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USACE / NAVFAC / AFCESA | **UFGS-07530 (March 2004)**

Preparing Activity: NAVFAC | **Superseding UFGS 07530a (January 2004)and UFGS 07536N (September 1999)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004
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SECTION 07530

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03/04

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SECTION 07530

ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOF MEMBRANE
03/04

****
NOTE: This guide specification covers the requirements for ethylene propylene diene terpolymer (EPDM) elastomeric sheet roofing, with associated elastomeric sheet flashing, for installations with the insulation below the membrane.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
****

****
NOTE: Standard application methods include loose-laid ballasted, fully adhered, and mechanically fastened systems. Also included is a special combined fully adhered and mechanically fastened system for excessive wind loading conditions. This guide specification does not include the structural roof deck, insulation, sheet metal fascias, gravel stops, flashings, nor use of elastomeric sheets for roofing located adjacent to kitchen or food service exhaust system discharge ducts. Grease and oil attack EPDM. Exhaust fumes must be directed away from the roofing system.

This section shall be coordinated with other roof system components specifications such as rough carpentry, insulation and sheet metal flashing. This section shall also be coordinated with the

criteria contained in Unified Facilities Criteria (UFC) 3-110-06 DESIGN: ROOFING as it relates to the specific project and Service Exceptions indicated therein.

Specified membrane attachment must be compatible with the insulation specified. Membrane shall not be adhered directly to polystyrene, perlite or standard wood fiber, insulation. Facer on polyisocyanurate insulations must be compatible with the adhesive of a fully adhered membrane application. Glass mat, moisture resistant gypsum roof board can be used as an underlayment over insulation for adhesive application of roof membrane with approval of the membrane manufacturer. Top insulation layer under ballasted roofing systems shall be wood fiberboard, perlite, or glass mat, moisture resistant gypsum roof board.

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2002) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM D 448	(2003) Sizes of Aggregate for Road and Bridge Construction
ASTM D 4637	(2003) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D 4811	(2004) Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing
ASTM D 6369	(1999) Design of Standard Flashing Details for EPDM Roof Membranes
ASTM E 108	(2000) Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM AS 4470	(1986; R 1992) Class I Roof Covers
FM P7825	(2003) Approval Guide
FM P7825c	(2003) Approval Guide Building Materials

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0405	(2001; R 2003, 5th Ed) Roofing and Waterproofing Manual

SPRI (SPRI)

SPRI RP-4	(2002) Wind Design Standard for Ballasted Single-Ply Roofing Systems

UNDERWRITERS LABORATORIES (UL)

UL 790	(2004) Test Methods for Fire Tests of Roof Coverings
UL RMSD	(2004) Roofing Materials and Systems Directory

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM[S]

****

NOTE: Coordinate with Part 2 materials specification.

Select the application method required. Delete other options.

Where EPDM systems are utilized, fully adhered systems applied over minimum two layers of rigid board roof insulation is the preferred norm.

Stone ballasted systems shall not be specified along flight lines, in wind zones exceeding 160 km/h (100 mph), within 8 km (5 miles) of coastline, within 457 m (1500 feet) of open body of water, and on or adjacent to critical facilities such as hospitals. Ballasted systems, where required in these areas shall utilize interlocking pavers designed to resist the required wind loads. Ballasted systems on air permeable decks (e.g., metal decks, precast concrete panels or planks) shall incorporate an air barrier in the assembly.

Mechanically fastened systems shall incorporate an air barrier in the roof assembly. Additionally, mechanically fastened systems shall utilize reinforced membrane in wind zones exceeding 160 km/h (100 mph), within 8 km (5 miles) of coastline or within 457 m (1500 feet) of open body of water.

Combination attachment should only be specified for

isolated geographic locations that experience extreme and extended wind conditions such as portions of Alaska and Iceland, or as otherwise required by the Government.

Where an air barrier is required, it shall be applied at the deck level or within the insulation sandwich. Air barriers shall be specified in Section 07220 ROOF INSULATION.

Where one membrane system is required for all roof areas, use the first paragraph. Where different systems are required, use the second paragraph successively and replace the open brackets with a description of the substrate(s) or area of the building or project where each system is to be applied.

****

[Fully adhered][Mechanically fastened][Ballasted][Combination fully adhered and mechanically fastened] EPDM roof membrane system applied over [insulation][recovery board][concrete roof deck] substrate. [Air barrier shall be incorporated in the roof assembly as specified in Section 07220 ROOF AND DECK INSULATION.]

[_____]: [Fully adhered][Mechanically fastened][Ballasted][Combination fully adhered and mechanically fastened] EPDM roof membrane system applied over [insulation][recovery board][concrete roof deck] substrate. [Air barrier shall be incorporated in the roof assembly as specified in Section 07220 ROOF AND DECK INSULATION.]

1.3 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes

following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roof plan drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, [,location of perimeter half-sheets][, spacing of perimeter, corner, and infield fasteners,] as applicable. The drawing shall reflect the project roof plan of each roof level and conditions indicated.[; G][; G, [_____]]

SD-03 Product Data

****

NOTE: Edit the product data submission requirements as necessary for the system specified. Include bracketed requirements as applicable to the system being specified.

****

EPDM Sheet[; G][; G, [_____]]

Seam Tape

Bonding Adhesive

Lap Splice Adhesive

Water Cutoff Mastic/Water Block

Lap Cleaner, Lap Sealant, and Edge Treatment

Flashing

Flashing Accessories

Flashing Tape

Fasteners and Plates

[Ballast]

Roof Insulation

[Protection Mat]

[PRE-MANUFACTURED ACCESSORIES]

Sample warranty certificate[; G][; G, [_____]]

Submit all data required by Section 07220, "Roof and Deck Insulation," together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation and other products and accessories to be provided. Products shall be as listed in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

SD-05 Design Data

****
NOTE: Incorporate this paragraph for ballasted systems and anytime non-FM rated systems are permissible. Coordinate with requirements of "Wind Uplift" paragraph.
****

Wind uplift calculations[; G][; G, [_____]]

[Engineering calculations validating the wind resistance of roof system.]

