

SECTION 07 52 16 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: SBS-modified bituminous membrane roofing system and supplementary items necessary for installation.
 - 1. Two ply SBS-modified bituminous membrane roofing system. **RS-01** including but not limited to the following:
 - a. Accessory roofing materials.
 - b. Substrate board.
 - c. Vapor retarder **VB-02**.
 - d. Roof insulation **INS-02**.
 - e. Insulation accessories.
 - f. Cover board.
 - g. Walkways.
- B. Related Work:
 - 1. Division 06, Section 06 06 00 "Sheathing" for wood nailers, curbs, plywood sheathing at parapets and blocking.
 - 2. Division 07, Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counter flashings.
 - 3. Division 07, Section 07 62 13.16 "Exterior Expansion Joint Cover Assemblies"
 - 4. Division 22, Section 22 14 23 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- A. Ponding: Means standing water on a roof that remains for twenty-four (24) hours or more.
- B. Roof Surface: The surface of the roof membrane the is exposed to the elements on the exterior side.
- C. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Water-proofing Manual" for definition of terms related to roofing Work in this Section.
- D. Roof Edge Regions: Refer to Structural drawing SF0-0-002 roof perimeter region definition.

1.3 ACRONYMS

- A. SBS: Styrene-butadiene-styrene.

1.4 ACTION SUBMITTALS

- A. Schedule and coordinate submittal and shop drawing review with Building Enclosure Commissioning provider (BECxP) for OPR verification. Primary submittal approval by AOR.
- B. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- C. Sustainable Design Submittals:
1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 2. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
 3. Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
 4. Bio-based Materials: For bio-based products and materials other than wood, submit documentation of product data and testing results in compliance with LEED requirements.
 5. Wood Products: Submit documentation of Forest Stewardship Council or USGBC equivalent certification.
 6. Materials Reuse: For products that are salvaged, refurbished, or reused, include a statement indicating costs for each product.
 7. Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 8. Regional Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
 - a. Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
 9. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method v1.2 2017, using the applicable exposure scenario.
 - a. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 113-2011.
 - b. Adhesives and Sealants: For wet applied on-site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of January 7, 2005.
 - c. Alternative tests for VOC above include ASTM D2369-10; ISO 11890 part 1; ASTM D6886-03; or ISO 11890-2.
 - d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants
 - e. Composite Wood: Submit documentation showing that wood used in the project has low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- D. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, de-tails of components and attachments to other work. Distinguish between shop and field-assembled work.
1. Show base flashings, cants, and membrane terminations.
 2. Show flat and sloped tapered insulation, including slopes.
 3. Show crickets and saddles, including slopes.
 4. Show roof plan showing orientation of roofing ply sheets and fastener spacing.

5. Show insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 6. Show cold-applied adhesive pattern for insulation installation; typical pattern of a 100 square foot area.
- E. Samples for Verification Purposes: For the following products:
1. Roofing membrane cap sheet, 12 in by 12 in (300 mm by 300 mm) square of color specified.
 2. Flashing sheets.
 3. Vapor Retarder, 12 in by 12 in (300 mm by 300 mm) square.
 4. Roof insulation.
 5. Walkways and protection course.
 6. Termination bars.
- F. Fabrication Engineering and Design Data Submittal: Submit for flashing metal assembly and wind uplift requirement to verify compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturers Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
1. Roofing manufacturer shall review and approve Shop Drawings in writing prior to submission.
 2. Manufacturer to submit letter indicating roof assemblies meet wind up-lift requirements on structural drawings.
- B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.
- C. Substrate Surface Temperature Readings at Cold Fluid-Applied Insulation Adhesive: Submit recorded readings when requested.
1. Submit surface temperature readings to roofing manufacturer.
- D. Warranty:
1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.
- E. Sustainable Design Submittals:
1. Building Product Disclosure and Optimization - Environmental Product Declarations
 - a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
 2. Building Product Disclosure and Optimization - Material Ingredients
 - a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000pm) with at least one of the following:
 - 1) Submit published manufacturer inventory of ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

