SECTION 075551 - BUILT-UP BITUMINOUS PROTECTED MEMBRANE ROOFING

This Section includes multiple-ply roofing of felts and asphalt bitumen, including base flashings placed directly on structural deck; loose-laid insulation; gravel, paver, or concrete ballast over insulation; primary flashings to roof protrusions and interruptions; and integral roofing control and expansion joints. Cant strips can be included in this Section or referenced elsewhere.

Note that ASTM D2178 is referenced below, although ASTM no longer considers this standard as active. However, there is no replacement reference, and ASTM has not yet indicated whether they will reinstate the standard or revise it. Manufacturers continue to show this standard in their current literature and on their websites.

The primary advantage of this roofing system over a conventional roof system is that this system has a waterproof membrane placed under insulation, as well as ballasting cover to protect membrane from temperature cycling and degradation from exposure to weather, elements, and sunlight.

Use Section 075113 for applying built-up membrane to insulated deck surface for "conventional" roofing systems.

This Section contains options to specify roof system by National Roofing Contractors Association (NRCA) code number, manufacturer's code, or descriptive statements. Edit to avoid conflicting requirements.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this Specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term "Architect/Engineer." "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See Drawing Coordination Considerations for information needed to coordinate this Specification Section with Drawings.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Sheathing over metal deck surface.

Insulation.

Membrane roofing.

Ballast cover.

Base flashings.

Membrane joints.

**[Cant strips.]**

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 034500 - Precast Architectural Concrete: Precast paver ballast.

Section 061053 - Miscellaneous Rough Carpentry: Wood nailers **[and cant strips]**.

Include following subparagraph if reroofing is part of Project.

Section 070150 - Maintenance of Membrane Roofing: Requirements for reroofing.

Section 076200 - Sheet Metal Flashing and Trim: Counterflashing and <\_\_\_\_\_\_\_\_>.

Section 077100 - Roof Specialties: Counterflashings and <\_\_\_\_\_\_\_\_>.

Section 084433 - Sloped Glazing Assemblies: Counterflashings and <\_\_\_\_\_\_\_\_>.

Section 086200 - Unit Skylights: Skylight frames **[and integral curbs]**; Counterflashing and <\_\_\_\_\_\_\_\_>.

Section 086300 - Metal-Framed Skylights: Skylight frames **[and integral curbs]**; Counterflashing and <\_\_\_\_\_\_\_\_>.

Section 221400 - Facility Storm Drainage: Roof **[drains] [sumps] [hoppers]** <\_\_\_\_\_\_\_\_>.

List Sections specifying installation of products included in this Section and indicate specific items.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: Lightning protection.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: Execution requirements for [recessed] strip reglet devices specified by this Section.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: Product requirements for acoustical insulation for deck flutes for placement by this Section.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: Flashing collars.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: No-fines concrete as ballast over insulation.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: Prefabricated curb for mechanical equipment.

Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_>: Product requirements for **[flashing devices,] [special coated metal counterflashings,] [and]** <\_\_\_\_\_\_\_\_> for placement by this Section.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

LEED requires compliance with specific editions of referenced standards.. Consider including publication dates for referenced standards in this Section to ensure the correct standard is used for LEED compliance.

* + - * 1. ASTM International:

ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

ASTM D312 - Standard Specification for Asphalt Used in Roofing.

ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

See note at beginning of this Section regarding following standard.

ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

ASTM D2626 - Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing.

ASTM D3909 - Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules.

ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

ASTM D4601 - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.

ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

* + - * 1. FM Global:

FM 4450 - Approval Standard for Class 1 Insulated Steel Deck Roofs.

FM DS 1-28 - Wind Design.

* + - * 1. Intertek Testing Services (Warnock Hersey Listed):

WH - Certification Listings.

* + - * 1. National Roofing Contractors Association:

NRCA - The NRCA Roofing and Waterproofing Manual.

* + - * 1. Single Ply Roofing Institute:

SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

SPRI RP-4 - Wind Design Standard for Ballasted Single-ply Roofing Systems.

* + - * 1. UL:

UL - Fire Resistance Directory.

UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.

UL 1256 - Fire Test of Roof Deck Constructions.

UL 1897 - Uplift Tests for Roof Covering Systems.

* + - * 1. U.S. Environmental Protection Agency:

ENERGY STAR - ENERGY STAR Voluntary Labeling Program.