SD-07 Certificates

Qualification of Manufacturer

Certify that the manufacturer of the roof membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer."

Qualification of Applicator

Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

[Wind Uplift Resistance classification, as applicable[; G][; G, [_____]]]

Fire Resistance classification[; G][; G, [_____]]

Submit the roof system assembly [wind uplift and] fire rating classification listings.

SD-08 Manufacturer's Instructions

****
NOTE: Edit the manufacturers instructions submission requirements as necessary for the system specified. Include bracketed requirements only as applicable to the system being specified.
****

APPLICATION[; G][; G, [_____]]

Application Method, including pattern and frequency of mechanical attachments required in the field of roof, corners, and perimeters to provide for the specified wind resistance[; G][; G, [_____]]

Membrane Flashing[; G][; G, [_____]]

Seam Tape

Tape Seams / Lap Splices

Adhesive Seams / Lap Splices

Perimeter Attachment

primer

fasteners

[Pavers]

[Protection mat]

[Pre-manufactured accessories]

cold weather installation[; G][; G, [_____]]

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

SD-11 Closeout Submittals

WARRANTY

INFORMATION CARD

INSTRUCTIONS TO GOVERNMENT PERSONNEL

Include copies of Material Safety Data Sheets for maintenance/repair materials.

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

****
NOTE: Specify 5 years manufacturer experience unless directed otherwise by the Government
****

EPDM sheet roofing membrane manufacturer shall have at least [5][_____] years experience in manufacturing EPDM roofing products.

1.4.2 Qualification of Applicator

****
NOTE: Specify 3 years as an approved contractor unless directed otherwise by the Government

****

Roofing system applicator shall be approved, authorized, or licensed in writing by the roof membrane manufacturer and shall have a minimum of [three][_____] years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator shall supply the names, locations and client contact information of 5 projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Fire Resistance

Complete roof covering assembly shall:

a. Be Class A rated in accordance with ASTM E 108 , FM AS 4470, or UL 790; and

b. Be listed as part of Fire-Classified roof deck construction in the UL RMSD or Class I roof deck construction in the FM P7825.

FM or UL approved components of the roof covering assembly shall bear the appropriate FM or UL label.

1.4.4 Wind Uplift Resistance

****

NOTE: Determine the required wind uplift resistance based on ASCE 7 wind loading calculations or applicable building code requirements.

The specified FM approval rating incorporates a safety factor of 2 over the maximum calculated uplift pressure in inch-pound units. Therefore, a FM approval rating of 1-90 correlates to a maximum uplift calculation of 2.2 kPa (45 psf). When specifying an FM rated system, ensure the designed roof system is capable of providing the specified FM approval rating. Where non-rated systems may be permissible, include the bracketed portion of the second sentence and the third sentence.

Ballast for loose-laid ballasted application should be designed in accordance with ANSI/RMA/SPRI RP-4. Where ballasted systems are specified include the bracketed option at the end of the paragraph.

****

Complete roof covering assembly, including insulation, shall be rated Class 1-[60][90][_____] in accordance with FM P7825 capable of withstanding an uplift pressure of [2.85][4.30][_____] kPa per square meter ([60][90][_____] psf). Non-rated systems shall not be installed[, except as approved by the Contracting Officer]. Provide wind load calculations and submit engineering calculations and substantiating data to validate wind resistance of any non-rated roof system. Wind uplift calculations shall be based on a design wind speed of [_____] km/h ([_____] mph) in accordance with ASCE 7[or applicable building code requirements]. [Resistance to wind uplift for loose-laid ballasted application shall be in accordance with requirements of SPRI RP-4.]

1.4.5 Preroofing Conference

After approval of submittals and before performing roofing [and insulation] system installation work, hold a preroofing conference to review the following:

a. Drawings, specifications and submittals related to the roof work;

b. Roof system components installation;

c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and

e. Quality control plan for the roof system installation;

f. Safety requirements.

Preroofing conference scheduling shall be coordinated with the Contracting Officer. The conference shall be attended by the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of roofing[and insulation], flashing and sheet metal work, [[mechanical] [and] [electrical] work], other trades interfacing with the roof work, and representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials in their original, unopened containers or wrappings with labels intact and legible. Where materials are covered by a referenced specification number, the labels shall bear the specification number, type, class, and shelf life expiration date where applicable. Deliver materials in sufficient quantity to allow continuity of work.

1.5.2 Storage

Store and protect materials from damage and weather in accordance with manufacturer's instructions, except as specified otherwise. Keep materials clean and dry. Store and maintain adhesives, sealants, primers and other liquid materials above 15 degrees C (60 degrees F). Insulated hot boxes or other enclosed warming devices shall be required in cold weather. Mark and remove damaged materials from the site. Use pallets to support and canvas tarpaulins to completely cover material materials stored outdoors. Do not use polyethylene as a covering. Locate materials temporarily stored on the roof in approved areas, and distribute the load to stay within the live load limits of the roof construction. Remove unused materials from the roof at the end of each days work.

1.5.3 Handling

Prevent damage to edges and ends of roll materials. Damaged materials shall not be installed in the work. Select and operate material handling equipment so as not to damage materials or applied roofing. Do not use materials contaminated by exposure or moisture. Remove contaminated materials from the site. When hazardous materials are involved, adhere to the special precautions of the manufacturer. Adhesives may contain petroleum distillates and may be extremely flammable; prevent personnel from breathing vapors, and do not use near sparks or open flame.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not install EPDM sheet roofing during high winds or inclement weather, or when there is ice, frost, moisture, or visible dampness on the substrate surface, or when condensation develops on surfaces during application. Unless recommended otherwise by the EPDM sheet manufacturer and approved by the Contracting Officer, do not install EPDM sheet when air temperature is below 4 degrees C (40 degrees) F or within 3 degrees C (5 degrees F) of the dewpoint. Follow manufacturer's printed instructions for installation during cold weather conditions.

