SECTION 075556 - FLUID-APPLIED PROTECTED MEMBRANE ROOFING

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:

Hot fluid-applied, rubberized-asphalt roofing membrane.

Base flashing sheet materials.

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 a letter from the manufacturer certifying that the roofing system has a Class A external fire resistance rating when tested in accordance with ASTM E 108 or UL-790.

Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

Submit evidence of compliance with performance requirements.

Installer Certification:

Submit a letter from the manufacturer certifying that the installer is licensed to install the roof system.

Submit the names, addresses, and telephone numbers of 3 previously installed “IRMA” protected membrane roof systems which have had the manufacturer’s warranty issued. Include the warranty numbers.

Submit a letter certifying that the crew chief and at least 2 other members of the roofing crew have installed at least 3 built-up type roofs 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. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

The application of the roofing system shall be performed by an installer licensed by the manufacturer the licensed installer must have previously installed at least 3 “IRMA” protected membrane roof systems for which the manufacturer’s warranty has been issued.

* + - * 1. Fire Hazard Classification: The protected membrane roof system must have a Class A external fire resistance rating as determined by tests conducted in accordance with ASTM E 108 or UL-790.
        2. New York City Fire Department Regulations:

Equipment and fuel shall meet the requirements of the New York City Fire Department.

Obtain permit for the storage of fuel from above Department.

* + - 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.
      2. 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. WARRANTY
         1. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

Warranty also includes base flashings, insulation, and other components of roofing system.

Warranty Period: 10 years from date of Substantial Completion.

1. PRODUCTS
   * + 1. SYSTEM DESCRIPTION

Use below with ballast (1000 lbs./sq). Delete insulation underlayment on asphalt roofs. Edit for type of substrate.

* + - * 1. Protected Membrane Roof System: Built-up bituminous roofing membrane, insulation underlayment, polystyrene insulation, ballast underlayment, and ballast installed over the structural deck/existing vapor barrier.

Use below with cement faced insulation (450 lbs./sq). Delete insulation underlayment on asphalt roofs. Edit for type of substrate.

* + - * 1. Protected Membrane Roof System: Built-up bituminous roofing membrane, insulation underlayment, cement faced polystyrene insulation, and metal strapping installed over the structural deck/existing vapor barrier.

Delete paragraph below if no repairs.

* + - * 1. Built-Up Roofing Repairs: Repair of built-up roofing membrane, flashings and other associated Work.
      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. Hot Fluid-Applied, Rubberized-Asphalt Roofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Tremco Incorporated.

Approved equivalent.

* + - 1. BASE FLASHING SHEET MATERIALS

Use article for base flashings, and to strip in metal flashings. Use for miscellaneous flashing work.

Retain "SBS-Modified Bituminous Flashing Sheet" paragraph below for granule-surfaced, SBS-modified bituminous flashing sheet. Retain one of three options for color.

* + - * 1. SBS-Modified Bituminous Flashing Sheet: ASTM D6164, Grade G, Type I or Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, [**white] [gray] [tan] <Insert color**>.

Retain backer sheet, if required, from "Backer Sheet" subparagraph below for first ply of two-ply, SBS-modified bituminous flashing.

Backer Sheet: ASTM D6164, Grade S, Type I or Type II, polyester-reinforced, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.

* + - 1. FELTS

Use paragraph below for asphalt roof membranes over concrete or steel decks or existing asphalt vapor barriers.

* + - * 1. Felts For Asphalt Roofing Membrane:

Fiber Glass Felt: Glass fiber mat bonded together with a resinous binder and coated with a weathering grade asphalt; ASTM D 2178, Type IV.

Use paragraph below for asphalt roof membranes over wood decks.

* + - * 1. Felts For Asphalt Roofing Membrane: Glass fiber mat bonded together with a resinous binder and coated with a weathering grade asphalt, as approved by the manufacturer.

Fiberglass Base Sheet: Nonporous glass fiber mat.

Fiberglass Felt: ASTM D 2178, Type IV.

Use paragraph below for coal tar roof membranes, over new decks or over existing coal tar vapor barriers.

* + - * 1. Felts For Coal Tar Roofing Membrane: No. 15 coal tar saturated organic felts; ASTM D 227, Type I.

Use paragraph below for coal tar roof membranes over existing asphalt vapor barriers and over wood decks.

* + - * 1. Felts For Coal Tar Roof Membranes:

Base Sheet: Asphalt saturated and coated organic felt base sheet, ASTM D 2626.

Coal Tar Felt: No. 15 coal tar saturated organic felts, ASTM D 227, Type I.

Use paragraph below for repairing existing coal tar vapor barriers and roofing membranes.

* + - * 1. Felts For Repairing Coal Tar Membranes: No. 15 coal tar saturated organic felts, ASTM D 227, Type I.

Use paragraph below for repairing existing asphalt vapor barriers and roofing membranes.

* + - * 1. Felts For Repairing Asphalt Membranes: No. 15 perforated asphalt saturated organic felt; ASTM D 226, Type I.
      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.

Do not use paragraph below for repair work. Use before installing membrane, asphalt roofs only.

* + - * 1. Asphalt Primer: ASTM D41.

Use paragraph below on new concrete decks only. Coal tar roofs.

* + - * 1. Coal Tar Primer (Creosote): ASTM D 43.
        2. Bitumen:

Steep Asphalt: ASTM D 312, Type III.

Use below on dead flat or roofs with ponding.

Coal Tar Pitch: ASTM D 450, Type I.

* + - * 1. Plastic Cement:

Asphalt Roofing Cement (Flashing Grade): ASTM D 4586.

Coal Tar Roofing Cement: ASTM D 4022 without asbestos.

Used article below over wood decks.

* + - * 1. Rosin Paper:

Rosin-sized, 5 lbs. per square.

Retain Reinforcing Fabric" paragraph below if a reinforced roofing membrane is required, or if using reinforcing fabric over joints and cracks not exceeding 1/8 inch thick and for repairs on existing built-up roofs.

* + - * 1. Reinforcing Fabric: Manufacturer's recommended, fiberglass mat.
        2. Roof Coatings:

Use below on smooth surface roofs.

Bituminous Aluminized Coating, Asbestos-free, fibrous: D-2824, Type III.

Use one of the next 2 paragraphs below on gravel surfaced roofs.

Asphalt Roof Preservative: Refined asphalt base, plasticizing oils and aromatic solvents blended with asbestos fibers to yield a heavy brushing consistency ready for use. One of the following:

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

Tremco, Inc.; Penefelt.

Approved equivalent.

Coal Tar Roof Preservative: Refined coke overtar, plasticizing oils, and aromatic tar solvents blended with mineral fillers (usually asbestos fiber) or stabilizers to yield a heavy brushing consistency ready for use. One of the following:

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

Tremco, Inc.; ECOlastic.

Approved equivalent.

* + - 1. FASTENERS
         1. Membrane Fasteners:

Use below on wood decks.

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

Use paragraph below to fasten underlayment board to steel deck.

* + - * 1. Substrate Board Fastener:

Hardened, self-tapping, Phillips pan head screw, coated to resist corrosion, and inserted thru a 3 inch diameter steel plate. Minimum penetration thru steel deck, 3/8 inch.

* + - 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. First option below corresponds to DiversiFoam's "Certifoam 40 Drainage Board," Dow Chemical's "Styrofoam Roofmate," and Owens Corning's "Foamular 404."

* + - * 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.

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.

* + - * 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 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.

Use paragraph below on coal tar membranes only.

* + - * 1. Insulation Underlayment: 6 mil thick black polyethylene.

Use paragraph below over steel decks only.

* + - * 1. Membrane Substrate Board: Gypsum board; 5/8 inch thick, Type X.

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:

Retain first option for use over extruded polystyrene board insulation (not mortar-faced insulation). Retain second option for repair existing build up roofs.

Size: ASTM C 33, [#57.][#67.]

* + - * 1. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67; and as follows:

Coordinate size selection in "Size" subparagraph below with minimum paver coverage required, especially at corners, perimeter, penetrations, and above large wall openings. Consider handling of pavers as weight increases. Paver sizes vary among manufacturers and include 12 by 12 and 18 by 18 inches.

Size: 24 by 24 inches. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, height, and thickness of 2-inches.

Compressive Strength: 3500 psi, minimum; ASTM C140.

Colors and Textures: As selected by Director’s Representative from manufacturer's full range.

Paver Supports:

Retain one of two subparagraphs below for paver supports, which are used to elevate pavers and facilitate drainage, if required. Retain first subparagraph if paver supports are integrally cast. Retain second subparagraph if separate pedestal supports, which are used to space, level, and stabilize pavers, are required. Pedestals may be of fixed height or adjustable for leveling pavers over a sloped substrate.

Integral corner pedestals.

Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including [**fixed-height] [adjustable or stackable**] pedestals, shims, and spacer tabs for joint spacing of [**1/8 inch] [3/16 inch] [1/8 to 3/16 inch**].

Retain "Roof-Paver Metal Straps" paragraph below if strapping roof pavers together with stainless-steel straps at roof corners or perimeter.

* + - * 1. Roof-Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches wide by 0.031 inch thick with stainless-steel anchors.

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.
         3. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.
         4. 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.
         5. Repair of Existing Vapor Barrier:

Remove deteriorated (loose, wet, blistered, torn) portions of the existing vapor barrier so that only sound, firmly bonded felts remain.

Use 2 or 3 below.

Asphalt Roofs: Prime the area to be repaired. Install 2 plys of No. 15 asphalt felt mopped in with hot steep asphalt, or plastic asphalt. Lap the felt over the existing vapor barrier a minimum of 6 inches.

Coal Tar Roofs: Install 2 plys of No. 15 coal tar felt mopped in with hot coal tar or plastic coal tar cement. Lap the felts over the existing vapor barrier a minimum of 6 inches.

* + - 1. JOINTS, CRACKS, AND TERMINATIONS
         1. Prepare and treat substrates to receive roofing, including joints and cracks, roof drains, and penetrations, according to roofing system manufacturer's written instructions.

Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D4258.

Retain first subparagraph below for reinforcing strips over nonmoving joints and cracks not exceeding 1/8 inch thick.

Embed strip of reinforcing fabric into a layer of hot fluid-applied, rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.

Retain subparagraph below with fabric-reinforced joints for unreinforced roofing membrane.

Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

* + - 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. Bond modified bituminous flashing sheet to substrate as follows:

Adhere SBS-modified bituminous[ **backer sheet and**] flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt.

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.
        3. Building In Metal Flashings:

Use below for sheet metal gravel stops.

Building In Sheet Metal Gravel Stops: Build in the gravel stop with 2 plies of modified bituminous sheet flashing.

Install one ply of sheet flashing over the built-up roofing. Extend the flashing over the front edge of the wood blocking and onto the roof surface 4 inches beyond the base of the cant strip. Heat fuse the flashing to the substrate.

Install the metal gravel stop. Embed the horizontal flange of the gravel stop in plastic cement.

Prime the flange with asphalt primer and allow to dry completely. Install one ply of modified sheet flashing over the flange of the gravel stop. Extend the flashing from the edge of the gravel stop onto the roof surface at least 8 inches beyond the base of the cant. Lap ends of flashing 4 inches. Heat fuse the flashing to the substrate.

Do not apply hot bitumen over the modified sheet flashing.

Use below for cant type gravel stops (Hickman type).

Building In Cant Type Extruded Aluminum Gravel Stops: Build in the gravel stop with one ply of modified bituminous sheet flashing.

Install one ply of modified sheet flashing over the built-up roofing. Extend the flashing from the top edge of the cant onto the roof surface 8 inches beyond the base of the cant. Heat fuse the flashing to the substrate. Lap ends of flashing 4 inches.

Do not apply hot bitumen over the modified sheet flashing.

Use below for sheet metal flashings.

Building In Sheet Metal Flashings: Build in the metal flashing with one ply of modified bituminous sheet flashing.

Embed the flange which extends over the roof surface in plastic cement.

Prime the flange with asphalt primer and allow to dry completely. Install one ply of modified sheet flashing over the flange of the metal flashing. Extend the sheet flashing onto the roof surface a minimum of 8 inches beyond the metal flange. Lap ends of flashing 4 inches. Heat fuse the flashing to the substrate.

Do not apply hot bitumen over the modified sheet flashing.

* + - * 1. Filling Pitch Pockets:

Fill pitch pocket with bituminous plastic cement of the same generic type as the top course of the roofing. Stiffen bottom half of bituminous cement with Portland Cement. Slope surface of top half to shed water.

* + - 1. INSTALLATION OF ROOFING MEMBRANE
         1. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
         2. Heat and apply rubberized asphalt according to manufacturer's written instructions.

Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.

Retain first paragraph below if applicable.

* + - * 1. Start application with manufacturer's authorized representative present.

Retain "Unreinforced Membrane" or "Reinforced Membrane" paragraph below, or both. If retaining both, indicate location of each system on Drawings.

* + - * 1. Unreinforced Membrane: Apply hot rubberized asphalt to area to receive roofing. Spread hot rubberized asphalt to form a uniform, unreinforced, seamless membrane, [**180-mil minimum thickness] [180-mil average thickness, but not less than 125 mils thick**].
        2. Reinforced Membrane: Apply hot fluid-applied, rubberized asphalt to area to receive roofing. Spread a 90-mil-thick layer of hot fluid-applied, rubberized asphalt; embed reinforcing fabric, overlapping sheets 2 inches; spread another 125-mil-thick layer of hot fluid-applied, rubberized asphalt to form a uniform, reinforced, seamless membrane, 215 mils thick.
        3. Apply hot fluid-applied, rubberized asphalt over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

Protection course also prevents insulation from sticking to membrane.

* + - * 1. Cover membrane with protection course with overlapped joints before membrane is subject to construction traffic.
      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. Flood coat the membrane with hot bitumen applied at the rate of 45 lbs. per square foot. This is in addition to the flood coat required during the roofing membrane installation.

Allow the bitumen to completely cool off and harden.

Use below on coal tar membranes only.

Dry apply insulation underlayment before installing insulation. Lap ends and edge a minimum of 1 foot.

* + - * 1. 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.
        2. 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. Geotextile fabric is usually omitted under roof-paver 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 required by insulation manufacturer, but not less than the following, carefully spreading aggregate to not damage roofing membrane and base flashings. Apply ballast as insulation is installed, leaving roofing membrane insulated and ballasted at end of workday.

Ballast: 10 lb./sq. ft., within 12 inches of roof perimeter and corners and of roof penetrations.

Retain first subparagraph below if partially replacing aggregate ballast with roof pavers. Coordinate with drawings.

Install one row of roof pavers in lieu of aggregate ballast at roof perimeter, corners, and penetrations.

Use subparagraph below on buildings exceeding 60 feet high. Use only with the above subparagraph.

Mechanically fasten roof pavers with metal straps. Secure the strap with one fastener per paver. Place the strap 6 inches from the outside edge of the paver.

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. 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. 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.

Use below for steep roofs above 1-1/2 inches per ft slope. Asphalt roofs only.

Set the insulation in a poured flood coat of hot bitumen, applied at the rate of 45 lbs. per square. This is in addition to the flood coat required during the roofing membrane installation.

Time the placement of the insulation boards as required to allow the bitumen to reach the correct temperature. Bitumen must be hot enough to obtain maximum bonding, without melting the insulation.

Test each board for proper bond. Remove loose boards and reset.

Use below for roofs pitched less than 1-1/2 inches per ft. Asphalt roofs only.

Flood coat the membrane with hot bitumen applied at the rate of 45 lbs. per square. This is in addition to the flood coat required during the roofing membrane installation.

Allow the bitumen to completely cool off and harden. Loose lay the insulation in place.

Use below for coal tar roofs only.

Flood coat the membrane with hot bitumen applied at the rate of 45 lbs. per square. This is in addition to the flood each required during the roofing membrane installation.

Dry apply insulation underlayment before installing the insulation. Lap ends and edges a minimum of 1 foot. Loose lay the insulation in place.

Delete first sentence for the subparagraph below for new decks.

At roof drain remove the existing dome strainer. Install the insulation over the drain body. Paint the entire surface of the insulation board or boards which cover the drain with latex paint. Paint color shall contrast with the surface of the insulation.

* + - * 1. Installing Roof-Pavers:

Before installing ballast, install roof-pavers where shown on the Drawings. Set the pavers over the insulation, and butt edges snugly.

* + - * 1. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.
      1. BUILT-UP ROOF REPAIRS
         1. General: Where felts, hot bitumen or plastic cement are specified for repair Work, use the same generic type as the existing membrane except that built-up flashings shall always be asphalt materials.
         2. Blister Repairs:

Spud off the existing aggregate in the area to be repaired. Extend the spudding a minimum of 6-inches beyond the limits of the finished patch. Remove dirt and dust.

Use above on gravel roofs only.

Cut off and remove raised or delaminated plies. Cut out exposed wet insulation (if any). Install insulation of matching thickness in plastic cement or hot bitumen.

Install 3 plies of No. 15 felts embedded in plastic cement or hot bitumen. Extend the first ply at least 3 inches beyond the cut area. Lap the second ply at least 3 inches beyond the first ply, and the third ply 3 inches beyond the second ply.

Coat the patched area with a liberal amount of plastic cement or hot bitumen. Embed aggregate into the fresh coating, hiding the black.

Use above on gravel roofs, below on smooth surface roofs.

Coat the patched area with bituminous aluminized coating applied at the rate of 1-1/2 gallons per square.

* + - * 1. Repair of Cracks and Splits:

Spud off the existing aggregate in the are to be repaired. Extend the spudding a minimum of 6-inches beyond the limits of the finished patch.

Use above on gravel roofs.

Cover the crack or split with 3 plies of No. 15 felt each embedded in plastic cement or hot bitumen. Extend the first ply at least 3 inches beyond the crack or split. Lap the second ply at least 3 inches beyond the first ply, and the third ply 3 inches beyond the second ply.

Coat the patched area with a liberal amount of plastic cement or hot bitumen. Embed aggregate into the fresh coating, completely hiding the black.

Use above on gravel roofs, below on smooth surface roofs.

Coat the patched area with bituminous aluminized coating applied at the rate of 1-1/2 gallons per square.

* + - * 1. Repair of Curled Felt Edges and Fishmouths:

Spud off the existing aggregate in the area to be repaired. Extend the spudding a minimum of 6-inches beyond the limits of the finished patch.

Use above on gravel roofs.

Cut off loose and deteriorated felts. Remove dirt and dust.

Coat the defective area with a liberal amount of plastic cement or hot bitumen. Embed aggregate into the fresh coating, completely hiding the black.

Use above on gravel roofs, below on smooth surface roofs.

Coat the defective area with bituminous aluminized coating.

* + - * 1. Build-Up Flashing Repairs:

Edit paragraphs below to suit job conditions. Coordinate with Job Captain.

Spud off the existing aggregate along the base of the cant in the area to be repaired. Extend the spudding a minimum of 6-inches beyond the limits of the finished patch or repair.

Use above on gravel roofs.

Remove dirt, dust, and loose or deteriorated materials.

Where top of flashing has lost bond with the substrate, secure the flashing with fasteners 6-inches o.c.

Patch cracks, holes, splits and blisters. Cut open blisters and dry wet surfaces, if any. Patch defects with one ply of woven mesh glass fabric, embedded in and coated with plastic cement. Extend the patch a minimum of 3 inches beyond defects.

Use one of the next 2 paragraphs below for complete resurfacing of flashing.

Resurface the existing built-up flashing with a heavy smooth trowel coating of plastic cement. Apply the plastic cement from the base of the cant, to the top edge of the flashing beneath the cap flashing.

Resurface the existing built-up flashing with one ply of woven mesh glass fabric embedded in and coated with plastic cement. Extend the fabric 3 inches onto the horizontal roof surface, and to the top edge of the flashing beneath the cap flashing.

* + - * 1. Coverstrip Repair:

Edit subparagraphs below to suit job conditions. Coordinate with Job Captain.

Use below on gravel roofs.

Spud off the existing aggregate in the area to be repaired. Extend the spudding a minimum of 6-inches beyond the limits of the finished patch or repair.

Remove dirt, dust, and loose or deteriorated portions of the existing cover strips.

Secure loose portions of the horizontal flashing leg with nails spaced 3 inches o.c. staggered.

Metal Base Flashing Joint Repair:

Centered over the joint, apply one 12-inch wide ply of woven mesh glass fabric embedded in and coated with plastic cement. Extend the fabric 3 inches beyond the horizontal edge of the metal flange and up the vertical portion of the flashing at least 1 inch beyond the bottom edge of the cap flashing.

Gravel Stop Joint Repair:

Centered over the joint apply one 12-inch wide ply of woven mesh glass fabric or No. 15 felt embedded in and coated with plastic cement. Extend the repair from the leading edge of the gravel stop to a point 3 inches beyond the end of the split and at least 3 inches beyond the horizontal edge of the metal flange.

Coverstrip Resurfacing:

Apply 2 plies of No. 15 felt coverstrips. Embed each ply in plastic cement. Provide coverstrips that are at least 8 inches and 12 inches wide respectively. Carry the strips past the edge of the metal flashing flange a minimum of 4 inches.

Delete last sentence below on smooth surface roofs.

Finish the surface with a heavy trowel coat of plastic cement. Embed aggregate completely hiding the black.

Use below for repairing sheet metal joints.

* + - * 1. Metal Joint Repair:

Centered over the joint apply one 6-inch wide ply of woven mesh glass fabric embedded in plastic cement. Cover the fabric with a 1/8-inch thick trowel coat of plastic cement.

* + - * 1. Pitch Pocket Repair: Remove dirt, dust and foreign matter. Dry exposed contact surfaces. Fill the depressed portion of the pitch pocket with plastic cement. Crown the surface to shed water.
        2. Applying Resurfacing:

Remove loose aggregate, dirt and debris by power vacuuming and power sweeping. Remove dust.

Use above on gravel roofs below on smooth surface roofs.

Remove dirt, debris and dust by brooming and vacuuming. Apply a uniform coating of asphalt primer.

Embed the surfacing aggregate in a poured flood coat of hot asphalt, applied at the rate of 65 lbs. per square.

Embed the surfacing aggregate in a poured flood coat of hot coal tar, applied at the rate of 75 lbs. per square.

Embed the surfacing aggregate in a coating of asphalt roof preservative, applied by brush or spray at the rate of 8 gallons per square.

Change to coal tar where required.

Apply gravel or crushed stone at the rate of 400 lbs. per square or apply slag at the rate of 300 lbs. per square.

Use below subparagraph only when specifically requested.

Apply calcite marble chips at the rate of 400 lbs. per square.

Use below on smooth surface roofs.

Apply bituminous aluminized coating at the rate of l-l/2 gallons per square.

* + - 1. FIELD QUALITY CONTROL
         1. Field Samples: From each tanker load of bitumen arriving at the job site, a quart sample shall be drawn in the presence of and turned over to the Director’s Representative for laboratory analysis. Work installed with materials that fail to meet the applicable specifications shall be removed.

Delete below when no new roofing.

* + - * 1. Test Strip: When and where directed by the Director’s Representative, and before insulation and ballast is applied to the completed membrane, cut a strip 3 inches wide by 40 inches long thru all plies of the built-up roofing. One such test strip may be required for every 50 squares of roofing and at least one test on each roof. After removal of the strip, immediately repair the area by applying the same number of plies of the same kind of felt and bitumen to fill the hole level. Repeat the same number of plies of the same kind of felt and bitumen over the filled strip with the first ply lapping each edge 12 inches and each succeeding ply lapping the preceding ply by at least 3 inches on all edges. Turn the test strips over to the Director’s Representative. The Director’s Representative will submit the test strips for examination. Failure of the samples to meet the specification requirements will be cause for rejection of Work.

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 075556