* + - 1. COORDINATION
				1. Section 013000 - Administrative Requirements: Requirements for coordination.
				2. Coordinate Work of this Section with installation of associated roof penetrations and metal flashings installed by other Sections, as Work of this Section proceeds.
			2. PREINSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
				2. Convene minimum **[one week] [<\_\_\_\_\_\_\_\_> weeks]** prior to commencing Work of this Section.
				3. Review preparation and installation procedures and coordinating and scheduling of related Work.
			3. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 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. Section 013300 - Submittal Procedures: Requirements for submittals.
				5. Product Data: Submit data indicating membrane and bitumen materials, base flashing materials, insulation, **[pavers,] [and] <\_\_\_\_\_\_\_\_>**.
				6. Shop Drawings: Indicate **[joint and termination detail conditions,] [conditions of interface with other materials,] [and] [paver ballast cover pattern]**.

Include following paragraph for submission of physical samples for selection of finish, color, texture, and other properties.

* + - * 1. Submit **[two] <\_\_\_\_\_\_\_\_>** sample **[1] <\_\_\_\_\_\_\_\_>**-lb. containers of roofing aggregate **[ballast] [pavers]**.
				2. Manufacturer's Certificate: Certify that **[products] <\_\_\_\_\_\_\_\_>** meet or exceed **[specified requirements] <\_\_\_\_\_\_\_\_>**.

Include separate paragraphs for additional certifications.

* + - * 1. Manufacturer's Instructions: Submit special procedures, perimeter conditions requiring special attention, and <\_\_\_\_\_\_\_\_>.
				2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				3. Manufacturer Reports:

Indicate procedures followed, including ambient temperatures, humidity, wind velocity during application **[, and] <\_\_\_\_\_\_\_\_>**.

Indicate activities on Site, adverse findings, and recommendations.

* + - * 1. Qualifications Statements:

Coordinate following subparagraphs with requirements specified in Qualifications Article.

Submit qualifications for manufacturer and applicator.

Submit manufacturer's approval of applicator.

* + - 1. SUSTAINABLE DESIGN SUBMITTALS
				1. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.
				2. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

Edit material certifications list to suit products specified in this section and Project sustainable design requirements. Specific certificate submittal and supporting data requirements are specified in Section 018113.

Sustainable Sites Certificates:

Certify roofing materials' Solar Reflectance Index (SRI).

Materials Resources Certificates:

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project Site.

* + - * 1. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

Provide cost data for the following products:

Edit list of material cost data to suit products specified in this section and Project sustainable design requirements. Specific cost data requirements are specified in Section 018113.

Products with recycled material content.

Regional products.

<\_\_\_\_\_\_\_\_>.

* + - 1. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

* + - * 1. Perform Work according to **[NRCA Roofing and Waterproofing Manual] <\_\_\_\_\_\_\_\_>**.
				2. Fire-Rated Roof Construction:

**[Rating as indicated on Drawings] [<\_\_\_\_\_\_\_\_>-hour rating]**.

Tested Rating: Determined according to ASTM E119.

Refer to BCNYS for tables of fire resistance ratings for various material and assemblies. Tables use item numbers to identify each assembly.

Prescriptive Rating:

**[Item Number <\_\_\_\_\_\_\_\_>.]**

Determined according to **[applicable] <\_\_\_\_\_\_\_\_>** code.

Comply with **[UL] [FM] [WH]** Assembly Design No. **<\_\_\_\_\_\_\_\_>**.

Select minimum fire classification based on construction type and applicable code. Class A provides greatest resistance to exterior fire exposure. Owner's insurer may require greater fire classification than as required by code.

* + - * 1. Roof Assembly Fire Classification:

Minimum **[Class A] [Class B] [Class C]** when tested according to **[ASTM E108] [or] [UL 790]**.

Roof Assembly with Foam Insulation: Pass **[FM 4450] [or] [UL 1256]**.

* + - * 1. Surface Burning Characteristics:

Foam Insulation: Maximum 75/450 flame-spread/smoke-developed index when tested according to ASTM E84.

* + - * 1. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.
				2. Manufacturer's Inspections:

Request manufacturer's presence before start of Work of this Section, to verify substrate acceptability, and to review installation procedures and completed Work, such that specified warranty can be issued.

Promptly repair unsatisfactory conditions disclosed by the manufacturer's visits to the Site.

In following paragraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <\_\_\_\_\_\_\_\_> standards.