1.7 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counterflashing are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. [Application of roofing shall immediately follow application of insulation as a continuous operation. Roofing operations shall be coordinated with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.]

1.8 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Revision or amendment to standard membrane manufacturer warranty shall be provided as required to comply with the specified requirements.

1.8.1 Roof Membrane Manufacturer Warranty

****
NOTE: Insulated and routinely occupied facilities or facilities containing sensitive equipment or operations shall require a warranty of not less than 15 years. Designer may specify 5 or 10 year manufacturer warranty on facilities of small roof area and of minor importance where interiors and contents are not severely impacted by potential water intrusion. Environmentally controlled interiors shall require minimum 10 year warranty regardless of small size.
****

Furnish the roof membrane manufacturer's [5][10][15][_____]-year no dollar limit roof system materials and installation workmanship warranty,

including flashing, insulation, and accessories necessary for a watertight roof system construction. The warranty shall run directly to the Government and commence at time of Government's acceptance of the roof work. The warranty shall state that:

a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, splits, tears, cracks, delaminates, separates at the seams, shrinks to the point of bridging or tenting membrane at transitions, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship shall be the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work shall be the responsibility of the roof membrane manufacturer.

b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others shall not void the warranty.

1.8.2 Roofing System Installer Warranty

The roof system installer shall warrant for a period of not less than two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. The warranty shall run directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials shall be the responsibility of the roof system installer. All costs associated with the repair or replacement work shall be the responsibility of the installer.

1.8.3 Continuance of Warranty

Repair or replacement work that becomes necessary within the warranty period shall be approved, as required, and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

1.9 CONFORMANCE AND COMPATIBILITY

The entire roofing and flashing system shall be in accordance with specified and indicated requirements, including fire and wind resistance requirements. Work not specifically addressed and any deviation from specified requirements shall be in general accordance with recommendations of the NRCA 0405, membrane manufacturer published recommendations and details, ASTM D 6369, and compatible with surrounding components and construction. Any deviation from specified or indicated requirements shall be submitted to the Contracting Officer for approval prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

Coordinate with other specification sections related to the roof work.

Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Materials provided shall be free of defects and suitable for the service and climatic conditions of the installation.

2.1.1 EPDM Sheet

****

NOTE: Refer to Designer Note in PART 1 - DESCRIPTION OF ROOF MEMBRANE SYSTEM for guidance regarding membrane attachment method and in editing the membrane materials requirements.

Specify 1.1 mm (0.045 inch) Type II reinforced membrane for mechanically fastened applications in wind zones exceeding 160 km/h (100 mph), within 8 km (5 miles) of coastline or within 457 m (1500 feet) of open body of water.

Typically specify 1.5 mm (0.060 inch) Type II non-reinforced membrane for fully adhered or ballasted application, except that 1.1 mm (0.045 inch) Type III membrane with fleece-backing may be used in fully adhered installations. When Type III membrane is required the adhesive is typically a spray applied compound, spray foam adhesive, or hot asphalt. Related portions of this specification shall be modified for proper adhesive and application parameters when Type III membrane is specified.

2.3 mm (0.090 inch) membrane is a special material with limited availability. Specify 2.3 mm (0.090 inch) membrane only for applications that experience regular heavy traffic conditions or regular extreme wind conditions. 2.3 mm (0.090 inch) membrane shall only be fully adhered.

****

Ethylene Propylene Diene Terpolymer (EPDM), ASTM D 4637, [Type I, non-reinforced][Type II, scrim or fabric reinforced][Type III, fabric or fleece backed], [1.1 mm (0.045 inch)][1.5 mm (0.060 inch)][2.3 mm (0.090 inch)] nominal thickness for [mechanically fastened] [fully adhered] [loose-laid ballasted] [combined fully adhered and mechanically fastened] application. Minimum thickness shall not be less than minus 10 percent of the specified thickness value. EPDM membrane thickness specified is exclusive of backing material on the EPDM membrane. Principal polymer used in manufacture of the membrane sheet shall be greater than 95 percent EPDM. Width and length of sheet shall be [as recommended by the manufacturer.][maximum width attainable as recommended by the manufacturer to minimize field formed seams in the field of the roof.]

2.1.2 Seam Tape

****

NOTE: Seam tapes have proven most effective in maintaining long term seal of field seams of roof membrane. Seam tapes can be difficult to apply to membrane flashing situations. As such, lap splice

adhesive or self-adhering flashing membrane are used as alternatives in difficult membrane flashing areas.

Seam tapes shall be minimum 75 mm (3 inches) wide. Some specific situations may require wider seam tapes as recommended by the membrane manufacturer.

****

Double-sided synthetic rubber tape, minimum 0.76 mm (0.03 inch) thick, minimum 75 mm (3 inch) wide. Seam tape shall be as supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data for forming watertight bond of EPDM sheet materials to each other for the application specified and conditions encountered. 150 mm (6 inch) wide tape is required for seam seals along lines of mechanical attachment of membrane.

2.1.3 Lap Splice Adhesive

****

NOTE: Lap splice adhesive is used for some membrane to membrane bond applications.

Include bracketed options as applicable.

Low VOC materials may be required in some geographic locations and on occupied buildings to minimize potential irritation to occupants.

Include second and third brackets options at end of paragraph when lap splice adhesive is prohibited for field seams of roof membrane.

****

[Low volatile organic compound (VOC)] synthetic rubber adhesive as supplied by roof membrane manufacturer and recommended by the manufacturer's printed data for forming watertight bond of EPDM sheet membrane materials to each other [in areas of membrane flashing]. [Splice adhesive shall not be used to form membrane seams in field of roof or at standard base flashing conditions.]

2.1.4 Bonding Adhesive

****

NOTE: Bonding adhesive is used for adhering EPDM membrane to materials other than EPDM.

Low VOC materials may be required in some geographic locations and on occupied buildings to minimize potential irritation to occupants.

When Type III (fleece-backed) membrane is specified, include the first bracketed option as applicable, delete the second bracketed option, and write in a description of the adhesive required as the third bracketed option. When hot asphalt is the specified adhesive, in Part 3, include parameters for heating of asphalt and application similar to those found in UFGS 07511.

****

[Low volatile organic compound (VOC)] [synthetic rubber][_____] adhesive as supplied by roof membrane manufacturer and recommended by the manufacturer's printed data for bonding EPDM membrane materials to insulation, wood, metal, concrete or other substrate materials. Bonding adhesive shall not be used to bond membrane materials to each other.

2.1.5 Lap Cleaner, Lap Sealant, and Edge Treatment

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.6 Water Cutoff Mastic/Water Block

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.7 Membrane Flashing and Flashing Accessories

Membrane flashing, including self-adhering membrane flashing, perimeter flashing, flashing around roof penetrations, and prefabricated pipe seals, shall be minimum 1.1 mm (0.045 inch) minimum cured EPDM, as recommended by the roof membrane manufacturer or minimum 1.4 mm (0.055 inch) thick uncured EPDM sheet in compliance with ASTM D 4811, Type I. Cured EPDM membrane shall be used to the maximum extent recommended by the roof membrane manufacturer. Uncured flashing material shall be limited to reinforcing inside and outside corners and angle changes in plane of membrane, and to flash scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical.

2.1.7.1 Flashing Tape

EPDM-backed synthetic rubber tape, minimum 150 mm (6 inch) wide as supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.8 Membrane Fasteners and Plates

Coated, corrosion-resistant fasteners as recommended by the roof membrane manufacturer and meeting the requirements of FM AS 4470 and FM P7825c for Class I roof deck construction and the wind uplift resistance specified. As supplied and warranted for the substrate type(s) by EPDM sheet manufacturer and recommended by EPDM sheet manufacturer's printed data.

2.1.8.1 Stress Plates for Fasteners

Flat corrosion-resistant round stress plates as recommended by the roof membrane manufacturer's printed instructions and meeting the requirements of FM AS 4470; not less than 50 mm (2 inches) in diameter. Discs shall be formed to prevent dishing or cupping.

2.1.8.2 Auxiliary Fasteners

Corrosion resistance screws, nails, or anchors suitable for intended attachment purpose and as recommended by the roof membrane manufacturer.

[2.1.9 Ballast

****
NOTE: Delete these paragraphs unless loose-laid ballasted system is specified. Normally specify stone ballast for a ballasted system. Specify paver ballast when:

1. There is danger of aggregate being drawn into air intakes of jet aircraft.

2. There is danger of wind-blown aggregate jeopardizing property and life safety.

3. In wind zones exceeding 160 km/h (100 mph), within 8 km (5 miles) of coastline, within 457 m (1500) feet of open body of water, and on or adjacent to critical facilities such as hospitals.

3. Heavy foot traffic over large areas of roof is expected.
****

[2.1.9.1 Stone Ballast

Smooth, rounded, river-washed stone graded in accordance with ASTM D 448, sizes 1, 2, 24, 3, and 4, nominal 19 mm to 38 mm (3/4 inch to 1-1/2) diameter, except as recommended otherwise by the roof membrane manufacturer and approved by the Contracting Officer.

][2.1.9.2 Ballast Pavers

****
NOTE: Specify paver weight based on calculated wind load conditions and ANSI/RMA/SPRI RP-4.

Lightweight interlocking paver ballast may be used in lieu of heavier weight non-interlocking pavers in wind zones in excess of 160 km/h (100 mph), within 8 km (5 miles) of coastline or within 457 m (1500 feet) of open body of water. Non-interlocking pavers should weight not less than 88 kg per square meter (18 pounds per square foot).

Elevated paver systems and pavers intended to support pedestrian traffic, such as plaza decks or observation decks, should be minimum 50 mm (2 inches) thick, 600 mm (24 inches) square, and minimum 51,700 kPa (7500 psi) compressive strength.

Specify paver pedestrals for pavers without drainage channels. Specify adjustable pedestals for systems required to be elevated to a level plane such as a plaza or observation deck.
****

Weather resistant, precast [interlocking] concrete roof pavers [with drainage channels on the underside], and as recommended by the roof membrane manufacturer. Pavers shall be minimum [20,680 kPa (3000

psi)][51,700 kPa (7500 psi)] compressive strength, weigh not less than [58 kg per square meter (12 pounds per square foot)] [88 kg per square meter (18 pounds per square foot)] [_____], not less than [30 mm (1-1/4 inch)][50 mm (2 inches)] thick and nominal [600 mm (24 inches)][_____] in length and width and without sharp edges and projections. [Elevate pavers above the roof membrane surface with paver manufacturer's recommended [adjustable] pedestal system [to provide for level walking surface] as required by the roof membrane manufacturer.]

]][2.1.10 Protection Mat / Slip Sheet

****
NOTE: Specify protection mat for application between roof membrane and ballast when ballasted systems are specified.
****

Minimum [154 gram per square meter (4.5 ounce per square yard)][200 gram per square meter (6 ounce per square yard)] ultraviolet resistant polypropylene, non-woven, needle punched fabric for use as protection mat under ballast system and as recommended by the roof membrane manufacturer.

]2.1.11 PRE-MANUFACTURED ACCESSORIES

****
NOTE: Edit, delete, and insert accessory materials requirements as required for the specific project and components to be installed.
****

Pre-manufactured accessories shall be manufacturer's standard for intended purpose,[comply with applicable specification section,] compatible with the membrane roof system and approved for use by the roof membrane manufacturer.

[2.1.11.1 Pre-fabricated Curbs

Curbs shall be [_____] gauge [G90 galvanized][AZ55 galvalume][_____] with minimum 100 mm (4 inch) flange for attachment to roof nailers. Curbs shall provide minimum height of 250 mm (10 inches) above the finished roof membrane surface.

][2.1.12 [Rubber Walkboards] [and] [Precast Concrete Paver Block Walkways]

****
NOTE: Use pavers or rubber walkboards as walkways where the roof or areas of the roof are intended to bear foot traffic for maintenance or other purposes once per month or more frequently.
****

Provide [either of] the following:

[2.1.12.1 Rubber Walkboards

Preformed reprocessed rubber, compatible with the EPDM sheet, 1/4 inch minimum thickness, and weighing not less than 1 1/2 pounds per square foot.

][2.1.12.2 Precast Concrete Paver Block

Precast concrete blocks, [450 mm by 450 mm (18 inch by 18 inch)][600 mm by 600 mm (24 inch by 24 inch)], without sharp edges and projections, and weighing no more than [20 kg (45 pounds)][36 kg (80 pounds)] each.

]][2.1.13 Elevated Metal [Walkways] [and] [Platforms]

As specified in Section[05500N METAL FABRICATIONS][05500A MISCELLANEOUS METALS], and as approved by the roof membrane manufacturer.

]2.1.14 Roof Insulation Below EPDM Sheet

****
NOTE: If the roofing system contains insulation, coordinate with the appropriate insulation specification section. The insulation specification should include materials and installation up to the substrate on which the roof membrane is applied.

Do not fully adhere single ply membrane to perlite, polystyrene, or standard wood fiber insulation board. High density wood fiber board is acceptable if approved by the roof membrane manufacturer for the wind resistance condition specified.

Coordinate insulation system attachment with the wind resistance requirements. In many instances, insulation system must be adhered or mechanically fastened to deck in corner and perimeter areas, if not throughout the field of the roof, when specifying a ballasted roof system.
****

Insulation system and facer material shall be compatible with membrane application specified and as approved by the roof membrane manufacturer[and as specified in Section 07220 ROOF AND DECK INSULATION].

2.1.15 Wood Products

****
NOTE: Coordinate with Section 06100 ROUGH CARPENTRY. Some fire retardant treatment (FRT) chemicals may affect EPDM materials. MSDS listing active ingredients for the FRT wood shall be submitted to EPDM manufacturer prior to applying EPDM materials in contact with FRT wood.
****

As specified in Section[06100A ROUGH CARPENTRY][06100N ROUGH CARPENTRY], except that fire retardant treated materials shall not be in contact with EPDM membrane or EPDM accessory products, unless approved by the membrane manufacturer and the Contracting Officer.

2.1.16 Membrane Liner

[Self-adhering]EPDM membrane liner conforming to ASTM D 4637, or other waterproof membrane liner material as approved by the roof membrane manufacturer and the Contracting Officer.

PART 3 EXECUTION

3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

a. [Drains,] [curbs,] [control joints,] [expansion joints,] [perimeter walls,] [roof penetrating components,] [and] [equipment supports] are in place.

b. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation.

c. The plane of the substrate does not vary more than 6 mm (1/4 inch) within an area 3 by 3 meters (10 by 10 feet) when checked with a 3 meter (10 foot) straight edge placed anywhere on the substrate.

d. Substrate is sloped to provide positive drainage.

e. Walls and vertical surfaces are constructed to receive counterflashing, and will permit mechanical fastening of the base flashing materials.

f. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inches above finished roofing surface.

****
NOTE: Coordinate with Section 06100 ROUGH CARPENTRY to ensure that preservative treatment is specified for wood which will be in contact with roofing components.
****

g. Pressure-preservative treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. [Embedded nailers are flush with deck surfaces.] [Surface-applied nailers are the same thickness as the roof insulation.]

h. Avoid contact of EPDM materials with fire retardant treated wood, except as approved by the roof membrane manufacturer and Contracting Officer.

****
NOTE: Wood cants should also be used where there are non-wall supported flashings at wood blocking forming area dividers and expansion joints, and at wall and roof intersections where roof deck is not supported on wall.
****

i. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than 89 mm (3-1/2 inches).

****
NOTE: Include venting provision for wet fill substrate materials like lightweight cellular concrete.
****

[j. Venting is provided in accordance with the following:

[(1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.]

[(2) Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.]

[(3) Vapor pressure relief vents: Holes equal to the outside diameter of vents are provided through the insulation where vents are required. Space vents in accordance with membrane manfacturer's recommendations.]]

[k. Exposed nail heads in wood substrates are properly set. Warped and split [boards] [sheets] have been replaced. There are no cracks or end joints 6 mm (1/4 inch) in width or greater. [Joints in plywood substrates are taped or otherwise sealed to prevent air leakage from the underside.]]

[l. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 6 mm (1/4 inch) in width. Insulation is attached as specified in Section 07220 ROOF AND DECK INSULATION. Insulation is being roofed over on the same day the insulation is installed.]

3.2 APPLICATION

****
NOTE: Coordinate application method with paragraphs "Description of Roof Membrane System" and appropriate subparagraph under "EPDM Sheet Roofing".
****

Apply entire EPDM sheet utilizing [fully adhered] [loose-laid ballasted] [mechanically fastened] [combined fully adhered and mechanically fastened] application method[s]. Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer.

3.2.1 Special Precautions

a. Do not dilute coatings or sealants unless specifically recommended by the materials manufacturer's printed application instructions. Do not thin liquid materials with cleaners used for cleaning EPDM sheet.

b. Keep liquids in airtight containers, and keep containers closed except when removing materials.

c. Use liquid components, including adhesives, within their shelf life period. Store adhesives at 15 to 27 degrees C (60 to 80 degrees F) prior to use. Avoid excessive adhesive application and

adhesive spills, as they can be destructive to some elastomeric sheets and insulations; follow adhesive manufacturer's printed application instructions. Mix and use liquid components in accordance with label directions and manufacturer's printed instructions.

d. Provide clean, dry cloths or pads for applying membrane cleaners and cleaning of membrane

e. Do not use heat guns or open flame to expedite drying of adhesives or primers.

f. Require workmen and others who walk on the membrane to wear clean, soft-soled shoes to avoid damage to roofing materials.

g. Do not use equipment with sharp edges which could puncture the EPDM sheet.

h. Shut down air intakes and any related mechanical systems and seal open vents and air intakes when applying solvent-based materials in the area of the opening or intake. Coordinate shutdowns with the Contracting Officer.

3.2.2 EPDM Sheet Roofing

Roof membrane sheet shall be watertight and free of contaminants and defects that might affect serviceability. Edges of sheet shall be uniform, straight, and flat. Unroll EPDM sheet roofing in position without stretching membrane. Inspect for holes. Remove sections of EPDM sheet roofing that are damaged. Allow sheets to relax minimum 30 minutes before seaming. Lap sheets as specified, to shed water, and as recommended by the roof membrane manufacturer's published installation instructions for the application required but not less than 75 mm (3 inches) in any case.

3.2.3 Application Method

[3.2.3.1 Combined Fully Adhered and Mechanically Fastened Application

****
NOTE: Delete this paragraph unless a combined fully adhered and mechanically fastened application is specified. Where this paragraph is included, include and edit the fully adhered and mechanically fastened membrane application paragraphs to remove redundancy of requirements.
****

Install combined fully adhered and mechanically fastened roof membrane system in the manner specified and including seaming, perimeter and infield fastening and half sheets.

][3.2.3.2 Fully Adhered Membrane Application

****
NOTE: Delete this paragraph unless a fully adhered or combined fully adhered and mechanically fastened application is specified.

Delete the bracketed option in the fourth sentence

and delete the fifth sentence when non-standard adhesives are specified such as sprayed foam or hot asphalt used with fleece-backed membrane.

****

Layout membrane and side lap adjoining sheets in accordance with membrane manufacturer's printed installation instructions. Allow for sufficient membrane to form proper membrane terminations. Remove dusting agents and dirt from membrane and substrate areas where bonding adhesives are to be applied. Apply specified adhesive evenly and continuously to substrate [and underside of sheets] at rates recommended by the roof membrane manufacturer's printed application instructions. When adhesive is spray applied, roll with a paint roller to ensure proper contact and coverage. Do not apply bonding adhesive to surfaces of membrane in seam or lap areas. Allow adhesive to flash off or dry to consistency prescribed by manufacturer before adhering sheets to the substrate. Roll each sheet into adhesive slowly and evenly to avoid wrinkles; broom or roll the membrane to remove air pockets and fishmouths and to ensure full, continuous bonding of sheet to substrate. Form field lap splices or seams as specified. Check all seams and ensure full lap seal. Apply lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

][3.2.3.3 Mechanically Fastened Membrane Application

****

NOTE: Delete this paragraph unless a mechanically fastened or combined fully adhered and mechanically fastened application is specified.

Membrane side lap depends on method of mechanical attachment, wind resistance testing of the specific system provided, and requirements of the membrane manufacturer. Generally, attachments shall be positioned such that minimum 75 mm (3 inch) seam width remains beyond the outer edge of the attachment plate or batten strip. Fastener and plate attachment typically requires 175 mm to 200 mm (7 to 8 inch) membrane overlap. Batten attachment typically requires 100 mm to 150 mm (4 to 6 inch) membrane overlap.

****

Layout membrane and lap adjoining sheets in accordance with membrane manufacturer's printed instructions such that a minimum [75 mm (3 inch)][_____] seam width is maintained and seam width is as required by tested assembly meeting specified wind resistance requirements. Account for additional overlap required for placement of fasteners and plates or battens beyond the closed seam. Allow for sufficient membrane to form proper membrane terminations. Ensure membrane is free of wrinkles and ridges in the installation. Mechanically secure the membrane sheet with specified fasteners in the lap area. Space fasteners as required to provide the wind uplift resistance specified and in accordance with submitted fastener patterns for the field, corner, and perimeter roof areas. Set fasteners firm to plate or batten. Form field lap splices or seams as specified. Check all seams and ensure full lap seal. Apply lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

][3.2.3.4 Ballasted Membrane Application

****
NOTE: Delete this paragraph unless a loose-laid ballasted application is specified.
****

Layout membrane and side lap adjoining sheets minimum 100 mm (4 inches) and according to membrane manufacturer's printed instructions. Allow for sufficient membrane to form proper membrane terminations. Ensure membrane is free of wrinkles and ridges in the installation. Form field lap splices or seams as specified and of width required by the membrane manufacturer's installation instructions. Check seams to ensure continuous seal before proceeding with further work. Apply continuous lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

]3.2.4 Tape Seams / Lap Splices

****
NOTE: Seam tape shall be the primary seaming, or lap splice, technique. Adhesive seaming in the field of the roof shall only be specified with Government approval. Adhesive seaming of flashing in limited areas may be required where tapes are difficult to apply.
****

Field form seams, or lap splices, with seam tape in accordance with membrane manufacturer's printed instructions and as specified. Clean and prime mating surfaces in the seam area. After primer has dried or set in accordance with membrane manufacturer's instructions, apply seam tape to bottom membrane and roll with a 75 mm to 100 mm (3 inch to 4 inch) wide smooth silicone or steel hand roller, or other manufacturer approved rolling device, to ensure full contact and adhesion of tape to bottom membrane. Tape end laps shall be minimum 25 mm (1 inch). Roll top membrane into position to check for proper overlap and alignment. Remove release paper from top of seam tape and form seam splice. Ensure top membrane contact with seam tape as release paper is removed. Roll the closed seam with a smooth silicone or steel hand roller, rolling first across the width of the seam then along the entire length, being careful not to damage the membrane. Apply minimum 225 mm (9 inch) long strip of membrane-backed flashing tape over T-intersections of roof membrane. Roll tape to ensure full adhesion and seal over T-joint.

[3.2.5 Adhesive Seams / Lap Splices

****
NOTE: Include the bracketed option in the first sentence as the norm. Government approval required for adhesive formed seams in the field of the roof.
****

Field-applied adhesive formed seams shall only be used [in flashing areas] where approved by the membrane manufacturer and the Contracting Officer. Adhesive formed seams shall not be used for field of roof membrane seaming[, except as approved by the membrane manufacturer and the Contracting Officer]. Thoroughly and completely clean mating surfaces of materials throughout the lap area. Remove all dirt, dust, and contaminants and allow to dry. Apply primer as recommended by the membrane

manufacturer. Apply splice adhesive with a 75 mm to 100 mm (3 inch to 4 inch) wide, 13 mm (1/2 inch) thick, solvent-resistant brush in a smooth, even coat with long brush strokes. Bleed out brush marks. Do not apply adhesive in a circular motion. Simultaneously apply adhesive to both mating surfaces in an approximate 0.63 mm to 0.75 mm (0.025 to 0.030 inch) wet film thickness, or other thickness as recommended by the roof membrane manufacturer's printed instructions. Allow the splice adhesive to set-up in accordance with membrane manufacturer's instructions. Perform manufacturer recommended field check to test for adhesive readiness prior to closing seam. Apply a 3 mm to 6 mm (1/8 to 1/4 inch) bead of in-seam sealant approximately 13 mm (1/2 inch) from the inside edge of the lower membrane sheet prior to closing the seam. Ensure the in-seam sealant does not extend onto the splice adhesive. Maintain the full adhered seam width required. Roll the top membrane onto the mating surface. Roll the seam area with a 50 mm to 75 mm (2 inch to 3 inch) wide, smooth silcone or steel hand roller. A minimum of 2 hours after joining sheets and when the lap edge is dry, clean the lap edge with membrane manufacturer recommended cleaner and apply a 6mm to 9 mm (1/4 inch to 3/8 inch) bead of lap sealant centered on the seam edge. With a feathering tool, immediately feather the lap sealant to completely cover the splice edge, leaving a mound of sealant over the seam edge. Lap sealant shall be applied to all adhesive formed seams.

]3.2.6 Perimeter Attachment

****
NOTE: All application methods of EPDM membranes require mechanical fastening of the membrane to wood nailers at the roof perimeters, at angular penetrations, or at circular penetrations, except roof drains greater than 18 inches in diameter.
****

Adhesive bond or mechanically secure roof membrane sheet at roof perimeter in a manner to comply with wind resistance requirements and in accordance with membrane manufacturer's printed application instructions. When adhesively bonding a mechanically fastened system in perimeter areas, the perimeter boundary of the adhesive bond shall be the same as the boundary required for additional perimeter mechanical fastening to meet wind resistance requirements.

3.2.7 Securement at Base Tie-In Conditions

Mechanically fasten the roof membrane at penetrations, at base of curbs and walls, and at all locations where the membrane turns and angle greater than 4 degrees (1:12). Space fasteners a maximum of 12 inches on center, except where more frequent attachment is required to meet specified wind resistance or where recommended by the roof membrane manufacturer. Flash over fasteners with a fully adhered layer of material as recommended by the roof membrane manufacturer's printed data.

3.2.8 Membrane Flashing

****
NOTE: Coordinate flashing requirements with Section 07600 and details. Ensure Section 07600 is properly edited for application to EPDM roofing systems and for inclusion of flashing conditions of the project.
****

Install flashing and flashing accessories as the roof membrane is installed. Apply flashing to cleaned surfaces and as recommended by the roof membrane manufacturer and as specified. Utilize cured EPDM membrane flashing and prefabricated accessory flashings to the maximum extent recommended by the roof membrane manufacturer. Uncured flashing material shall be limited to reinforcing inside and outside corners and angle changes in plane of membrane, and to flashing scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical. Extend base flashing not less than 8 inches above roofing surface and as necessary to provide for seaming overlap on roof membrane as recommended by the roof membrane manufacturer. Seal flashing membrane for a minimum of 75 mm (3 inches) on each side of fastening device used to anchor roof membrane to nailers. Completely adhere flashing sheets in place. Seam flashing membrane in the same manner as roof membrane, except as otherwise recommended by the membrane manufacturer's printed instructions and approved by the Contracting Officer. Reinforce all corners and angle transitions by applying uncured membrane to the area in accordance with roof membrane manufacturer recommendations. Mechanically fasten top edge of base flashing with manufacturer recommended termination bar fastened at maximum 300 mm (12 inches) on center. Sheet metal flashing shall be installed over the termination bar in the completed work. Mechanically fasten top edge of base flashing for all other terminations in a manner recommended by the roof membrane manufacturer. Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components. Metal flashing are specified under Section 07600, "Flashing and Sheet Metal."

[3.2.8.1 Flashing at Roof Drain

****
NOTE: Include this paragraph when roof drains are indicated.
****

Roof drains are specified in Section 15400N PLUMBING SYSTEMS. Flashing for roof drains, are specified in Section 07600 FLASHING AND SHEET METAL. Provide a tapered insulation sump into the drain bowl area. Tapered slope shall not exceed 18 degrees (4:12) for unreinforced membrane and 5 degrees (1:12) for reinforced membrane. Tapered insulation shall have surface suitable for adhering membrane in the drain sump area. Avoid field seams running through or within 600 mm (24 inches) of roof drain, or as otherwise recommended by the roof membrane manufacturer. Adhere the membrane to the tapered in the drain sump area. Apply water block mastic and extend membrane sheets over edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Membrane shall be free of wrinkles and folds in the drain area. Securely clamp membrane in the flashing clamping ring. Ensure membrane is cut to within 20 mm (3/4 inch) of inside rim of clamping ring to maintain drainage capacity. Do not cut back to bolt holes.

][3.2.9 Pre-fabricated Curbs

Prefabricated curbs shall be securely anchored to nailer or other base substrate and flashed with EPDM membrane flashing materials.

3.2.9.1 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories, or isolated paver block, are set on the membrane, adhere reinforced membrane or walkpad material, as recommended by the roof membrane manufacturer, to bottom of accessories prior to setting on roofing membrane. Specific method of installing set-on accessories must permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

3.2.9.2 Lightning Protection

Lightning protection system components shall be flashed or attached to the roof membrane in a manner acceptable to the roof membrane manufacturer.

]3.2.10 Roof Walkpads

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the roof membrane manufacturer's printed instructions. Provide minimum 150 mm (6 inch) separation between adjacent walkpads to accommodate drainage.

[3.2.11 Elevated Metal [Walkways] [and] [Platforms]

Install over completed roof system in accordance with Section 05500. Provide for protection of roof membrane by placing reinforced membrane or walkpad material, or other material approved by the Contracting Officer, at all surface bearing support locations.

]3.2.12 Isolated Paver Blocks

Install paver blocks where indicated and as necessary to support surface bearing items traversing the roof area. Paver block shall be set on a layer of reinforced membrane or walkpad applied over the completed roof membrane.

[3.2.13 [Stone][Paver] Ballast [Paver System]

****

NOTE: Indicate the appropriate ballast type. Indicate ballast weight required based on wind loading conditions.

In some instances paver ballast may be used in perimeter and corner areas in combination with stone ballast in the field of the roof. If so, include the [Paver] option in item "a".

Where elevated paver system is required, refer to as "Paver System" in the paragraph title. Delete bracketed options related to protection mat installation, stone ballast, and coverage rates. The paver type and weight shall be as specified in Part 2.

****

Complete all membrane and membrane flashing work, including inspection and repair of all membrane and seams in the area of [ballast][paver]

application prior to applying [ballast][paver] system. [Install protection mat over roof membrane in accordance with roof membrane manufacturer's recommendations. Provide minimum 75 mm (3 inch) side laps and 150 mm (6 inch) end laps. Turn mat up vertical surfaces to extend 50 mm (2 inches) above ballast. Immediately after placement of protection mat,][Install and level pedestal system in accordance with manufacturer's requirements and] apply [stone][and][paver] [ballast][system.] [at the following coverage rates:

a. [Pavers:][_____] pounds per square foot for perimeter and corner areas of roof.

b. [_____] pounds per square foot for field of roof.

In no case apply ballast at a coverage rate less than 10 pounds per square foot or more than[_____] pounds per square foot.]

]3.2.14 Correction of Deficiencies

Where any form of deficiency is found, additional measures shall be taken as deemed necessary by the Contracting Officer to determine the extent of the deficiency and corrective actions shall be as directed by the Contracting Officer.

3.2.15 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.3 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied membrane roofing system from water intrusion.

[3.3.1 Water Cutoffs

****
NOTE: Include this paragraph when roof insulation is a substrate for the EPDM sheet roofing.
****

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of the roof membrane system in an effective manner. [Seal off flutes in metal decking along the cutoff edge.] Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

]3.3.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Remove temporary flashing before applying permanent flashing.

3.3.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits

of roof construction. Use rubber-tired equipment for roofing work.

3.4 FIELD QUALITY CONTROL

3.4.1 Construction Monitoring

During progress of the roof work, Contractor shall make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

a. Equipment is in working order. Metering devices are accurate.

b. Materials are not installed in adverse weather conditions.

c. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

The proper number, type, and spacing of fasteners are installed.

Materials comply with the specified requirements.

All materials are properly stored, handled and protected from moisture or other damages. Liquid components are properly mixed prior to application.

Membrane is allowed to relax prior to seaming. Adhesives are applied uniformly to both mating surfaces and checked for proper set prior to bonding mating materials. Mechanical attachments are spaced as required[, including additional fastening of membrane in corner and perimeter areas as required.]

Membrane is properly overlapped.

Membrane seaming is as specified and seams are hand rolled to ensure full adhesion and bond width. [In-seam sealant is applied when adhesive seams are used in the field of the roof.] All seams are checked at the end of each work day.

Applied membrane is inspected and repaired as necessary prior to ballast installation.

[Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths.]

Installer adheres to specified and detailed application parameters.

Associated flashings and sheet metal are installed in a timely manner in accord with the specified requirements.

Ballast is within the specified weight range.

Temporary protection measures are in place at the end of each work shift.

[3.4.2 Manufacturer's Inspection

****
NOTE: Include this paragraph when manufacturer's inspection of work is required. Select desired frequency of manufacturer inspection and coordinate with text of optional 2nd and 3rd bracketed sentences.
****

Manufacturer's technical representative shall visit the site a minimum of three [_____] times [once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place.[Inspections shall occur during the first 20 squares of membrane installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections shall not exceed one for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors shall be performed as requested by the Contracting Officer.] After each inspection, a report, signed by the manufacturer's technical representative shall be submitted to the Contracting Officer within 3 working days. The report shall note overall quality of work, deficiencies and any other concerns, and recommended corrective action.

][3.4.3 Roof Drain Test

****
NOTE: Include this paragraph when roof drains are required. Consult with structural engineer to verify loading capability of roof structural system.
****

After completing roofing but prior to Government acceptance, perform the following test for watertightness. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

]3.5 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the roof membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.6 INFORMATION CARD

For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm (0.032) inch thick aluminum card for exterior display. Card shall be 215 mm by 275 mm (8 1/2 by 11 inches) minimum. Information card shall identify facility name and number;

location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. The card shall be a minimum size of 215 mm by 275 mm (8 1/2 by 11 inches). Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --