

Delete items are struck out and new items are underlined.

**Modified Bituminous Sheet Roofing
TECHNICAL GUIDE**

TG 07550

1. COORDINATION ISSUES:

- 1.1** Coordinate the Work of this Technical Guide with sheet metal flashing, gutters and downspouts usually specified in a section 07620. Make sure the warranties required are similar to this Tech Guide.
- 1.2** Mechanical, Plumbing and Electrical Penetrations: Coordinate design of vent pipe flashing and roof drains with plumbing design section. Coordinate mechanical penetrations. Coordinate electrical penetrations.

2. DESIGN ISSUES:

- 2.1 Roof Slopes:** Roof structure and insulation slope must adhere to the minimum and maximum roof slopes permitted by DAGS, the roofing membrane manufacturer or the NRCA. NRCA/HRCA recommends a minimum slope of ¼ inch per foot. The DAGS minimum slope on new buildings is ½ inch per foot.

2.2 Mechanical Attachments:

- 2.2.1 Problem:** Mechanical fastening of roof insulation to metal decking creates an unsightly appearance where the underside of the deck is exposed such as in Lanais and covered walkways. Protruding fasteners make the surface difficult to repaint and maintain.
- 2.2.2 Recommendation:** Where the underside of the metal deck will be exposed to view in either new or renovation/ re-roofing projects, specify the sacrament of roof insulation using roof insulation adhesives.

2.3 Hot Mopping:

- 2.3.1 Environmental Concerns:** If hot asphalt is used, provide contractor's restrictions to prevent asphalt fumes from becoming a hazard. For example, consider shutting down all HVAC equipment and close all points of ingress to minimize potential entry of emissions into the
- 2.4 Bird Baths and Ponding Areas:** Asphalt roofing cannot tolerate continuous submersion in water without re-emulsifying. Identification and correction of water points of water ~~retainage~~ ponding must be addressed in re-roofing projects. Source of ponding and possible leakage may be structural (sagging or improperly sloped joists, beams or decking), damaged or wet insulation, or damaged, inadequate or clogged roof drains or scuppers. Before selection of re-roofing system perform the following field investigations if rain or water test shows points of water collection:
- 2.4.1** Structural Investigation: If possible view underside of roof. Ponding at mid-spans may indicate a structural problem.
- 2.4.2** Damaged or wet insulation: Perform test cuts (small roofs) or obtain a commercially available non -destructive subsurface moisture survey (large roofs) to determine the extent of damaged insulation. Re-roofing design must include removal of damaged or wet insulation.
- 2.4.3** Damaged or Clogged Roof Drains and Scuppers: If possible view roof drains from underside to confirm water-tightness and condition of structural attachment to slab or decking. Clean drain sufficiently to confirm flashing condition, utility and free-draining ability of the roof drain.
- 2.5** See TG 07590 for Repair and Maintenance re-roofing guides.

3. DRAWING NOTES:

3.1 Gravel Stops:

- 3.1.1** Show gravel stop details on plans. If roof drains over edging, call for "0" lips. Use 3/8 inch height of lip for gravel surfaced roofing.
- 3.1.2** Provide closely spaced substantial anchorage of the face flange in high wind areas or areas exposed to high wind conditions. Continuous sheet metal clips with closely space fasteners or direct nailing of the face flange which closely spaced fasteners having neoprene washers are acceptable. Verify with your Project Coordinator if your project is in this category.

3.2 Sheet Metal Housings:

- 3.2.1** Conduits, pipes, etc., (other than vent pipes) which penetrate the roof shall be routed laterally through sheet metal housings. The housings

shall cover the openings in the roof and have horizontal flanges at least 4 inches wide. The assemblies shall be placed and counter flashed.

3.3 Insulation:

3.3.1 Specify thickness if it is critical to detailing. Add Notes on appropriate drawing or details: "Insulation thickness assumed for this detail is ____ inches. Required changes shall be coordinated if actual thickness is other than as shown."

3.3.2 Be sure that insulation specified on metal decks will span flute-to-flute clear span.

3.4 Correction:

3.4.1 For re-roofing projects, show location of existing bird-baths or ponding areas on the roof plan. Address correction. Provide a positive drainage plan.

3.5 Flashing at Penetrations:

3.5.1 Use 2 ~~3~~ plies of base flashing for all roof penetrations. ~~If acceptable under the provisions of the roofing manufacturer's warranty, 2 plies of torch-applied modified bitumen membrane may be used in lieu of the 3 plies.~~

4. STANDARD DRAWINGS:

4.1 As of 03/2003, DAGS Standard Roofing Details will no longer be maintained.

4.2 Plates from the NRCA Roofing and Waterproofing Manual may be reproduced or redrawn onto the Project drawing sheets to serve as drawing details. Choose only plates for the roof membrane termination and penetration conditions applicable to the project.

5. SPECIFICATION NOTES: (Not Used)

6. GUIDE SPECIFICATION:

6.1 SECTION 07550 MODIFIED BITUMINOUS SHEET ROOFING is attached.

This section covers:

- APP torch applied roofing.
- SBS hot mop, torch or cold adhesive applied roofing.

***SPECIFIER'S NOTE:** Blue colored italicized text is used for notes to the specifier and should be completely deleted from the final text. Where **[Red colored italicized text in parentheses]** is shown in this specification section, insert wording, numbers, etc. as appropriate and delete parentheses. Where **<Red colored text in brackets>** is shown, a choice is indicated. Make the appropriate choice and delete the brackets. Maintain footer notation with the current version used (e.g. TG 07550 ~~v02-02~~ 05.01). Verify that section titles cross referenced in this Section correspond to this Project's specifications; Section titles may have changed.*

UPDATED INFORMATION IS UNDERLINED. NEW INFORMATION IS UNDERLINED AND DELETED TEXT IS STRUCK OUT.

SECTION 07550 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

SPECIFIER'S NOTE: Choose one of two paragraphs below and modify for chosen system.