Include following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <\_\_\_\_\_\_\_\_> **[copy] [copies]** of each standard affecting Work of this Section on Site.
			1. QUALIFICATIONS

Coordinate following paragraphs with requirements specified in Submittals Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum **[three] [five] <\_\_\_\_\_\_\_\_> years' [documented]** experience.
				2. Applicator: Company specializing in performing Work of this Section with minimum **[three] <\_\_\_\_\_\_\_\_>** years' **[documented]** experience **[and approved by manufacturer]**.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
				2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				3. Deliver products in manufacturer's original containers, dry, undamaged, and with seals and labels intact.
				4. Store products in weather protected environment, clear of ground and moisture.
				5. Protect foam insulation from direct exposure to sunlight.
			2. AMBIENT CONDITIONS
				1. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
				2. Do not apply roofing membrane during **[inclement weather] [ambient temperatures below <\_\_\_\_\_\_\_\_>** degrees F or above **<\_\_\_\_\_\_\_\_> degrees F ]** without proper weather protection.
				3. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
				4. Do not expose materials vulnerable to water **[or sun]** damage in quantities greater than can be weatherproofed during same day.
			3. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish 30-year manufacturer's material and labor warranty to cover water penetration.
1. PRODUCTS
	* + 1. DESCRIPTION

Restrict statements to describe components used to assemble system.

* + - * 1. Protected Membrane Built-up Asphalt Roofing System:

Description: **[Four] [Three]**-ply asphalt membrane system **[placed over sheathing]**.

Provide **[separation sheet placed over membrane,]** loose-laid insulation, **[water-pervious fabric,]** and **[aggregate] [paver] [concrete]** ballast.

Following paragraph offers option of specifying by NRCA system number. If using this number system, ensure that specific system components are specified.

* + - * 1. NRCA Specification Plate: <\_\_\_\_\_\_\_\_>.

Consider using reference document in following paragraph for specifying membrane ballasting in lieu of descriptive methods used in this Section. The reference specifying method is based on certain building roof area criteria, height of membrane above grade, and roof parapet configuration.

If following paragraph is used, edit relevant Part 2 and Part 3 paragraphs describing ballast material and installation criteria to suit selected system and exposure.

* + - * 1. Criteria for Ballasting Membrane System: Comply with SPRI RP-4, **[1] [2] [3]**, Exposure **[E] [P]**.
			1. PERFORMANCE AND DESIGN CRITERIA
				1. Low Slope Membrane Roof Edge Securement: Conform to SPRI ES-1 for wind speeds determined from **[applicable]** <\_\_\_\_\_\_\_\_> code.

Following paragraph applies to metal deck assemblies only.

* + - * 1. Roof Assembly Classification:

FM Class **[1]** <\_\_\_\_\_\_\_\_> Construction, windstorm classification of **[1-60] [1-90] [1-180]**.

Comply with FM DS 1-28.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Uplift Resistance:

Uplift Pressure Resistance: **[60] [90]** <\_\_\_\_\_\_\_\_> psf .

Comply with UL 1897.

* + - 1. PROTECTED MEMBRANE BUILT-UP ASPHALT ROOFING
				1. Manufacturer List:

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following subparagraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Furnish materials according to <\_\_\_\_\_\_\_\_> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Asphalt Saturated Organic Felts:

Comply with ASTM D226.

**[Type I, No. 15] [Type II, No. 30]**.

**[Unperforated] [Perforated]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Glass Fiber Felts: ASTM D2178, Type **[IV] [VI]**, asphalt saturated.
				2. Base Sheet:

Description: Asphalt saturated and coated.

ASTM D2626, **[unperforated] [perforated]** organic felt.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

ASTM D4601, Type **[I] [II], [unperforated] [perforated]** glass fiber.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

ASTM D4897, Type II, vented glass fiber, asphalt saturated and coated.

* + - * 1. Mineral Surfaced Felts:

**[Comply with ASTM D3909]**.

Provide **[white] [black]** <\_\_\_\_\_\_\_\_>-colored mineral granules.

* + - * 1. Dry Sheathing Paper: **[Clean white cellulose] [Red rosin]** paper, unsaturated.

Asphalt Types and Softening Points:

- Type I: 135 to 151 degrees F (57 to 66 degrees C) for slopes up to 1:24; not recommended for built-up asphalt roofing.

- Type II: 158 to 176 degrees F (70 to 80 degrees C) for slopes up to 1:24. Code requirements in certain states including FL, TX, NM, AZ, and CA limit use of this type.

- Type III: 185 to 205 degrees F (85 to 96 degrees C), for slopes of 1:24 to 1:4.

- Type IV: 210 to 225 degrees F (99 to 107 degrees C), for steep slopes of 1:6 to 1:2.

* + - * 1. Asphalt Bitumen: Comply with ASTM D312, Type **[II] [III] [IV]**.
				2. Asphalt Primer: Comply with ASTM D41.
				3. Plastic Cement:

Comply with ASTM D4586, **[Type I] [Type II]**.

Type: Cutback asphalt.

For ASTM D1227:

- Type I: Containing asbestos filler or fiber reinforcement.

- Type II: Containing filler or fiber reinforcement other than asbestos.

- Type III: Contains no fibrous reinforcement.

- Class 1: Asphalt prepared with mineral colloid emulsifying agents.

- Class 2: Asphalt prepared with chemical emulsifying agents.

* + - * 1. Asphalt Emulsion:

Comply with ASTM D1227.

Type I, **[Class 1] [Class 2]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Type II, **[Class 1] [Class 2]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Type III, **[Class 1] [Class 2]**.

Delete or edit following paragraph appropriate to specified system and required deck surface preparation.

* + - * 1. Gypsum Sheathing:

**[Comply with ASTM C1177.]**

Type: Fire rated **[, paper face]**.

Thickness: **[5/8]** <\_\_\_\_\_\_\_\_> inch .

Coordinate height of curbs and cant strips with insulation thickness. Consider UL requirements for Class A, B, C, and FM requirements for Class I and II roofs.

In following paragraphs, insulation thickness may be expressed using one of following techniques:

- With K-factor indicated below and dimensional thickness indicated in Part 3.

- With R-Value indicated in Part 3, deleting indicated K-factor.

* + - * 1. Insulation:

Extruded Polystyrene Board:

Comply with ASTM C578, Type **[VI]** <\_\_\_\_\_\_\_\_>.

Surfaces: Natural skin.

**[Furnish drainage channels on one face.]**

Board Density: <\_\_\_\_\_\_\_\_> pcf.

Board Size: <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> inch.

Board Thickness: **[<\_\_\_\_\_\_\_\_> inch] [Factory tapered thickness]**.

Maximum Thermal Conductivity: ASTM C177, <\_\_\_\_\_\_\_\_> Btu-in./h-ft.-deg. F at <\_\_\_\_\_\_\_\_> degrees F.

Board Edges: Square.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Extruded Polystyrene Board, Concrete Clad:

**[Comply with ASTM C578, Type VI.]**

Concrete Layer:

Factory bond to latex-modified portland cement.

Thickness on One Face: 3/8-inch.

Board Density: <\_\_\_\_\_\_\_\_> pcf.

Board Size: <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> inch.

Board Thickness: **[<\_\_\_\_\_\_\_\_> inch] [Factory tapered thickness]**.

Maximum Thermal Conductivity: ASTM C177, <\_\_\_\_\_\_\_\_> Btu-in./h-ft.-deg. F at <\_\_\_\_\_\_\_\_> degrees F.

Board Edges: **[Square]** <\_\_\_\_\_\_\_\_>.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

Consider including following paragraph for use with concrete-clad insulation boards and proprietary paver systems, as required.

* + - * 1. Insulation Perimeter Restraint:

Description: Metal edge device configured to restrain insulation boards in position and to provide top flashing over ballast.

Select flashings compatible with membrane and associated materials. First paragraph below is for proprietary specifying; second paragraph is for descriptive specifying.

Metal counterflashings are specified in Section 076200.

* + - * 1. Flexible Flashings:

Material: **[EPDM] [Butyl] [Neoprene] [Modified bitumen, SBS type]** <\_\_\_\_\_\_\_\_>.

Color: **[Black] [White]**.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Flexible Flashings:

Material: **[EPDM] [Butyl] [Neoprene] [Modified bitumen, SBS type]** <\_\_\_\_\_\_\_\_>.

Thickness: <\_\_\_\_\_\_\_\_> mils.

Maximum Perm Rate: <\_\_\_\_\_\_\_\_>.

Tensile Strength: **[1,200]** <\_\_\_\_\_\_\_\_> psi.

Elasticity: **[50]** <\_\_\_\_\_\_\_\_> percent with full recovery without set.

Color: **[Black] [White]** <\_\_\_\_\_\_\_\_>.

Exercise caution when specifying prefabricated joint components as Site installation irregularities could result in weather leakage at joints and junctions. Alternatively, consider detailing or referencing NRCA "Roof Divider" details of wood curb, cant strips, and associated flashings using fourth paragraph below.

* + - * 1. Manufactured Roof Specialties: As specified in Section **[077100 - Roof Specialties]** <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Prefabricated Control **[or Expansion]** Joint Flashing:

Description: Sheet **[butyl]** <\_\_\_\_\_\_\_\_> over closed-cell foam backing seamed to **[galvanized steel] [stainless steel] [copper]** flanges.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Control **[or Expansion]** Joint Flashing:

Description: Sheet **[butyl]** <\_\_\_\_\_\_\_\_>, metal counterflashings, and **[wood]** <\_\_\_\_\_\_\_\_> materials, as indicated on Drawings.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Control **[or Expansion]** Joint Flashing:

Description: Sheet **[butyl]** <\_\_\_\_\_\_\_\_>, metal counterflashings, and **[wood]** <\_\_\_\_\_\_\_\_> materials, according to NRCA Construction Details <\_\_\_\_\_\_\_\_>, <\_\_\_\_\_\_\_\_>, and <\_\_\_\_\_\_\_\_>.

Delete following paragraph if concrete-clad insulation is specified. If concrete-clad insulation requires supplementary ballasting, edit following paragraph as appropriate.

* + - * 1. Roof Surfacing:

Select one or more of the following subparagraphs to specify insulation ballast cover.

First subparagraph below includes option for ASTM D448 with No. 57 aggregate gradation; this is 3/4-inch nominal aggregate. Larger aggregate may be specified.

Aggregate:

Description: Sound, hard, washed **[crushed gravel] [stone]**.

**[Comply with ASTM D448, Gradation No. 57.]**

Sizes:

Minimum: **[3/4]** <\_\_\_\_\_\_\_\_> inch.

Maximum: **[1-1/2]** <\_\_\_\_\_\_\_\_> inch.

Fines:

Size: Less than 5/8 inch.

Dirt or organic materials are not acceptable.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Pavers: Precast concrete as specified in Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Pavers:

Precast concrete units.

Compressive Strength: **[4,000] [8,000]** <\_\_\_\_\_\_\_\_> psi.

Mix: Air entrained.

Size: **[24 by 24 by 2] [<\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_>]** inches.

Finish: **[Smooth] [Broom]**.

Color: <\_\_\_\_\_\_\_\_> **[As selected]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

If proprietary paver system is desired, edit following subparagraph as appropriate. Consider minimum ballast weight for roof system when editing following subparagraph.

Pavers:

Description: <\_\_\_\_\_\_\_\_>.

Color: <\_\_\_\_\_\_\_\_> **[As selected]**.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

Pavers can be placed directly on insulation (which should slope to drain) or elevated to a flush horizontal surface with pedestals.

* + - * 1. Pedestals:

Description: **[Injection-molded, weathering-grade plastic, cruciform shape, and configured to permit height adjustment] [Injection-molded, weathering-grade plastic, <\_\_\_\_\_\_\_\_> shape, and configured to permit height adjustment]** <\_\_\_\_\_\_\_\_>.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

Consider following paragraph for use with aggregate ballast.

* + - * 1. Water-pervious Fabric:

Description: Black, open to moisture movement, and UV stabilized.

Material: **[Woven polyethylene (PE)] [Non-woven polyester] [Non-woven PE]** <\_\_\_\_\_\_\_\_>.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

A separation sheet may be used over membrane to ensure that insulation does not adhere to membrane. Membranes that are "tacky" or have cold flow properties conducive to eventual adhesion of insulation should be covered with a separation sheet. Selected material must be non-biodegradable and permit moisture movement to drains.

* + - * 1. Separation Sheet:

Material: **[Sheet PE]** <\_\_\_\_\_\_\_\_>.

Thickness: **[2] [4]** <\_\_\_\_\_\_\_\_> mils

Select first alternative paragraph below to specify cant strips in this Section or select second paragraph to refer to Section 061053.

* + - * 1. Fiber Cant and Tapered Edge Strips:

Description: Asphalt-impregnated wood fiberboard, preformed to **[45-degree angle] [tapered edge strip] [configuration as indicated on Drawings]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Wood Cant Strip:

As specified in Section **[061053 - Miscellaneous Rough Carpentry]** <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_>.

Treatment: **[Pressure]** preservative treated.

* + - 1. SUSTAINABILITY CHARACTERISTICS

Insert sustainable design characteristics in this Article to suit content of this Section and Project sustainable design requirements specified in Section 018113. The following two paragraphs contain examples.

* + - * 1. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.
				2. Sustainable Sites Characteristics:

Consider SRI 79 for low-sloped roofs, i.e., less than or equal to 2/12 pitch. Consider SRI 29 for steep-sloped roofs, i.e., greater than 2/12 pitch.

Roof Surface:

Minimum SRI of **[78] [29] [for 75 percent of roof area]**, calculated according to ASTM E1980.

Reflectance: Measured according to ASTM E903, ASTM E1918, or ASTM C1549.

Emittance: Measured according to ASTM E408 or ASTM C1371.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Roof Surface: ENERGY STAR compliant with following performance:

Emissivity: Minimum 0.9 **[for 75 percent of roof area]**, according to ASTM E408.

* + - * 1. Materials and Resources Characteristics:

Recycled Content Materials: Furnish materials with maximum available recycled content **[including:] [.]**

Insert list of materials specified in this Section required to have recycled content.

<\_\_\_\_\_\_\_\_>.

Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site **[including:] [.]**

Insert list of materials specified in this Section required to be regional materials.

<\_\_\_\_\_\_\_\_>.

* + - 1. ACCESSORIES

Consider using first, second, or both of following paragraphs for gypsum sheathing over metal deck.

* + - * 1. Sheathing Adhesive: Non-combustible type for adhering gypsum sheathing to metal deck.
				2. Sheathing Fasteners:

Appropriate for purpose intended.

Approved by **[FM] [and] [system manufacturer]**.

Length: As required for thickness of material **[plus metal washers]**.

<\_\_\_\_\_\_\_\_>, as manufactured by <\_\_\_\_\_\_\_\_>.

* + - * 1. Sheathing Joint Tape:

Type: **[Paper] [Heat-resistant]** <\_\_\_\_\_\_\_\_>.

Width: <\_\_\_\_\_\_\_\_> inches

Self-adhering.

* + - * 1. Strip Reglet Devices:

Material: **[Galvanized steel] [Extruded plastic]** <\_\_\_\_\_\_\_\_>.

Maximum possible lengths per location.

Furnish attachment flanges.

* + - * 1. Roofing Nails:

Type: Galvanized **[, hot dipped,]** or non-ferrous type.

Size and Configuration: As required to suit application.

Following paragraph includes paint for top coating polystyrene insulation surface. This coating is for aesthetic purposes only.

* + - * 1. Protective Paint:

Type: Latex, residential quality.

Color: **[White]** <\_\_\_\_\_\_\_\_>.

1. EXECUTION
	* + 1. EXAMINATION

Select and edit following paragraphs as appropriate to deck type and Project requirements.

* + - * 1. Verify that surfaces and Site conditions are ready to receive Work.
				2. Verify that deck is supported and secure.
				3. Verify that deck is clean and smooth; free of depressions, waves, or projections; properly sloped to **[drains] [valleys] [or] [eaves]**; and suitable for installation of roof system.

Include following paragraph if manufacturer's inspection was included in Part 1 - Quality Assurance.

* + - * 1. Verify that substrate is acceptable to manufacture.
				2. Verify that deck surfaces are dry and free of snow and ice.

Include following paragraph for wood or concrete decks.

* + - * 1. Confirm dry deck by moisture meter with **[<\_\_\_\_\_\_\_\_> percent moisture maximum] [moisture content acceptable to roofing manufacturer]**.
				2. Verify that adjacent precast concrete roof members do not vary more than 1/4 inch in height.
				3. Verify that grout keys are filled flush.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Include following paragraph for plywood decks.

* + - * 1. Verify that adjacent plywood sheets do not vary more than 1/4 inch in height.
				2. Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set and that **[wood cant strips] [wood nailing strips] [and reglets]** are in place.

If Section 070150 is used, delete entire following Article.

* + - 1. PREPARATION

Select one of following three paragraphs based on required deck substrate and subsequent vapor retarder type.

* + - * 1. Wood Deck:

Verify that joints of wood decking are flat and tight.

Seal joints of decking with tape.

Fill knot holes with latex filler.

Lay one ply of dry sheathing paper, lapping edges 2 inches.

Base Sheet:

Lay asphalt-coated base sheet, lapping edges 4 inches.

Nail laps 6 inches o.c.

Nail field area at 12 inches o.c., staggered.

Apply glaze coat of hot asphalt to top surface of prepared deck if membrane is not installed immediately following deck preparation.

Extend **[two plies of felt] [one ply of flexible flashing]** from **[12]** <\_\_\_\_\_\_\_\_> inches around roof perimeter to roof edge and onto wall air seal material with <\_\_\_\_\_\_\_\_> inches of lap, and seal air tight.

Mop cant strips in place with hot bitumen.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Concrete Deck:

Fill surface honeycomb and variations with latex filler.

Include following subparagraph only for precast concrete decks that do not have grouted plank joints.

Lay two-ply strip of dry applied felt, 18 inches wide, over precast concrete deck joints.

Apply asphalt primer at **[1]** <\_\_\_\_\_\_\_\_> gal./100 sq. ft. and allow to dry.

Apply glaze coat of hot asphalt to top surface of prepared deck if membrane is not installed immediately following deck preparation.

Extend **[two plies of felt] [one ply of flexible flashing]** from **[12]** <\_\_\_\_\_\_\_\_> inches around roof perimeter to roof edge and onto wall air seal material with <\_\_\_\_\_\_\_\_> inches of lap, and seal air tight.

Mop cant strips in place with hot bitumen.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Metal Deck:

Install preformed sound absorbing glass fiber insulation strips supplied by Section **[053113 - Steel Floor Decking]** <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_> in acoustic deck flutes.

Edit following subparagraphs for applying gypsum sheathing over metal decking. Acceptability of applying gypsum sheathing to steel roof decks will be determined by local codes or by UL or FM requirements.

Install gypsum sheathing on metal deck **[using continuous mopping of adhesive on each flute] [with fasteners]** <\_\_\_\_\_\_\_\_>.

Lay sheathing with long side at right angle to flutes and stagger end joints while providing support at ends.

Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface, and tape joints.

Select and edit following subparagraphs singly or in combination. Confirm that fastening frequency in one of following two subparagraphs does not conflict with FM 1-60 or 1-90 requirements.

Mechanically fasten sheathing at full-roof area, using **[six] [eight]** <\_\_\_\_\_\_\_\_> fasteners with washers per sheathing board.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Mechanically fasten sheathing at roof perimeter to distance of **[4]** <\_\_\_\_\_\_\_\_> feet in from edges, using **[six] [eight]** <\_\_\_\_\_\_\_\_> fasteners with washers per board.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Mechanically fasten sheathing to roof deck according to **[FM]** <\_\_\_\_\_\_\_\_> requirements.

Apply roller coat of primer to top of sheathing surfaces and let dry.

Apply glaze coat of hot asphalt to top surface of prepared deck if membrane is not installed immediately following deck preparation.

Extend **[two plies of felt] [one ply of flexible flashing]** from **[12]** <\_\_\_\_\_\_\_\_> inches around roof perimeter to roof edge and onto wall air seal material with <\_\_\_\_\_\_\_\_> inches of lap, and seal air tight.

Mop cant strips in place with hot bitumen.

* + - 1. APPLICATION

Optional ply described in following paragraph may count as one ply in a three- or four-ply roof system. Coated base sheet may be used where deck or substrate is less than ideal.

* + - * 1. Membrane Application:

Base Sheet:

Lay one-ply base sheet, coated side down.

Lap sides 2 inches, and lap ends 6 inches.

Equiviscous Temperature (EVT) at Point of Application: According to NRCA.

Felt:

Apply **[3] [4]** plies of roof felt **[over coated base ply]**.

Weather-lap edges and ends.

Mop with **[20] [23]** <\_\_\_\_\_\_\_\_> lb./100 sq. ft. of bitumen per ply.

**[Apply felt "two-on-two" in same direction] [Apply felt "two-on-two" in opposite directions]**.

Apply felts smooth, free from air pockets, wrinkles, fishmouths, or tears.

Extend **[base ply and]** membrane felts up cant strips minimum of **[4] [6]** <\_\_\_\_\_\_\_\_> inches onto vertical surfaces.

Mop on two additional plies of felt and one ply of granular surfaced felt as base flashings over roofing membrane plies.

Secure to **[nailing strips at 4 inches o.c.] [nailing strips at <\_\_\_\_\_\_\_\_> inches o.c.] [and] [to] [reglets]**.

Install two plies membrane and bitumen glaze coat for cutoff at end of day's operation.

Glaze felts exposed at end of working day and remove cutoff before resuming roofing.

Mop and seal two additional plies of felt around roof penetrations.

Apply uniform flood coat of bitumen at rate of **[60]** <\_\_\_\_\_\_\_\_> lb./100 sq. ft. .

Consider using following subparagraph only if separation sheet is required.

Separation Sheet:

Place separation sheet over final flood mopping of bitumen.

Lap edges and ends **[**2**]** <\_\_\_\_\_\_\_\_> inches.

Verify compatibility of flashing materials with roofing system materials.

* + - * 1. Flashing and Accessories:

Apply **[granular surfaced felt] [flexible]** base flashings to seal membrane to vertical elements.

Edit first subparagraph below for proprietary prefabricated control and expansion joints; edit subsequent subparagraph for Site-built joints.

Install prefabricated roofing **[control] [and] [expansion]** joints to isolate roof into areas **[as indicated on Drawings]** and make joints watertight.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Fabricate roofing **[control] [and] [expansion]** joints to isolate roof into areas as indicated on Drawings and make joints watertight.

Coordinate installation of roof **[drains] [sumps]** <\_\_\_\_\_\_\_\_> and related flashings with NRCA Drawing **[W-1]** <\_\_\_\_\_\_\_\_>.

Mop in and seal flashings and flanges of items penetrating membrane using two plies of felt.

Select one of following two paragraphs. If ballasting is to be achieved using concrete-clad insulation board, use first paragraph and delete second paragraph.

* + - * 1. Concrete-clad Insulation Installation:

Place concrete clad insulation boards, butting into close contact.

Place channel cut face down.

Bevel insulation to allow snug fit at cant strips.

Cut neatly around protrusions through roof.

Minimum Total Insulation Thickness: **[<\_\_\_\_\_\_\_\_>-inch] [As required to achieve insulation R-Value of <\_\_\_\_\_\_\_\_> ]**.

Place and fit perimeter restraint to minimize movement of insulation boards.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

If ballasting is to be achieved using concrete-clad insulation board, delete following paragraph. If supplementary ballasting to concrete-clad insulation is required, use and edit following paragraphs accordingly.

* + - * 1. Unclad Insulation Installation:

Place insulation boards, butting into close contact.

**[Place channel cut face down.]**

Bevel insulation to allow snug fit at cants.

Cut neatly around protrusions through roof.

Minimum Total Insulation Thickness: **[<\_\_\_\_\_\_\_\_> inch ] [As required to achieve insulation R-Value of <\_\_\_\_\_\_\_\_> ]**.

Place water-pervious fabric over insulation boards.

In addition to providing protective cover for insulation, ballast is often required to counteract wind uplift and flotation qualities of polystyrene insulation; depth and weight of ballast should be calculated accordingly. Increased ballast may be required at building corners where wind scouring of ballast is likely to be more severe.

Minimum cover should be 1,000 lb./100 sq. ft.for insulation up to two inches thick. Add 500 lb./100 sq. ft. for each 1-inch insulation thickness thereafter.

Loose-laid insulation with fabric cover typically requires 1,000 lb./100 sq. ft. Consider including following two subparagraphs for aggregate cover.

Apply aggregate ballast dry and at rate of **[1,000]** <\_\_\_\_\_\_\_\_> lb./100 sq. ft..

**[Evenly distribute aggregate cover] [Evenly distribute over general roof area and at parapet area increase ballast to <\_\_\_\_\_\_\_\_> lb./100 sq. ft ]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Include following three subparagraphs for precast paver ballast.

Install precast concrete pavers **[provided in Section <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_>]**.

Install pavers **[directly on insulation] [on paver pedestals to maintain level paver surface]**.

Provide approximately **[1/4] [3/8]** <\_\_\_\_\_\_\_\_> inch space between pavers to permit surface water drainage.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

If proprietary paver system is desired, edit and supplement following subparagraph as appropriate. Minimum ballast weight for roof system must be considered.

Install paver system **[, placing pavers in <\_\_\_\_\_\_\_\_> pattern]**.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Include following subparagraph for cast-in-place concrete cover. No-fines concrete is sometimes used in this application.

Install **[no-fines]** concrete topping as specified in Section **[033000 - Cast-in-Place Concrete]** <\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_>.

Following subparagraph requires two-level roof drain inlet; coordinate with plumbing Specifications.

Set roof drain inlets at membrane level and set top grating at **[finish deck level] [top of insulation]** <\_\_\_\_\_\_\_\_>.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following paragraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Application Standards: Install Work according to <\_\_\_\_\_\_\_\_> standards.
			1. FIELD QUALITY CONTROL
				1. **[Field] [Laboratory]** Testing: **[As required to ascertain bitumen quantities actually placed]** <\_\_\_\_\_\_\_\_>.
				2. Require site attendance of roofing **[and insulation]** material manufacturers **[daily]** <\_\_\_\_\_\_\_\_> during installation of Work.
			2. CLEANING
				1. Remove bituminous markings from finished surfaces.
				2. In areas where finished surfaces are soiled by Work of this Section, consult manufacturer of surfaces for cleaning advice and conform to manufacturer's **[documented]** instructions.
				3. Repair or replace defaced or disfigured finishes caused by Work of this Section.
			3. PROTECTION
				1. Protect building surfaces against damage from roofing Work.
				2. Do not permit traffic over unprotected floor surface.

END OF SECTION 075551