- 2) Submit documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
 - 3) Submit Declare product label indicating that all ingredients have been disclosed down to 1000 ppm or designated as Red List Free or Declared
 - 4) Living Product Challenge
 - 5) Product Lens Certification
 - 6) USGBC approved program.
- b. Material Ingredient Optimization: Submit documentation confirming chemical inventory of products to at least 0.01 % (100ppm) and/or that has a compliant material ingredient optimization report with at least one of the following:
- 1) Submit GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
 - 2) Submit third-party verified documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
 - 3) Submit third-party verified Cradle to Cradle v3 Material Health certificate at the Bronze Level or better
 - 4) Submit third-party verified Declare product label indicating that all ingredients have been disclosed down to 100 ppm
 - 5) Submit third-party verified documentation that product is Living Product Challenge certified with a Red List Free or LBC Red List Free Declare label.
 - 6) Submit documentation that product has a manufacturer prepared action plan with material inventory to at least 1000 ppm.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
 2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
 3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
- B. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.
- C. Quality Standards:
1. Unless otherwise recommended by roofing system manufacturer, provide roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
 2. Comply with FMG System Loss Prevention Data Sheet 1-49 for attachment and anchorage of nailers, blocking, and other associated members for wind zone pressures indicated on structural drawings.
 3. Comply with FMG System Loss Prevention Data Standards 1-28 and 1-28S for attachment and anchorage of roof insulation to metal decking.
 4. Construct sheet metal details in accordance with latest version SMACNA.

- D. Fire-Test-Response Characteristics: Provide roofing system materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: ASTM E 108, Class A, for application and roof slopes indicated as listed by UL.
 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
 3. FM Class 1 per FM 4470.

1.8 PRE-INSTALLATION CONFERENCE

- A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.
1. Participants:
 - a. Architect.
 - b. Contractor, including superintendent.
 - c. Installer, including project manager and supervisor (superintendent).
 - d. If requested, Manufacturer's qualified technical representative.
 - e. Installers of other construction interfaced with Work.
 - f. Testing agency.
 - g. Owners Building Enclosure Commissioning provider (BECxP).
 2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
 - a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
 - b. Review Contract Document requirements.
 - c. Review approved submittals.
 - d. Review inspection and testing requirements.
 - e. Review environmental conditions and procedures for coping with unfavorable conditions.
 - f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications
 - g. Review deck substrate requirements for conditions and finishes, including flatness, presence of moisture, and fastening.
 - h. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - i. Review governing regulations and requirements for insurance and certificates if applicable.
 - j. Review temporary protection requirements for roofing during and after installation.
 - k. Review roof observation and repair procedures after roofing installation.
 3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

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

- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

1.10 PROJECT CONDITIONS

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

1.11 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.12 WARRANTY

- A. Manufacturer's Warranty: Furnish manufacturer's written "Total Roofing System" warranty signed by an authorized representative using manufacturer's standard form, without monetary limitation (NDL), agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty includes roofing, flashings, expansion joints, adhesives, sealants, insulation, fastener systems, substrate board, cover board, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using in-staller's standard form agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.
 - 1. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, substrate board, cover board, and other components of roofing system.
 - 2. Warranty includes roof edge flashings integral with roofing system as specified in Division 07, Sections 07 76 00 "Flashing and Sheet Metal", Section 07 72 00 "Roof Accessories" and expansion joints as specified in Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies".
 - 3. Warranty shall cover wind speeds up to 100 mph for peak gusts measured 32.8 feet above ground level.
 - 4. Warranty shall also include thirty-six (36) man hours of labor per year throughout the term of the warranty for puncture repair work.
 - 5. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

- A. General Performance:
 - 1. Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather including rain, snow, hail, ice, wind, sun, thermal shock, service traffic and applied loads without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 2. Roofing system and base flashings shall remain watertight.
 - 3. There shall be no ponding of water permitted on the roofing system. Ponding water shall be considered a defective roof.
 - 4. Minimum drainage to roof drains shall be not less than ¼ inch per foot roof surface slope.
- B. Fabrication Engineering and Design Data Engineering: Installed roofing system and base flashings shall withstand design loads including, but not limited to, requirements established by authorities having jurisdiction, applicable local building codes, and as indicated. Contractor shall obtain required design data and identify requirements accommodated on submittal drawings.
- C. Material Compatibility: Provide roofing system materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- D. Edge Systems Design: Provide edge systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to SPRI Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems ES-1 and structural drawings.
- E. Roofing System Design: Provide roofing systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure and external fire exposure.
- F. FMG Listing: Provide roofing system, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in

FMG Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG Approvals markings.

1. Minimum Fire/Windstorm Classifications required:
 - a. Fire/Windstorm Classification at Roof Corner and Perimeter Region: Class 1A.
 - b. Fire/Windstorm Classification at Field of Roof: Class 1A.
- G. Energy Performance for Low Slope Roofs: Provide roofing system with Solar Reflectance Index calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
 1. Initial SRI of not less than 82 or 3-Year Aged SRI of not less than 64.
- H. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- I. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.
- J. Low-Emitting Materials:
 1. Architectural paints and coatings wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
 2. All paints and coatings wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01, Section 01 81 13 "Sustainable Design Requirements - LEED v4 BD+C."
 3. Adhesives and Sealants wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
 4. All adhesives and sealants wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01, Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C."