1. New roofing system, consisting of:
 - a. **<Thermal barrier.>**
 - b. **<Insulation and insulation cover board.>**
 - c. Incorporated metal edging and flashing as specified in another section.
 - d. Modified bituminous base sheet, membrane, and cap sheet.
 - e. Modified bituminous base flashing.
2. Re-roofing system over **<existing roof membrane><existing insulated substrate (tear off)>** consisting of:
 - a. Removal and reinstallation of existing covering metal: Copings, cap flashing, and counter-flashing.
 - b. **<Preparation of existing roof surface for re-roofing>. <Removal of existing roofing and base flashing and preparation of insulated substrate for re-roofing.>**
 - c. Selective replacement, repair or reanchoring of existing wood nailers, incorporated metal items and insulation.
 - d. Temporary roofing.
 - e. New **<venting base sheet ><cover board> over existing <roofing><insulated substrate>.**
 - f. Modified bituminous base sheet, membrane, and cap sheet.
 - g. **<Roofing vents.>**

SPECIFIER'S NOTE: Modify paragraph 1.01.B as needed. Delete paragraph 1.01.C if not required.

B. Related Sections include the following:

1. ~~Section~~ SECTION 06100 "Rough Carpentry" - ROUGH CARPENTRY for wood nailers, cants, curbs, and blocking.
2. ~~Section~~ SECTION 07620 "Sheet Metal Flashing and Trim" - SHEET METAL FLASHING AND TRIM for metal items incorporated into the roofing system and for attached metal copings, cap flashing, gutters and downspouts.
3. Division 15 for roof drains.

C. Unit Prices: Refer to ~~Section~~ SECTION 01270 "Unit Prices" - VARIABLE QUANTITIES UNIT PRICES for description of Work in this Section affected by unit prices.

1.02 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

SPECIFIER'S NOTE: Provide winds uplift values derived from the code required wind speed and building exposure.

~~C. Windstorm Performance: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to the latest adopted edition of the Uniform Building Code.~~

- ~~1. Corner Uplift Pressure: [Insert number] lbf/sq. ft.~~
- ~~2. Perimeter Uplift Pressure: [Insert number] lbf/sq. ft.~~
- ~~3. Field of Roof Uplift Pressure: [Insert number] lbf/sq. ft.~~

SPECIFIER'S NOTE: Choose appropriate class per the Building Code requirements of Table 15A.

~~D. Fire-Test-Response Performance: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing~~

identical products per test method below by UL, 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: Class **<A>** ****; ASTM E 108, for application and roof slopes indicated.

SPECIFIER'S NOTE: Delete subparagraph 1.02.D.2 below if fire-resistance rating of roof assembly is not applicable. Indicate rating, testing agency, and testing agency's design designation on Drawings.

2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

SPECIFIER'S NOTE: Determine R value requirement to meet the minimum Hawaii Energy Code requirement for opaque roof surfaces (RHGF - Roof Heat Gain Factor), and coordinate with mechanical.

ED. Provide an average insulation board thermal resistance (R) value of not less than **<19>** **[Insert number]** btu/hr./sq. ft. The minimum insulation thickness at any point shall not be less than the minimum required to conform to the roofing system manufacturer's warranty requirements.

1.03 SUBMITTALS

A. Product Data and Material Safety Data Sheets (MSDS): For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Base flashings, cants, and membrane terminations.
2. Layout of tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns.

C. Warranty Drawings: Provide record drawings with information sufficient to satisfy the requirements of the manufacturer's warranty.

D. Samples for Verification: For the following products:

1. 12-by-12-inch square of **<base sheet>** **<ply sheet>** **<smooth-surfaced roofing membrane sheet base>** **<flashing backer sheet>**.
2. 12-by-12-inch square of **<smooth-surfaced roofing membrane sheet>** **<mineral-granule-surfaced roofing membrane cap sheet>** **<flashing sheet>**, of color specified.
3. 12-by-12-inch square of vapor retarder.
4. 12-by-12-inch square of roof insulation.
5. 12-by-12-inch square of walkway pad or walkway cap sheet.
6. Six insulation fasteners of each type, length, and finish.

E. Certificates:

1. Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
2. Signed by roofing system manufacturer certifying that its representative is authorized to act on and make commitments on behalf of the manufacturer.
3. Signed by roofing system manufacturer certifying that the independent roofing auditor/inspector is authorized to act and make commitments in the manufacturer's behalf.
4. Signed by adhesive manufacturer showing that roofer is a trained and authorized applicator of the assembly only for condition where insulation is be adhesive applied onto metal decking. The certificate shall also reference the Project, type of deck, insulation and adhesive materials being used.

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

1. Submit evidence of meeting performance requirements.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

1. Fire classification rating test.
2. **<Rated roof assembly test.>**

- H. ICBO or Factory Mutual Research/Evaluation Reports: For components of roofing system.
- I. Maintenance Data: For roofing system to include in maintenance manuals.
- J. Warranties: ~~Special W~~warranties specified in this Section.
- K. Inspection Report: Copy of roofing system manufacturer representative's or independent roofing inspection progress and final inspection reports.
- L. Information Card: For each roof project, furnish a typewritten information card for facility records and a card laminated in plastic, attached to the underside of the roof hatch, or as directed by the Contracting Officer. Cards shall be 8-1/2 inches x 11 inches. Information card shall identify facility name and/or facility designation (letter or number), contract number, type of roof system installed, including deck type, type of membrane, number of plies, method of application, manufacturer; manufacturer's representative contact information, insulation and cover board system and thickness; date of completion; installer's warranty expiration date; installing contractor and contact information; membrane manufacture's material warranty expiration date; warranty reference number, and warranty contact information. See Roofing Information Card on next page.

ROOFING INFORMATION CARD

FACILITY

Building Name _____ Bldg. desig/No. _____

DAGS Job. No. _____

ROOF

Type of Roof System _____ Type of Deck _____

MEMBRANE

Type of Membrane _____ No. of Plies _____

APPLICATON

Method of Application _____ (nailed, heat applied, self-adhered, etc.)

INSULATION

Type of Insulation _____ Cover Board _____

Thickness _____ Thickness _____

INSTALLER (Roofing Contractor)

Company _____ Contact person _____

Contact No. _____

MANUFACTURER

Company _____ Representative _____

Contact No. _____

COMPLETION DATE _____

DATE INSTALLER'S WARRANTY EXPIRES _____

DATE MANUFACTURER'S WARRANTY EXPIRES _____

Warranty Reference No. _____ Warranty Contact person _____

Contact No. _____

1.04 SYSTEM DESCRIPTION

SPECIFIER'S NOTE: Describe the components that make up the roofing assembly or assemblies required for the project. The following paragraph is an example. Edit for the project.

[A. Modified bitumen roofing and insulation assembly meeting the performance requirements of this Section and consisting of the following components:

- 1. Thermal Barrier: Deck sheathing attached to steel deck with fasteners installed in conformance with the tested and approved fire assembly.*
- 2. Uniform thickness polyisocyanurate insulation with gypsum overlay board adhered or mechanically fastened to the steel roof deck. Provide tapered insulation crickets to direct water to roof drains.*
- 3. Two ply APP mineral surfaced membrane roof covering, torch applied, or adhered with hot asphalt or cold adhesive to the gypsum cover board substrate installed in conformance with the tested and approved fire rated assembly.*
- 4. Two ply APP mineral surfaced base flashing torch applied or adhered with hot asphalt or cold adhesive to roofing membrane.]*

SPECIFIER'S NOTE: Be sure to call for coordination with this section in your sheet metal, plumbing, concrete and carpentry sections.

1.05 COORDINATION WITH OTHER SECTIONS

- A. Coordinate installation of metal edging, pitch pocket pans, gutters, counterflashing, etc. with ~~SHEET METAL Section~~ SECTION 07620 - SHEET METAL FLASHING AND TRIM.
- B. Coordinate installation of vent pipe flashing and roof drains with SECTION 15400 - PLUMBING Section.
- C. Coordinate installation of wood nailer, curbs and blocking related to roofing with Section 06100 - ROUGH CARPENTRY.

1.06 QUALITY ASSURANCE

- A. 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 warranty.
- B. Manufacturer Qualifications: A qualified manufacturer that has a UL listing for roofing system identical to that used for this Project.
- ~~C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.~~

SPECIFIER'S NOTE: Retain paragraph 1.06.~~D~~C below if required to meet provisions of special manufacturer's warranty. Consult manufacturer's literature for requirements because they vary.

~~D~~C. Source Limitations: Obtain components for roofing system ~~<from>~~ ~~<or>~~ **<approved by>** roofing system manufacturer.

SPECIFIER'S NOTE: Retain paragraph 1.07 only when the size or complexity of the roofing and flashing work warrants a Pre-installation Meeting. Otherwise delete paragraph 1.07 entirely.

1.07 PRE-INSTALLATION MEETING: The General Contractor, the authorized roofing and roofing adhesive manufacturers' representatives or their independent roofing inspectors shall attend a pre-installation meeting at Project site. Include other related trades, such as sheet metal contractor, as applicable. Confirm the required participants with the Contracting Officer. Notify participants at least five days prior to meeting.

- A. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
- B. Review and finish construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- C. Review odor and air quality mitigation procedures, including location of asphalt kettles, ventilation openings and air flow.
- D. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
- E. Review structural loading limitations of roof deck during and after roofing.
- F. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
- G. Review governing regulations and requirements for insurance and certificates if applicable.
- H. Review temporary protection requirements for roofing system during and after installation.

- I. Review roof observation and repair procedures after roofing installation.

1.08 ROOFING SYSTEM MANUFACTURER'S PROJECT PARTICIPATION: General Contractor, Roofing Installer and Roofing System Manufacturer Representative or their independent roofing inspector shall inspect the roof surfaces at the following times:

- A. Prior to the start of the roofing installation.
- B. At the start of the roofing application.

SPECIFIER'S NOTE: Change number of inspections to suit magnitude and complexity of the project. A minimum of one inspection is required during the roofing application for roofs not larger than 7,000 square feet with no unusual penetrations and with no rooftop equipment mounts.

- C. At least once during the roofing application, unless the Roofing System Manufacturer requires additional inspections for warranty provisions.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. General: Each package of modified bitumen roof covering materials shall bear the label of a recognized agency having a service for the inspection of material and finished products during manufacture (e.g., ASTM, UL, etc.)
- C. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- D. Protect roll goods, roof insulation and any other materials that absorb or are affected by moisture 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. Do not use wet materials and/or materials which appear to have been deteriorated after getting wet.
- E. Storage of Materials at Job Site
 - 1. Except when placed on roof decks immediately prior to installation, store roofing materials above the supporting surfaces, such as on pallets.
 - 2. Store materials containing solvents in a dry, cool area with proper fire and safety precautions.
 - 3. Store roll goods shall be stored on end.
 - 4. Distribute materials stored on other than the ground, so that their resultant weight does not exceed the design live load on the deck (normally 20 lbs. per square foot on roofs and 40 lbs. per square foot on floors).

SPECIFIER'S NOTE: If applicable , add restrictions when using hot applied asphalt.

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 manufacturer's written instructions and warranty requirements.
- B. Operational restrictions to mitigate odor and air quality problems with asphalt or adhesive fumes: ***[Insert restrictions.]***

1.11 WARRANTY

- A. The warranty provisions and number of years for the warranty required by this article shall take precedence over the standard provisions in the GENERAL CONDITIONS.

SPECIFIER'S NOTE: Include the roof components used on the project.

- B. ~~Special Manufacturer's~~ Roofing Installer and Manufacturer(s), ~~bonded~~ warranty without monetary limitation, in which roof installer and manufacturer(s) agrees to repair or replace components of roofing system that fail in materials or workmanship within the specified warranty period. Failure includes roof leaks, and materials and adhesion failure due to wind conditions
 - 1. ~~Special Manufacturer's~~ warranty includes roofing membranes and base flashings, <roofing membrane accessories <roof insulation> <fasteners> <cover boards> <substrate boards> <vapor retarders> <roof pavers> <walkway products> and other components of the roofing system.
 - 2. Warranty Period: ~~For~~ <10> <15> <20> years from the Project Acceptance Date.
 - 3. Wind Conditions: ~~Warranty shall cover peak~~ Warranty shall cover basic wind speeds up to 80 MPH, Exposure _____, and Importance Factor _____, as defined by the latest adopted editions of the Building Code for the applicable building heights.

4. Warranty shall state the Manufacturer's acceptance that the roof was installed in accordance with the contract requirements and that the State's personnel were properly instructed in the maintenance procedures.
 5. In the event of a failure State, Contractor, Roofing Installer and Manufacturer shall mutually agree and determine roof system failures and remedies.
- C. ~~Special~~ Project Warranty: Submit Contractor's bonded warranty, covering work of this section, including all components of roof system such as roofing membrane, base flashing, roofing membrane accessories, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period and conditions:
1. Warranty Period: ~~Three~~ Two years from the Project Acceptance Date.
 2. Warranty shall cover repairs or replacement of damages to the building and its finishes due to leaks.
- D. Warranty Roof Inspections: Conduct a yearly inspection with the State representative just prior to the first, ~~third, fifth and tenth~~ second year anniversary of the Project Acceptance Date. The purpose of the inspections are is to identification identify and correct deficiencies in all components of the roofing and flashing system.

PART 2 - PRODUCTS

SPECIFIER'S NOTE: Select appropriate materials.

2.01 APP-MODIFIED ASPHALT PLY AND CAP SHEET MATERIALS

- A. Smooth Surfaces Roofing Membrane Sheet: ~~<ASTM D 6222, Grade S, or II, polyester-reinforced>~~ ~~<ASTM D 6223, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>~~, APP-modified asphalt sheet; smooth surfaced; suitable for application method and fire rating specified.
- B. Smooth Surfaced Cap Sheet: ~~<ASTM D 6222, Grade S, Type II, polyester-reinforced>~~ ~~<ASTM D 6223, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>~~, APP-modified asphalt sheet; smooth surfaced; suitable for application and fire rating method specified.
- C. Granular Surfaced Roofing Membrane Cap Sheet: ~~<ASTM D 6222, Grade G, Type II, polyester-reinforced>~~ ~~<ASTM D 6223, Grade G, Type II, composite polyester- and glass-fiber-reinforced>~~, APP-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 1. Granule Material: Mineral ~~<ceramic coated>~~ ~~<slate>~~.
 2. Granule Color: ~~<White>~~ ~~<Gray>~~ ~~<Tan>~~ *[Insert color]*.

SPECIFIER'S NOTE: Retain paragraph 2.02.4 A below if using smooth-surfaced SBS-modified asphalt sheet as first ply, or base ply, of two-ply modified bituminous roofing membrane. Two-ply composite modified bituminous roofing membranes are offered by several manufacturers. Select option from ASTM product standards below. Delete remaining systems.

2.02 SBS-MODIFIED ASPHALT PLY AND CAP SHEET MATERIALS

- A. Roofing Membrane Sheet: ~~<ASTM D 6164, Grade S, Type I or II, polyester-reinforced>~~ ~~<ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced>~~ ~~<ASTM D 6162, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>~~, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.

SPECIFIER'S NOTE: Retain paragraph below for smooth-surfaced roofing membrane cap sheet to be flood coated and aggregate surfaced. Select option from ASTM product standards below.

- B. Roofing Membrane Cap Sheet: ~~<ASTM D 6164, Grade S, Type I or II, polyester-reinforced>~~ ~~<ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced>~~ ~~<ASTM D 6162, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>~~, ~~<fire-rated>~~ SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.

SPECIFIER'S NOTE: Retain paragraph below for granule-surfaced roofing membrane sheet. Select option from ASTM product standards below.

- C. Roofing Membrane Cap Sheet: ~~<ASTM D 6164, Grade G, Type I or II, polyester-reinforced>~~ ~~<ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced>~~ ~~<ASTM D 6162, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced>~~, ~~<fire-rated>~~ SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 1. Granule Color: ~~<White>~~ ~~<Gray>~~ ~~<Tan>~~ *[Insert color]*.

SPECIFIER'S NOTE: Retain paragraph below for metal-foil-surfaced, SBS-modified asphalt sheet produced by several manufacturers for torch and, in some cases, hot-mopped application.

- D. Roofing Membrane Cap Sheet: ASTM D 6298, glass-fiber-reinforced, SBS-modified asphalt sheet; metal-foil surfaced; suitable for application method specified, and as follows:
 1. Foil Surfacing: ~~<Aluminum>~~ ~~<Copper>~~ ~~<Stainless steel>~~ ~~<Aluminum, fluoropolymer coated finish, of color and gloss selected by Contracting Officer from manufacturer's full range>~~.

SPECIFIER'S NOTE: Select one or two coated base sheets from paragraphs 2.03.A, ~~OR 2.03.B~~, OR 2.03C below if required by manufacturer's specifications. Coated base sheets separate roofing membrane from deck, support and cushion roofing membrane from rough or irregular deck, and provide a strong first layer to the roofing membrane. On nailable roof decks, base sheets may also provide a base layer to adhere rigid insulation. Retain paragraph 2.03.D for coated glass-fiber venting base sheet. Venting base sheets may be used over insulating concrete decks or, if permitted by roofing manufacturer, over existing roofing before reroofing.

2.03 BASE-SHEET MATERIALS

- A. Asphalt Base Sheet for Nailable Decks: <ASTM D 4601, Type II, >SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.
1. ~~Weight: <25 lb/100 sq. ft.1.2 kg/sq. m> <40 lb/100 sq. ft.1.95 kg/sq. m> <50 lb/100 sq. ft.2.4 kg/sq. m> <60 lb/100 sq. ft.2.9 kg/sq. m> <75 lb/100 sq. ft.3.7 kg/sq. m>~~, minimum:
- B. APP Base Sheet: ASTM D6509, APP-modified asphalt base sheet, glass-fiber-reinforced; smooth surfaced; suitable for application method specified.
- C. SBS Base Sheet: <ASTM D 6164, Grade S, Type I or II, polyester-reinforced> <ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced> <ASTM D 6162, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>, SBS-modified asphalt base sheet; smooth surfaced; suitable for application method specified.
- BD. Venting Base Sheet for Nailable Insulating Concrete Decks and Nailable Concrete Fills: ASTM D 4897, Type II, venting, ~~<perforated><nonperforated>~~, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

SPECIFIER'S NOTE: Select paragraph 2.04.A for smooth-surfaced flashing sheet or paragraph 2.04.B for granular cap sheet. Normally, smooth surface sheets are coated. Select option from ASTM product standards below. DAGS standard is granular cap sheet.

2.04 BASE FLASHING SHEET MATERIALS

- A. Smooth Flashing Sheet:
1. <ASTM D6509, glass-fiber-reinforced> <ASTM D 6222, Grade S, Type I or II, polyester-reinforced> <ASTM D 6223, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>, APP-modified asphalt sheet; smooth surfaced; suitable for application method specified. Provide backer sheet if required by roofing system manufacturer.
2. <ASTM D 6164, Grade S, Type I or II, polyester-reinforced> <ASTM D 6163, Grade S, Type I or II, glass-fiber-reinforced> <ASTM D 6162, Grade S, Type I or II, composite polyester- and glass-fiber-reinforced>, SBS-modified asphalt base sheet; smooth surfaced; suitable for application method specified.
- B. Granular Flashing Sheet:
1. <ASTM D 6222, Grade G, Type I or II, polyester-reinforced> <ASTM D 6223, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced>, APP-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
2. <ASTM D 6164, Grade G, Type I or II, polyester-reinforced> <ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced> <ASTM D 6162, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced>, <fire-rated> SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.
- † 3. Granule Color: Match roofing cap sheet.

2.05 AUXILIARY ROOFING MEMBRANE MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

SPECIFIER'S NOTE: Retain paragraph 2.05.B below if adhering base sheets or base flashing in cold-applied adhesives.

- B. Cold-Applied Adhesive: Roofing system 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>~~.

SPECIFIER'S NOTE: Retain paragraph 2.05.C if asphalt roofing cement is used to adhere flashings or integral metal sheet flashings. Revise material if unacceptable to roofing system manufacturer.

- C. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

SPECIFIER'S NOTE: Plastic cement is not compatible with modified bitumen.

- D. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, non-skinning, and nondrying.
- E. 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.

- F. Metal Flashing Sheet: Metal flashing sheet is specified in ~~Section~~ SECTION 07620 "Sheet Metal Flashing and Trim." – SHEET METAL FLASHING AND TRIM.
- G. Roofing Granules: Match roofing cap sheet.
- H. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

SPECIFIER'S NOTE: *The Uniform Building Code requires the installation of a fire-resistant thermal barrier unless the insulation passed fire testing conducted in accordance with ANSI-UL 1256 or Factory Mutual 4450. ~~At the time, isocyanurate foam (e.g. Firestone ISO-95+ and specially treated EPS boards) are the only plastic roof insulation that meet either or both of these tests. All other foam plastic roof insulations, including all standard extruded and expanded polystyrene boards require a thermal barrier.~~*

SPECIFIER'S NOTE: *Select one of three substrate boards below if required or delete this Article. Substrate boards may serve as model-building-code-required thermal barriers separating foam insulation from steel or wood deck. They may also be used over steel deck as part of a fire-resistance-rated roofing system or to provide a smooth substrate for a vapor retarder or temporary roofing.*

2.06 THERMAL BARRIERS

- A. ASTM C 36, Type X gypsum wall board, 5/8 inch ~~16 mm~~ thick.
- B. ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, ~~<1/4 inch 6 mm>~~ ~~<1/2 inch 13 mm>~~ ~~<Type X, 5/8 inch 16 mm>~~ thick.
 - 1. Product: Subject to compliance with requirements, provide "Dens-Deck" by Georgia-Pacific Corporation or approved equal.
- C. ASTM C 728, perlite substrate, 3/4" thick.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in Factory Mutual Standard FMG 4470, designed for fastening substrate panel to roof deck.

SPECIFIER'S NOTE: *Be sure that insulation specified on metal decks will span the flutes. Do not use phenolic foam roof insulation.*

2.07 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

SPECIFIER'S NOTE: *Specify thickness if it is critical to detailing.*

1. Design Insulation Thickness to Achieve Thermal Performance Required in Paragraph 1.02.E Above: ~~<[Insert thickness] inches.>~~ ~~>>As indicated on the drawings.>~~ Thickness(es) are based on the use of ~~[Insert type]~~ insulation.
2. If another insulation thickness is required based on the unit R-value of a differing type of insulation selected by the Contractor from the choices listed below, prepare revised detail drawings and coordinate the work with other trades as may become necessary because of the thickness change. Additional costs incurred to implement such a detail change, including the cost of additional materials such as additional blocking, shall be borne by the Contractor.

SPECIFIER'S NOTE: *For all insulation types, roofing system manufacturers may require use of their own insulation or limit approvals to specific insulation manufacturers.*

- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type ~~<IV, 1.6-lb/cu. ft.>~~ ~~<X, 1.3-lb/cu. ft.>~~ minimum density, square edged.

SPECIFIER'S NOTE: *Retain paragraph and subparagraphs below for unfaced molded-polystyrene board insulation. Select density of insulation from options in paragraph. Higher-density insulation offers improved compressive resistance, better ability to span steel deck flutes, and more rigid substrate. However, costs increase as density increases. Select type IX or denser board for roofing systems employing a venting base sheet in lieu of cover board.*

- C. Molded-Polystyrene Board Insulation: ASTM C 578 Type ~~<II, 1.35-lb/cu. ft.>~~ ~~<VIII, 1.15-lb/cu. ft.>~~ ~~<IX, 1.8-lb/cu. ft.>~~ minimum density, ~~<integrally termite treated>~~.
- D. Polyisocyanurate Board Insulation: ASTM C 1289, Type ~~<II, felt or glass-fiber mat>~~ facer on both major surfaces.
 1. Faced polyisocyanurate insulation Boards complying with ASTM C 1289 (polyisocyanurate only, polyurethane not permitted). Insulation shall have an in-service R-value of

$$\frac{5.6 \text{ degrees } -F \times \text{ft}^2 \times \text{hr}}{\text{BTU}}$$
 per inch thickness.
 2. Insulation containing chlorofluorocarbon (CFC) is not permitted.
- E. Glass-Fiber-Board Insulation: ASTM C 726, combining glass fibers with thermosetting resin binders, faced on one side with

asphalt-coated fiberglass scrim and kraft paper.

- F. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of **<1/4 inch per 12 inches> [Insert slope]**, unless otherwise indicated.
- G. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.08 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

SPECIFIER'S NOTE: Retain paragraph below if priming concrete roof deck.

- C. Asphalt Primer: ASTM D 41.

SPECIFIER'S NOTE: Retain one of three options in paragraph below for traditional roofing asphalt. See roofing manufacturer's written instructions for requirements. Although "steep" asphalt, Type III, is used, "extra steep" asphalt, Type IV, predominates.

- D. Roofing Asphalt: ASTM D 312, Type **<III> <IV> <III or IV as recommended by roofing system manufacturer for application>**.
- ~~E. Roofing Asphalt: ASTM D 6152, SEBS modified.~~

~~E. F.~~ Cold Fluid-Applied Adhesive:

- 1. Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

SPECIFIER'S NOTE: Use cellulosic fiber cants. in combination with insecticide treated EPS insulation.

- ~~F. G.~~ Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

SPECIFIER'S NOTE: Select one of two cover boards below if required by roof covering or insulation manufacturer. Cover or overlay boards are usually needed over noncomposite foam insulation or over existing roofing before installing new roofing. Do not specify perlite cover board. Because of termite problems, do not specify cellulose cover boards. At present the only glass-mat water-resistant gypsum coverboard is Dens-Deck made by Georgia-Pacific.

~~G. H.~~ Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, **<1/4 inch> <1/2 inch>** thick.

- 1. Product: Subject to compliance with requirements, provided "Dens-Deck" by Georgia-Pacific Corporation or approved equal.

~~H. F.~~ Cover Board: Proprietary glass fiber reinforced SBS modified asphalt acceptable to roofing membrane manufacturer.

~~I. J.~~ Substrate Joint Tape: 6- or 8-inch- ~~150- or 200-mm~~ wide, coated, glass-fiber joint tape, or as recommended by roofing manufacturer.

~~J. K.~~ Roof Insulation Adhesive Use to Secure Insulation to Metal Deck Substrates, Insulation to Insulation, and Insulation to Facing Boards: Adhesive shall be asbestos-free, solvent-free, waterproof (non-emulsifying), single or multi-component polyurethane type, compatible with the insulation and substrate as recommended by the adhesive and roof insulation manufacturer, specially designed for adhering insulation boards to the specified substrate (metal deck, insulation or facing boards) and conforming to the wind uplift and fire rating requirements of Underwriters Laboratories 1897 or Factory Mutual (FM I-90).

SPECIFIER'S NOTE: DAGS does not recommend using a roof coating on new installations unless there is a need to achieve a fire rating. Roof coating may be used for remedial repairs as a maintenance coating. Delete article if not used.

2.09 COATING MATERIALS

- A. Roof Coatings, General: Emulsions and coatings shall be asbestos free, compatible with the finish coating and as recommended by the roof membrane and finish coating manufacturer.
- B. Roof Coating: ASTM D 1227, Type II Class **<1, mineral-colloid-emulsified, fibered> <2, chemically emulsified, filled or fibered>** asphalt emulsion, asbestos free.
- C. Roof Coating: ASTM D 1227, Type III, Class **<1, mineral-colloid-emulsified> <2, chemically emulsified>** asphalt emulsion, nonfibered.
- D. Roof Coating: ASTM D 2824, Type **<I, nonfibered> <III, fibered, asbestos-free>** aluminum-pigmented asphaltic coating.
- E. Roof Coating: ASTM D 6083, acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces.
 - 1. Color: **<White> <Gray> <Buff> [Insert color]**.

SPECIFIER'S NOTE: Locate walkway pads on roof plan drawings.**2.10 WALKWAYS**

- A. Walkway Pads: **<Mineral-granule-surfaced, reinforced asphaltic composition> <Polymer-modified, reconstituted solid-rubber, surface-textured>**, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, **<3/8 inch> <1/2 inch> <3/4 inch>** thick, minimum.
1. Pad Size: **[Insert size.]**
- B. Walkway APP-Modified Cap Sheet Strips: **<ASTM D 6222, Grade G, Type I or II, polyester-reinforced> <ASTM D 6223, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced>**, APP-modified asphalt sheet; granular surfaced; suitable for application method specified.
1. Walkway backer strips: Provide smooth surfaced APP- modified asphalt sheet walkway backer strips.
- C. Walkway SBS-Modified Cap Sheet Strips: **<ASTM D 6164, Grade G, Type I or II, polyester-reinforced> <ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced> <ASTM D 6162, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced >**, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

SPECIFIER'S NOTE: Wood cants, blocking, curbs, and nailers are required at edges of roof penetrations, area dividers, and terminations. Wood nailers are not required on lightweight insulating concrete decks or on noninsulated, nailable decks. ~~Delete clause 3.01.A.6 if not using hot roofing asphalt is required.~~

2. Verify that cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that roof construction and surface meets the requirements of the roofing manufacturer.
4. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

SPECIFIER'S NOTE: ~~Delete subparagraph 3.01.A.5.a. if no hot roofing asphalt is required. Delete first subparagraph 3.01.A.6 if not using wood or plywood decks.~~

- a. Test for moisture by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.

SPECIFIER'S NOTE: ~~Delete first subparagraph 3.01.A.6 if not using wood or plywood decks~~

6. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch ~~1.6 mm~~ out of plane relative to adjoining deck.
7. Proceed with installation only after unsatisfactory conditions have been corrected.

SPECIFIER'S NOTE: Delete wither article 3.02 or 3.03 depending on project. Retain 3.02.C if acoustical roof deck rib insulation, shaped to fit into topside ribs of acoustical roof deck, is installed in this Section.

3.02 PREPARATION - NEW ROOFING

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. 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.
- C. Install acoustical roof deck rib insulation strips, specified in Section 05310 according to acoustical roof deck manufacturer's written instructions.

3.03 PREPARATION - REROOFING

- A. Power broom and vacuum all surfaces, removing all loose aggregate and foreign substances. Splits, blisters, buckles, and surface irregularities should be cut out and patched using appropriate compatible materials.
- B. Remove any areas of the assembly where moisture is present and replace them with compatible materials, bringing the area back to level

with the surrounding surfaces.

- C. Remove and discard all of the base flashing, and any metal incorporated into the roof system (i.e., gravel stops, vent stack jacks, drain leads, etc.) Bring these areas back to level using compatible materials.
- D. Install new wood nailers where necessary due to deterioration or nailing requirements, or when required to bring the nailer to the proper height.
- E. Remove all of the existing counterflashing and determine whether it is in a reusable condition. Lifting of the existing counterflashing in good condition. Lifting of the existing counterflashing in good condition is acceptable only if it can be resecured to its original position without deformation which would affect its performance.
- F. Except in those cases where the new assembly will be mechanically attached to the deck, the existing assembly should be resecured as necessary to meet all local code wind uplift requirements.

SPECIFIER'S NOTE: Delete paragraph 3.04 if not required by rated roof assembly or by metal deck flute width.

3.04 THERMAL BARRIER INSTALLATION

- A. 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 board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.

3.05 INSULATION INSTALLATION

- A. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- B. Where the underside of the metal deck will be exposed to view in the final construction, use insulation adhesive specified above to adhere a minimum one inch thickness insulation layer to the topside of the metal deck.
 - 1. The units of insulation shall be installed in strict accordance with the adhesive and insulation manufacturer's instructions and recommendations and shall conform to the requirements of Underwriters Laboratories (UL 1897) or Factory Mutual Class 1, I-90 installation."

SPECIFIER'S NOTE: Retain paragraph 3.05.C if mechanically fastening base sheet to substrate before adhering first layer of insulation.

- C. Install one lapped base sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.

SPECIFIER'S NOTE: Roofing system manufacturers require nailer strips for insulation-covered roof decks with slopes greater than 1 inch per 12 inches (1:12). Verify roofing system manufacturer's backnailing requirements for reducing nailer-strip spacing as roof slope increases. Absent manufacturer's written instructions, NRCA recommends spacing nailers approximately 16 feet (~~4.88 m~~) apart for slopes up to 3 inches per 12 inches (3:12) and 48 inches (~~1220 mm~~) apart for greater slopes. Delete nailer strips on lightweight insulating concrete decks or other noninsulated nailable decks.

- D. Nailer Strips: Mechanically fasten 4-inch nominal ~~89-mm actual~~ width preservative treated wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - 1. ~~<8 feet>~~ [Insert spacing] apart for roof slopes greater than 1 inch per 12 inches but less than 3 inches per 12 inches 3:12.
 - 2. ~~<48 inches>~~ [Insert spacing] apart for roof slopes greater 3 inches per 12 inches.
- E. Install tapered insulation under area of roofing to conform to slopes indicated.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness exceeds NRCA recommendations for a single layer or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches ~~150 mm~~ in each direction.
- H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- I. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- J. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in a solid mopping of hot roofing asphalt.
 - 2. Set each layer of insulation in a cold fluid-applied adhesive.

SPECIFIER'S NOTE: Retain appropriate paragraph 3.05. ~~J~~ K or 3.05. ~~L~~ L if mechanically fastening insulation layers. Roofing manufacturer

may require a pull test to satisfy warranty requirements.

- K. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 1. Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- L. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.

SPECIFIER'S NOTE: Select one of two subparagraphs below.

- ~~1.~~ Install subsequent layers of insulation in a solid mopping of hot roofing asphalt. **OR**
- ~~2.~~ Install subsequent layers of insulation in a cold fluid-applied adhesive.

SPECIFIER'S NOTE: Retain paragraph 3.05.M if cover boards will be field installed over roof insulation and immediately below roofing membrane. Joint taping protects molded- or extruded-polystyrene insulation against damage from hot roofing asphalt and minimizes offsets at joints between adjacent cover boards.

- M. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches ~~150 mm~~ in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.
 1. Fasten to resist uplift pressure at corners, perimeter, and field of roof.
 2. Apply hot roofing asphalt to underside and immediately bond cover board to substrate.
 3. Apply adhesive to top side of roof insulation and set cover board onto substrate.

SPECIFIER'S NOTE: Retain subparagraph 3.06 5.A.1 if referencing NRCA's specification-plate classification system or schedule individual plate numbers from the NRCA Roofing and Waterproofing Manual at the end of Part 3 below.

3.06 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane system 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."
 1. Install roofing system [*insert roofing system number*], according to specification-plate classifications in the NRCA Roofing and Waterproofing Manual and requirements of this Section.
- B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

SPECIFIER'S NOTE: Retain paragraph 3.06.C and subparagraph 3.06.C.1 below if roof slope exceeds minimum permitted. DAGS minimum roof slope is /12 inch per foot. Confirm with Project Coordinator and Quality Control Branch if proposing to install a roof with less than ½ inch per foot slope.

- C. Where roof slope exceeds 3/4 inch per 12 inches, install roofing membrane sheets parallel with slope.

SPECIFIER'S NOTE: Retain first option in subparagraph below for backnailing to nailer strips for insulated and non-nailable decks. Retain second option for backnailing directly to nailable substrate.

1. Backnail roofing membrane sheets to **<nailer strips>** **<substrate>** according to roofing system manufacturer's written instructions.
- D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
 - E. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt 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.

SPECIFIER'S NOTE: Retain wither paragraph 3.06.F or 3.06.G if using hot roofing asphalt. Retain 3.06.F for traditional roofing asphalt complying with ASTM D 312; retain 3.06.G for SEBS-modified roofing asphalt.

- F. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

~~G. Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing system manufacturer's written instructions.~~

~~G.H. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.~~

SPECIFIER'S NOTE: Retain paragraph 3.07 9.A and subparagraphs below if base sheet is required as first ply of roofing membrane. Select appropriate installation method from subparagraphs below. Usually retain 3.07.A.1 for nailable substrate and remaining subparagraph for non-nailable or insulated substrates. Mechanically fasten or spot- or strip-mop vented base sheets because they vent laterally.

3.07 BASE-SHEET INSTALLATION

- A. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
1. Mechanically fasten to substrate.
 2. Adhere to substrate in a solid mopping of hot roofing asphalt.
 3. Adhere to substrate in a uniform coating of cold-applied adhesive.

SPECIFIER'S NOTE: Retain subparagraph 3.08 3.B.2 below for torched or heat-welded laps of granule-finished roofing membrane cap sheet if required. Granule application to beads is considered temporary.

3.08 MEMBRANE APPLICATION - GENERAL

- A. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
- B. Laps: Accurately align roofing membrane 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 to cover exuded bead at laps while bead is hot.
- C. Install roofing membrane sheets so side and end laps shed water.

SPECIFIER'S NOTE: Select either paragraph 3.09 4.A.1 or 3.09 7.A.2 below. Torch-applied is standard.

3.09 APP-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install modified bituminous roofing membrane **<sheet> <and> <cap sheet>** according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
1. Adhere to substrate in cold-applied adhesive.
 2. Torch apply to substrate.

SPECIFIER'S NOTE: Select a subparagraph 3.10.A.1 or 3.10.A.1 through 3.10.A.3. Hot applied or torch applied are standard. Delete first subparagraph 3.01.A.6 if not using wood or plywood decks.

3.10 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F.
 2. Adhere to substrate in cold-applied adhesive.
 3. Torch apply to substrate.

SPECIFIER'S NOTE: Be sure to call for the furnishing of items of adjoining work in the appropriate specification sections. Delete paragraphs which are not applicable to your project and add paragraphs as required. Describe work in detail and show details on plans. (e.g. Roof Scupper, Expansion Joint, Equipment Curbs and Mountings, etc.)

3.11 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 as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.

SPECIFIER'S NOTE: Retain one of four three subparagraphs below if a single backer sheet is required behind flashing sheet. Retain first for backer sheets mechanically fastened to wood-surfaced walls or parapets and second, or third, or fourth for adhered backer sheets.

2. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. **<Adhere backer sheet over roofing membrane at cants in cold-applied adhesive.>**
3. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
4. Backer Sheet Application: Install backer sheet and adhere to substrate in cold-applied adhesive at rate required by roofing system manufacturer.

5. Backer Sheet Application: Torch and flop backer sheet onto substrate.

SPECIFIER'S NOTE: Retain one of three subparagraphs below or revise to suit Project. Usually APP-modified flashing sheets may be applied by any method below.

5. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
 6. Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement; apply cement at rate required by roofing system manufacturer.
 7. Flashing Sheet Application: Torch apply flashing sheet to substrate.
- B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.
- D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

SPECIFIER'S NOTE: Show detail on plans. Refer to Detail Nos. R-3 and R-4/TG 0755. Provide closely spaced substantial anchorage of the face flange in high wind areas or areas subject to high wind conditions. Continuous sheet metal clips with closely spaced fasteners or direct nailing of the face flange with closely spaced fasteners having neoprene washers are acceptable. Verify with your Project Coordinator if your project is in this category.

- E. Incorporated Items:
1. Wood Blocking: Install where shown on the plans and shall be secured to the deck with appropriate fasteners spaced at maximum 48 inches on center.
 2. Metal Edging and Incorporated Flashing: Set in a full bed of flashing cement on top of the modified bitumen interply membrane not including the cap sheet. Overlap (nested not cut) edging at least 5 inches at joints, with a flexible non-hardening sealant compatible with the flashing cement and modified bitumen, placed between the two layers of metal in such manner that metal does not touch metal anywhere. Securely fasten edging flange to edge nailing strips using large headed-nails at least 1-1/2 inches long. Nail at 3 inches on-center and stagger on either side of flange centerline. Double nail laps. Prime flange and flash with one strip of the modified bitumen inter-ply sheet 6 inch wider than the flange width torched-on onto the substrate. Torch-on, mop or adhere cap sheet with the edge 1/4 inch away from the outside corner of the metal edging. Apply a continuous bead of flashing cement and press into this edge. Anchor the face flange of the metal edging as shown in the drawings.
 3. Install metal penetration flashing in accordance with roofing system manufacturer's written instructions.

SPECIFIER'S NOTE: Delete either paragraph 3.11.F or 3.11.G as applicable to project.

- F. Roof Drains - New: Set minimum 30-by-30-inch metal flashing in bed of roofing-manufacturer approved asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches 6 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
1. Install stripping according to roofing system manufacturer's written instructions.
- G. Roof Drains - Existing:
1. Clean existing locking ring before tightly bolting it to the drain housing to ensure a watertight system.
 2. Replace all broken or missing locking rings, bolts and strainers.
 3. Install roofing membrane and lead flashing as indicated on the plans.
 4. Clean all drainage channels through locking rings thoroughly after reroofing to ensure unimpeded flow of water into the drain.

3.12 COATING INSTALLATION

SPECIFIER'S NOTE: Retain this Article if roof coatings are required.

- A. Apply coatings to roofing membrane and base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.

SPECIFIER'S NOTE: Retain this Article if walkways set directly on roofing membrane are required.

3.13 WALKWAY INSTALLATION

- A. Walkway Pads: Install walkway pads in cold-applied adhesive, using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
- B. Walkway Strips: Install walkway backer and cap sheet strips over roofing membrane.
 - 1. Install walkway strips **<in cold-applied adhesive> <by torch application>**.

3.14 FIELD QUALITY CONTROL - INSPECTIONS

- A. Progress Roof Inspections:
 - 1. Contractor, roofing installer, <independent roofing auditor/inspector> and roofing system manufacturer's technical personnel shall inspect the roof surfaces at the following times.
 - a. At the actual start of the roofing installation.

SPECIFIER'S NOTE: Insert a number of progress inspections to suit the magnitude and complexity of the roofing installation. A minimum of one inspection is required during the roofing installation for roofs greater than 7000 s. f. with no unusual penetrations and with no A. C. equipment. One inspection during installation is adequate for most projects.

- b. ~~<One><Two><Three>~~ time ~~<s>~~ ~~Once~~ during the roofing installation.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Contracting Officer and to roofing manufacturer as needed to meet warranty requirement.
 - 1. Notify Contracting Officer 48 hours in advance of date and time of inspection.
 - 2. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
 - 3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.15 FIELD QUALITY CONTROL - TESTING

- A. Testing Agency: At Contracting Officer's discretion the State may at its own expense engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

SPECIFIER'S NOTE: Paragraph and subparagraphs below are based on Appendix 2 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing." ARMA/NRCA recommends continuous visual examination of roofing installation. Test cuts are intended to evaluate problems observed during quality-assurance inspections.

- B. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - 1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
 - 2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

SPECIFIER'S NOTE: 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.

- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Contracting Officer.
 - 1. Notify Contracting Officer 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.16 PROTECTING AND CLEANING

- A. Protect 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 Contracting Officer.
- B. Cleaning
 - 1. **<Clean roof coating overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.>**
 - 2. Remove debris from roofing work from the premises and dispose at the end of each working day and upon completion of the work to the satisfaction of the Contracting Officer. Leave roof in good, clean condition.

3. Bitumen, modified and otherwise, shall be removed completely from all surfaces other than the roofing, especially those to which sealants must be bonded and/or metal flashings which are to be painted. Cleaned out gutters, downspouts, roof drains, and scuppers and remove all blockages prior to acceptance of the project.

END OF SECTION