stop to a minimum of 3 inches beyond the horizontal metal flange of the gravel stop. Apply lap sealant at both edges and all splice joints.

* + - * 1. Installing Pitch Pockets:

Install the metal pitch pocket over the roofing membrane. Completely cover the pitch pocket with flashing set in splicing cement. Turn down the flashing 1/2 inch into the pitch pocket and a minimum of 3 inches beyond the horizontal flanges of the pitch pocket. Seal edges and splice joints with lap sealant.

Cover the bottom half of the pitch pocket with mortar. Fill the remaining half of the pitch pocket with pourable sealer.

* + - * 1. Installing Scupper Flashing:

Strip in flanges of the metal scupper with sheet flashing. Completely cover the metal flanges. Extend the flashing a minimum of 3 inches beyond the flanges onto the roofing membrane. Apply lap sealant at exposed edges.

Use below for expansion joints at walls.

* + - * 1. Installing Expansion Joint at Building Wall:

Install premolded joint filler and expansion joint filler tube at intersection of deck and vertical building wall.

Extend the roof membrane over the tube and up the vertical surface and terminate as shown on the Drawing.

Apply bonding adhesive to the membrane and to the substrate. Roll the membrane into the adhesive.

Do not wrap the membrane around inside and outside corners. Form the corners with sheet flashing.

Secure the membrane to the deck with the membrane manufacturer’s anchor bar placed over the membrane and secured one foot oc.

Strip in the anchor bar with 6-inch wide sheet flashing centered over the bar and applied to the EPDM roof membrane.

Fasten the membrane across the top edge 12 inches o.c.

Apply lap sealant at splice edges.

* + - * 1. Installing Grease Guards:

Cover EPDM curb base flashing with 0.030 inch aluminum sheet flashing before installing grease guard.

Install grease guards prior to installation of ballast.

Install grease guards in accordance with the manufacturer’s printed instructions, and the membrane manufacturer’s recommendations.

* + - 1. INSTALLATION OF INSULATION
				1. Install the insulation immediately as the membrane is being completed. If this is not possible a maximum of one week will be allowed between the installation of the membrane and placement of the insulation.
				2. Before installing insulation, ballast underlayment, and ballast, inspect the membrane and splice joints to ensure that the system is watertight. Repair defects before proceeding.
				3. Loosely lay board insulation units over roofing membrane, with long joints of insulation in continuous straight lines and with end joints staggered between rows. Abut edges and ends between units.

“Occasional” joint widths up to 1/8 inch will be allowed.

* + - * 1. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within 3/4 inch of projections and penetrations.

Retain subparagraph below if required, or revise to suit Project. Revise below if one or more insulation layers are topped with a final layer of mortar-faced board insulation.

Where overall insulation thickness is 2 inches or more, install required thickness in two or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of 6 inches in each direction.

Retain paragraph below for aggregate ballast.

* + - * 1. Install geotextile fabric over insulation, overlapping edges and ends at least 12 inches. Do not lap ends of fabric sheets within 72 inches of roof perimeter. Extend fabric 2 to 3 inches above ballast at perimeter and penetrations. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation. Do not cover drains or restrict water flow to drains.
			1. INSTALLATION OF BALLAST

Retain option in paragraph below if roof-paver ballast is required.

* + - * 1. To roofed area, apply aggregate ballast uniformly over geotextile fabric at rate of 1000 lbs. per square, carefully spreading aggregate to not damage roofing membrane and base flashings.

Ballast: 10 lb./sq. ft., within 48 inches of roof perimeter and corners and of roof penetrations.

* + - * 1. Apply ballast as insulation is installed, leaving roofing membrane insulated and ballasted at end of workday.

Retain "Walkway Pavers" subparagraph below with "Ballast" subparagraph retained above if required. Roofing manufacturers recommend use of walkway pavers in place of ballast in areas subject to service traffic.

Walkway Pavers: Install walkways formed from [one row] [two rows] of roof pavers, loosely laid and butted.

* + - 1. INSTALLATION OF ROOF PAVERS
				1. Install roof pavers over roofed area according to insulation manufacturer's written instructions.
				2. At the perimeter of the roof, paint the vertical exposed face of the insulation with latex paint.
				3. Set concrete pavers over the insulation with edge joints butted snugly together. Lap pavers over the edge of the insulation 1/2 inch.

Retain “Mortar-Faced Board Insulation” if required.

* + - 1. INSTALLATION OF MORTAR-FACED BOARD INSULATION
				1. Install the insulation immediately as the membrane is being completed. If this is not possible a maximum of one week will be allowed between the installation of the membrane and placement of the insulation.
				2. Before installing mortar-faced insulation, inspect the membrane and splice joints to ensure that the system is watertight. Repair defects before proceeding.
				3. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested. Stagger end joints of adjoining rows and abut insulation.
				4. Cut the insulation where required at changes in roof slope so it will lay flat against the roof surface.
				5. At locations required by the insulation manufacturer provide a 3 inch wide, metal securement strap over the insulation. Secure the strap with one fastener per board.
				6. At the perimeter of the roof, and at penetrations larger than 4 feet in any direction, set one row of concrete pavers over the cement mortar faced insulation. Set the pavers in accordance with the manufacturer’s instructions.

Paint the vertical exposed face of the insulation with latex paint

* + - 1. FIELD QUALITY CONTROL
				1. As the joints are completed or at the end of each workday, in the presence of the Director’s Representative closely examine joints in the membrane and flashing. Cut out and repair areas of the joints that are not fully bonded or that contain “fishmouth” or “wrinkles”. Repair the membrane so it is restored to its full waterproof integrity. Lap patches a minimum of 6 inches beyond cuts.

Do not proceed with installation of ballast until joints in the area to be ballasted have been inspected.

A roof inspection is required by manufacturer before warranty issue. Revise scope of inspection and source of report to a qualified roofing consultant or an independent testing and inspecting agency if preferred.

* + - * 1. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

Retain subparagraph below if Director’s Representative wants to be present during manufacturer's final inspection.

Notify Director’s Representative 48 hours in advance of date and time of inspection.

* + - 1. PROTECTING AND CLEANING
				1. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Director’s Representative.
				2. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
				3. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075553