2.4 MODIFIED BITUMINOUS MEMBRANE ROOFING SHEET MATERIALS

- A. Base Sheet: Complying with specified products, provide one of the following as suitable for application method and performance requirements:
 1. ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced.
 - a. Soprema Elastophene Flam 180 R.
 - b. Siplast Paradiene 20 2- Cold Adhesive.
- B. Cap Sheet: Factory-surfaced with manufacturer standard highly reflective white flat angular pigmented polymer flakes or white acrylic-coated ceramic roofing granules that meet the "Energy Performance" requirements, subject to prior review and acceptance by Architect.
 1. Complying with specified products, provide one of the following as suitable for application method and performance requirements:
 - a. ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced.
 - 1) Soprema Elastophene 180 FR GR with ECO₃ granules.
 - 2) Siplast Paradiene 30 FR with Eco-Activ granules.
- C. Granular-Surfaced Flashing Sheet: SBS-modified asphalt sheet; surfaced as cap sheet; suitable for application method specified.
 1. Complying with specified products, provide one of the following as suitable for application method and performance requirements:

- a. ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced.
 - 1) Soprema Elastophene 180 FR GR with ECO₃ granule.
 - 2) Siplast Paradiene 30 FR with Eco-Activ granules.
2. Color: Match roofing membrane cap sheet.

2.5 MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
 1. Asphalt Primer: ASTM D41.
- B. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required by roofing system manufacturer for application method.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- D. Liquid-Applied Reinforced Membrane Flashing: Bonded to base of pipe and stack, including roof and overflow drains, as recommended by roofing system manufacturer.
 1. Manufacturers and Products:
 - a. Siplast; Parapro 123 Flashing System.
 - b. Soprema; Alsan Flashing System.
- E. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07, Section 07 62 00 "Sheet Metal Flashing and Trim".
- F. Termination Bars: ASTM A666, Type 304 formed stainless steel or extruded alloy 6063 aluminum bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with corrosive resistant fasteners. No plastic bars allowed.
- G. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing membrane and base flashings.
- H. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 SUBSTRATE BOARDS FOR FIRE RESISTANCE

- A. Horizontal Roof Substrate Boards: Glass-Mat Faced Exterior Gypsum Sheathing Board.
 1. Basis of Design: Georgia-Pacific Gypsum LLC; DensDeck Prime.
 2. Material Quality Standard: ASTM C1177/C1177M.
 3. Description: Glass-mat faced exterior gypsum sheathing board specifically manufactured for use beneath roofing systems. Non-combustible moisture-resistant gypsum core with glass-mat facings. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
 4. Thickness: Minimum 5/8 in (15.8 mm); or as required to meet performance requirements.

- B. Vertical Substrate Boards: As specified in Division 06, Section 06 16 00 "Sheathing".

2.7 VAPOR RETARDER

- A. Vapor Retarder **VB-02**:
1. ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced.
- B. Installation Method: Cold adhesive.
1. Basis of Design: Siplast Irex 40.

2.8 ROOF INSULATION AND ACCESSORIES

- A. General: Provide preformed roof insulation boards that comply with requirements of referenced standards, selected from manufacturer's standard sizes and thicknesses. Provide accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
1. Provide insulation thickness required to maintain minimum aged R-value as indicated on the Drawings.
 2. Insulation board thickness of individual insulation layers to be 2 in (50 mm) maximum.
 3. Insulation board size to be 4 ft by 4 ft (1.22 m by 1.22 m) maximum.
 4. Provide factory, tapered insulation boards where indicated for sloping to drain. Fabricate with 1/4 in (6 mm) in per 12 in (300 mm) (1:48) taper, unless otherwise indicated.
 5. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- B. Polyisocyanurate Board Insulation **INS-02**:
1. Rigid, cellular polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 2, Grade 2 or 3 with fiberglass facers.
 2. Manufacturers and Products:
 - a. Siplast Paratherm CG.
 - b. Soprema Sopra-ISO Plus.
- C. Cold Fluid-Applied Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Bead-applied, low-rise, two-component urethane adhesive.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- E. Treated Wood Nailers and Cant Strips: As specified in Division 06, Section 06 10 53 "Miscellaneous Rough Carpentry".

2.9 COVER BOARD

- A. General: Cover board as recommended in writing by roof membrane manufacturer for intended use; compatible with other roofing system components and suitable for installation method specified.

- A. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Products: Subject to compliance with requirements, provide Basis of Design: Georgia-Pacific Gypsum LLC. Dens Deck Prime.
 - a. CertainTeed; SAINT-GOBAIN.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - c. USG Corporation; Securock.
 - 2. Thickness: 1/2 inch (13 mm).
 - 3. Surface Finish: Fiberglass facer, factory primed.

2.10 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
 - 1. Asphalt Primer: ASTM D41.
- B. Asphalt Roofing Cement: ASTM D4586, of consistency required by roofing system manufacturer for application method.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- D. Liquid-Applied Reinforced Membrane Flashing: Bonded to base of pipe and stack, including roof and overflow drains, as recommended by roofing system manufacturer.
 - 1. Manufacturers and Products:
 - a. Siplast; Parapro 123 Flashing System.
 - b. Soprema; Alsan Flashing System.
- E. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07, Section 07 62 00 "Sheet Metal Flashing and Trim".
- F. Termination Bars: ASTM A666, Type 304 formed stainless steel or extruded alloy 6063 aluminum bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with corrosive resistant fasteners. No plastic bars allowed.
- G. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing membrane and base flashings.
- H. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.
- I. Walkway protection pad designed for light foot traffic for modified bituminous membrane roofing with slip-resistant surface.
 - 1. Minimum 1/4 inch thick.
 - 2. Width: Minimum 30 inches.

- J. Flashing and Sheet Metal: Refer to Division 07, Section 07 62 00 "Sheet Metal Flashing and Trim".
- K. PMMA Resin Paste: High-performance multi-component, fast-curing paste.
 - 1. Basis of Design: Pro Paste, Siplast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and as-associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions, including concrete moisture content, have been corrected in a manner complying with roofing manufacturer recommendations and Contract Documents. Starting work with-in a particular area will be construed as acceptance of surface conditions.
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thickness of insulation.
 - 3. Metal Decking Substrates:
 - a. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05, Section 05 31 00 "Steel Decking".
- B. Substrate Surface Temperature at Cold Fluid-Applied Insulation Adhesive: Confirm that concrete substrate or substrate board surface temperature is a minimum 50 deg F (10 deg C) prior to application of adhesive.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.
- C. Pitch Pockets (aka Pitch Pans) at Roof Penetrations: Pitch pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to the drawings for allowable roof penetration details.
- D. Pipe Penetrations:
 - 1. Single pipe and conduit penetrations shall be flashed to the roofing system with roofing system manufacturer approved penetration materials and details.
 - 2. Multi-pipe and conduit penetrations shall be through covered metal pipe enclosures similar to SMACNA Figure 4-15A.

3.3 PREPARATION

- A. General: Comply with roofing system manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 SUBSTRATE BOARDS FOR FIRE RESISTANCE - INSTALLATION

- A. Install substrate boards with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate boards to top flanges of steel deck according to recommendations in FMG Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
 - 2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 VAPOR RETARDER INSTALLATION

- A. Vapor Retarder Substrate Board: Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate boards to top flanges of steel deck according to recommendations in FMG Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
- B. Vapor Retarder: Install according to roofing system manufacturer's written instructions.
- C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into modified bituminous membrane roofing.

3.6 INSULATION INSTALLATION

- A. General: Comply with FMG and roofing system manufacturer's written instructions for installing roof insulation. Secure insulation according to requirements in FMG's "Approval Guide" for specified Wind-storm Resistance Classification.

- B. Coordinate installing membrane roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Maintain a maximum panel size of 4 feet by 4 feet for polyisocyanurate and cover panel and apply insulation panels to prepared substrate with cold applied adhesive.
- E. Install one or more layers of insulation under area of roofing to achieve required thickness. Where over-all insulation thickness is 2 in (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 in (150 mm) in each direction.
- F. Lay tapered boards, tapered edge strips, or cut boards to slope to form a minimum 3 feet square by 1 1/2-inch-deep sump at roof drains. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 - 1. Trim insulation to maximum 1 inch less than required R-value.
- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 in (6 mm) with insulation. Cut and fit insulation within 1/4 in (6 mm) of nailers, projections, and penetrations.
 - 1. Stagger insulation layers and cover board (i.e., at temporary roof edge conditions), to prevent a cold joint through the roofing assembly. Provide a sacrificial base ply to cover board and insulation to provide a temporary flashing condition until modules are set at the terminal and flashed permanently together. Monitor laps at the temporary flashing condition to prevent moisture infiltration into the roofing system.
- H. Cast-in-Place Concrete or Composite Metal Deck Substrate:
 - 1. Install and adhere base layer of insulation to substrate in a layer of cold fluid-applied adhesive.
 - 2. Install subsequent layers of insulation in a layer of cold fluid-applied adhesive.
- I. Steel Roof Deck Substrate: Provide the following method according to performance criteria requirements for specified Windstorm Resistance Classification:
 - 1. Mechanically Fastened and Adhered Insulation: Install base layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type. Install subsequent layers of insulation in a layer of cold fluid-applied adhesive.
- J. Apply no more insulation than can be covered with membrane in same day.
- K. Substrate Board Substrate: Install and adhere base layer of insulation to substrate board in a layer of cold fluid-applied adhesive. Install subsequent layers of insulation in a layer of cold fluid-applied adhesive.

3.7 ROOF SUBSTRATE BOARD INSTALLATION

- A. General: Comply with FMG and roofing system manufacturer's written instructions for installing roof substrate boards. Secure roof substrate boards to insulation substrate according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

- B. Install roof substrate boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 in (150 mm) in each direction. Loosely butt roof substrate boards together.
 - 1. Provide following fastening method according to performance criteria requirements for specified Wind-storm Resistance Classification:
 - a. Adhere roof substrate boards to insulation substrate in a layer of cold fluid-applied adhesive.
 - b. Score boards, if necessary, to conform to substrate irregularities. Comply with manufacturer's installation recommendations to insure proper adhesion and adhesive set.
 - c. Comply with manufacturer's installation recommendations to insure proper adhesion and adhesive set.
- C. Secure roof substrate boards to insulation to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturer written instructions.

3.8 MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM INSTALLATION

- A. Install roofing according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing". Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
- B. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- C. Coordinate installing roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when inclement weather is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing ply sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- E. Install modified bituminous roofing base sheet and cap sheet according to roofing system manufacturer's written instructions, starting at low point of roofing system. Extend roofing sheets over and terminate beyond cants, installing as follows:
 - 1. Base Sheets:
 - a. Adhere to substrate in a uniform coating of cold-applied adhesive.
 - 2. Cap Sheets:
 - a. Adhere to substrate in a uniform coating of cold-applied adhesive.
- F. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - 1. Repair tears and voids in laps and lapped seams not completely sealed.

2. Apply roofing granules/chips to cover extruded bead at laps while bead is hot.
- G. Install roofing sheets so side and end laps shed water.

3.9 BASE FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and to meet warranty requirements:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 2. Flashing Sheet Application: Install as follows and in compliance with performance requirements:
 - a. Heat-weld flashing sheet to substrate.
- B. Extend base flashing up walls or parapets a minimum of 8 in (200 mm) above roofing and 4 in (100 mm) onto field of roofing.
- C. Using termination bars, mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
- D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.
- E. Roof Drains: Set metal flashing in bed of asphalt roofing cement on completed roofing. Cover metal flashing with roofing cap-sheet stripping and extend a minimum of 4 in (100 mm) to 6 in (150 mm) beyond edge of metal flashing onto field of roofing. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring. Install stripping according to roofing system manufacturer's written instructions.
- F. Liquid-Applied Reinforced Membrane Flashings: Liquid applied reinforced membrane bonded to base at pipe and stacks. Install according to roofing system manufacturer's written instructions.
- G. Protection Course for Lightning Protection System: Apply 12 in by 12 in (300 mm by 300 mm) additional layer of base flashing material over the vertical face of parapet for lightning protection system and as recommended by manufacturer.

3.10 WALKWAY AND PROTECTION COURSE INSTALLATION

- A. Modified Bitumen Protection Course: Install roofing membrane protection course over roofing membrane. Cut sheets in five-foot maximum lengths. Space with 2 in (50 mm) gap at end joints.
1. Installation Method: Use same installation method as roofing membrane cap sheet.

3.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Cold Fluid-Applied Insulation Adhesive Manufacturer's Inspection: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
 1. Test Cuts: The cold fluid-applied insulation adhesive manufacturer shall perform field quality control test cuts of the cold fluid-applied insulation adhesive installation.
- C. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control, including infrared inspections on installed roof assemblies. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor expense.
 1. Infrared Inspection: Where infrared survey indicates moisture intrusion, wet insulation and damaged or deficient materials or construction shall be replaced in a manner to provide watertight and specified wind uplift resistant construction and maintain the roof system warranty.
- D. Schedule and coordinate roof system installation verification with Building Enclosure Commissioning provider (BECxP).

3.12 REPAIR, CLEANING, AND PROTECTING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION