UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

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BUILT-UP BITUMINOUS WATERPROOFING

02/16

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USACE / NAVFAC / AFCEC / NASA | **UFGS-07 12 00 (February 2016)**

Preparing Activity: NAVFAC | **Superseding UFGS-07 12 00 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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SECTION 07 12 00

BUILT-UP BITUMINOUS WATERPROOFING
02/16

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NOTE: This guide specification covers the requirements for built-up bituminous membrane waterproofing.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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NOTE: This specification is intended for use where local practice and experience indicates, or where International Code Council (ICC), International Building Code (IBC), section Dampproofing and Waterproofing allows, that protection against hydrostatic pressure or conditions of excessive dampness can be achieved by using membrane waterproofing. For other acceptable methods of waterproofing, refer to the appropriate unified facilities guide specification.

NOTE: Verify compliance of the project with ICC IBC section Dampproofing and Waterproofing, particularly article 1805.3 which says "Where the ground water investigation required by Section 1803.5.4 indicates that if a hydrostatic pressure condition exists, and the design does not include a ground water control system as described in Section 1805.1.3, walls and

floors must be waterproofed in accordance with this section". If the project is not compliant with this requirement, do not use this specification section; choose appropriate resilient membrane waterproofing system instead.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

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.

ASTM INTERNATIONAL (ASTM)

ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C726	(2017) Standard Specification for Mineral Wool Roof Insulation Board
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D173/D173M	(2003; R 2011; E 2012) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D449/D449M	(2003; R 2014; E 2014) Asphalt Used in Dampproofing and Waterproofing

ASTM D517	(1998; R 2008) Asphalt Plank
ASTM D1327/D1327M	(2004; R 2020) Standard Specification for Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
ASTM D1668/D1668M	(1997a; R 2014; E 2014) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D2178/D2178M	(2015a) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When

used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

****
NOTE: Prefabricated laminated asphalt membrane waterproofing and copper fabric shower pans may be included as a Contractor's option for shower pans.
****

Manufacturer's Standard Details, G[, [_____]]

Protection Board; G[, [_____]]

[Prefabricated Laminated Asphalt Waterproofing; G[, [_____]]

][Prefabricated Copper Fabric; G[, [_____]]

] Membrane Fabric; G[, [_____]]

Reinforcing Fabric; G[, [_____]]

SD-06 Test Reports

****
NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is constructed within 160 kilometers 100 miles of a bulk liquid asphalt manufacturer's plant.
****

Bulk Liquid Asphalt Certified Laboratory Reports; G[, [_____]]

****
NOTE: Certificates are required for verification of materials complying with UFC 1-200-02 High Performance and Sustainable Building Requirements; edit as necessary.
****

SD-07 Certificates

Membrane Fabric; G[, [_____]]

Reinforcing Fabric; G[, [_____]]

Protection Board; G[, [_____]]

[Prefabricated Laminated Asphalt Waterproofing; G[, [_____]]

][Prefabricated Copper Fabric; G[, [_____]]

] Certificates of Compliance; G[, [_____]]

SD-08 Manufacturer's Instructions

Installation Instructions

SD-11 Closeout Submittals

Asphalt Shipment Records

Certificates of Compliance; S

Volatile Organic Compounds (VOC) Contents; S

Recycled Content; S

1.3 MANUFACTURER'S DETAIL

Submit manufacturer's standard details indicating methods of attachment and spacing, transition and termination conditions, installation details.

1.4 ENVIRONMENTAL CONDITIONS

Apply the primers and waterproofing specified herein when the ambient temperature is above 4 degrees C 40 degrees F.

1.5 DELIVERY AND STORAGE

1.5.1 Materials Packaging

Deliver materials in bundles, rolls, and sealed containers in accordance with manufacturer's printed handling instructions and bearing manufacturer's original labels. Material labels indicate dates for use or shelf life; remove outdated material, damaged, and deteriorated material from the jobsite. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth.

1.5.2 Materials Storage

1.5.2.1 Asphalt

Protect asphalt from freezing. Store asphalt in a weathertight enclosure, free from contact with soil. Store and maintain at not less than 10 degrees C 50 degrees F for at least 24 hours before use.

1.5.2.2 Reinforcement Fabrics

Handle and store reinforcement fabrics in accordance with manufacturer's printed instructions. Protect fabrics from moisture damage and absorption in a weathertight enclosure or off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup therefore do not use them to cover waterproofing materials.

[1.5.3 Bulk Liquid Asphalt

****

NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is constructed within 160 kilometers 100 miles of a bulk liquid asphalt manufacturer's plant.

****

Deliver bulk liquid asphalt in fully insulated, heated transport tanker vehicles with circulating pump devices. Maintain the temperature of the liquid asphalt between 204 and 232 degrees C 400 and 450 degrees F during storage, provided the transport and storage time does not exceed 12 hours. If the transport and storage time exceeds 12 hours, lower the temperature to between 150 and 165 degrees C 300 and 325 degrees F at the time the 12 hours are exceeded. Use liquid asphalt within 36 hours after loading in the transport tanker. Provide bulk liquid asphalt certified laboratory reports for results of tests performed on asphalt delivered to the construction site by bulk liquid asphalt tankers.

1.5.3.1 Asphalt Shipment Records

Obtain from the bulk liquid asphalt manufacturer a certified shipping statement for each asphalt shipment. Following completion of the waterproofing installation, submit certificates to the Contracting Officer for verification and recordkeeping. Indicate the following:

a. Manufacturer's name

b. Specification identification of asphalt

c. Quantity of asphalt

d. Documentation of transport tanker having been empty and free of foreign and incompatible materials at the time of loading

e. Date, time, and temperature of asphalt at time of loading

]1.6 Flame Heated Equipment

1.6.1 Fire Protection

Locate melt kettles no closer than 8 meters 25 feet from buildings or combustible materials. Provide and maintain two approved 4-A:40-B:C fire extinguishers within 8 meters 25 feet of each operating kettle. Fire extinguishers, operations and locations must comply with NFPA 1 Section Tar Kettles. Equip asphalt (tar) kettles with tight fitting lids.

1.6.2 Operational Requirements

Equip kettles with automatic thermostatic control capable of maintaining asphalt temperature. Calibrate and maintain controls in working order for the duration of the work. Equip kettles with means of agitation and ensure they are operating as necessary to produce a controlled uniform temperature throughout kettle contents to prevent spot heating. Do not heat contents above flash point. Do not place flame heated equipment on the roof.

1.6.3 Drippage of Bitumen

Seal joints in and at edges as necessary to prevent drippage of asphalt into the building or onto adjacent surfaces.

PART 2 PRODUCTS

****

NOTE: Specify sustainable materials in accordance

with UFC 1-200-02 High Performance and Sustainable Building Requirements. Reduce the environmental impact of materials by specifying products that have a lesser or reduced effect on human health and the environment such as low emitting materials and materials with high recycled content. Consider product life cycle and travel distance when compared with competing products or services serving the same purpose.

****

2.1 PRODUCT SUSTAINABILITY CRITERIA

Where allowed by performance criteria:

2.1.1 Reduce Volatile Organic Compounds (VOC) Contents

Provide products with reduced VOC content and provide certificates of compliance in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

2.1.2 Recycled Content

Provide products with recycled content and provide certificates of compliance in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph RECYCLED CONTENT.

2.2 BITUMEN

****

NOTE: Type I is suitable for use below grade under uniformly moderate temperature conditions (foundations, tunnels, and subways); Type II is suitable for use above grade where not exposed to temperatures exceeding 50 degrees C 122 degrees F (railroad bridges, culverts, retaining walls, tanks, dams, conduits, and spray decks); Type III is suitable for use above grade on vertical surfaces exposed to direct sunlight or temperatures above 50 degrees C 122 degrees F.

****

Asphalt; ASTM D449/D449M, Type [I] [II] [III].

2.3 BITUMINOUS PLASTIC CEMENT

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NOTE: Type I is made from asphalts characterized as self-healing adhesive and ductile and should be used where Types I and II asphalt (STM D449/D449M) are used. Type II cement has a high softening point and has relatively low ductility and should be used where Type III asphalt (ASTM D449/D449M) is used.

****

ASTM D4586/D4586M, Type [I] [II] for asphalt.

2.4 MEMBRANE FABRIC

****
NOTE: One of the following reinforcement fabrics may be selected by Designer or all fabrics may remain in section as Contractor options.
****

The following requirements apply:

Felt or Fabric Material	Saturant or Impregnant	Specification
Glass (felt) mat	Asphalt	ASTM D2178/D2178M, Type III
Cellulose fiber mat-based (organic) felt	Asphalt	ASTM D226/D226M
Reinforcing glass fabric	Asphalt	ASTM D1668/D1668M REV A, Type I
Reinforcing cotton fabric	Asphalt	ASTM D173/D173M
Reinforcing woven burlap fabric	Asphalt	ASTM D1327/D1327M

2.4.1 Cotton Fabrics

Provide cotton fabrics woven entirely of cotton in accordance with ASTM D173/D173M and thoroughly and uniformly saturated with asphalt.

2.4.2 Woven Burlap Fabrics

Provide woven burlap fabrics in accordance with ASTM D1327/D1327M composed of 100 percent jute fiber and two cotton threads at each selvage, and thoroughly and uniformly saturated with asphalt. Fabric cannot be completely closed or sealed by the process of saturation and is to have sufficient porosity to allow successive moppings of plying asphalt to seep through. Fabric surface cannot be coated or covered with talc or any other substance that interferes with the adhesion between fabric and plying asphalt. Provide fabric surface uniformly smooth and free of irregularities, folds, knots, ragged or untrue edges, breaks, cracks, and other visible defects.

2.5 NAILS

Provide galvanized roofing nails or nails in accordance with fabric and protection board manufacturer's written recommendations. If fabric contains metal, provide nails as necessary to avoid electrolytic action due to proximity of dissimilar metals.

2.6 PRIMER

ASTM D41/D41M for asphalt.

2.7 PROTECTION BOARD

ASTM D517, plain, asphalt plank; ASTM C208, construction grade building board, 12.7 mm 1/2 inch thick, asphalt saturated or coated; ASTM C726, 11

mm 7/16 inch thick, covered on one side with waterproof paper or asphalt-saturated felt.

[2.8 PREFABRICATED LAMINATED ASPHALT WATERPROOFING

****
NOTE: Prefabricated laminated asphalt membrane waterproofing and copper fabric shower pans may be included as a Contractor's option for shower pans.
****

Provide prefabricated laminated construction consisting of plies of kraft paper bonded by layers of bitumen reinforced with layers of fibrous glass and one layer of polyethylene facing. MProvide material and weight as follows:

a. One layer polyethylene facing, 13.6 kgs 30 lbs. ream weight; seven intermediate layers of bituminous-saturated kraft paper.

b. Seven layers of bitumen.

c. Three layers of 8.8 per 10 mm 20.20 fibrous glass mesh.

d. Bottom "cushion" sheet of crepe kraft paper.

e. Total minimum weight of materials of 1.95 kgs per square meter 0.40 lbs. per square foot.

f. Minimum bituminous content of 75 percent by weight.

g. Permanently pliable and impervious to mildew and other organic attack, including termites and rodents.

[h. Puncture resistant and self sealing.

]][2.9 PREFABRICATED COPPER FABRIC SHOWER PANS

****
NOTE: Prefabricated laminated asphalt membrane waterproofing and copper fabric shower pans may be included as a Contractor's option for shower pans.
****

A factory fabricated sheet of copper bonded to and between two layers of asphalt impregnated fiberglass or cotton fabric. Copper sheet to weigh [.92] [1.52] [2.14] kilograms per square meter [3] [5] [7] ounces per square foot.

]2.10 WOOD NAILERS

****
NOTE: Where treated wood is specified in areas to be waterproofed, waterproofing should not be applied in contact with wood treatment preservatives which may leach through and destroy the effectiveness of the asphalt.
****

Specified in Section 06 10 00 ROUGH CARPENTRY.

PART 3 EXECUTION

3.1 INSPECTION OF SURFACES

Before starting the work, inspect all surfaces that must be waterproofed to determine if in satisfactory condition. Check the location and setting of all embedded items. Place backing and blocking and perimeter framing for recessed items as required by the various trades on the project. Complete conduit, piping, and other required rough-in. Notify the Contracting Officer of serious defects or conditions that prevent satisfactory application. Start application after such defects and conditions have been corrected.

3.2 PREPARATION OF SURFACES

****

NOTE: Concrete surfaces to which membrane waterproofing is to be applied should be moist cured. Waterproofing should not be applied to surfaces which have been cured with membrane-forming compounds or other coatings which may reduce the bonding of the waterproofing to the concrete. Masonry over which waterproofing is to be applied should be specified to have flush mortar joints.

****

Ensure surfaces to receive treatment are clean and dry, smooth and free from deleterious and excess materials and projections. [Ensure masonry surfaces are free of oil, grease, dirt, laitance, loose and broken material, frost, debris and other contaminants.] [Ensure concrete surfaces are properly cured, free of release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Thoroughly wet holes, joints, cracks, and voids in concrete with water, then fill with Portland cement mortar, strike flush, and permit to dry.] Cut off or grind high spots smooth. [Ensure mortar joints in masonry walls are flush and free of extraneous mortar.] [Ensure metal surfaces are dry and free of rust, scale, loose paint, oil, grease, dirt, frost and debris.] Coat surfaces to receive asphalt membrane waterproofing with a priming coat of asphalt primer. Apply priming coat at a rate of not less than 4 liters per 10 square meters one gallon per 100 square feet, covering the entire waterproofedsurface. Allow primer to dry per manufacturer's printed instructions before applying waterproofing.

3.3 APPLICATION

3.3.1 Building Envelope Requirements

Provide a continuous waterproofing system at all material and building transitions. Lap, wrap, fasten and seal products in accordance with manufacturer's printed instructions. Locate waterproofing components within envelope assemblies in locations indicated on the Drawings. Envelope assembly variations are not permitted without written approval from the Contracting Officer's Representative.

****

NOTE: Prefabricated laminated asphalt membrane waterproofing and copper fabric shower pans may be included as a Contractor's option for shower pans.

****

3.3.2 General Installation Requirements

Provide waterproofing where indicated. [At the Contractor's option, shower pans of [prefabricated laminated asphalt waterproofing] [or] [prefabricated copper fabric shower pan], as specified herein, may be used instead of bituminous membrane waterproofing.] [Provide ventilation for enclosed spaces when using bituminous membrane waterproofing.]

3.3.3 Prefabricated Pan

****

NOTE: Prefabricated laminated asphalt membrane waterproofing and copper fabric shower pans may be included as a Contractor's option for shower pans.

****

Provide [prefabricated laminated asphalt waterproofing] [or] [prefabricated copper fabric shower pan]. Form each shower pan from a single piece of the laminated material without joints and with no opening except for shower drain. Provide pan in accordance with manufacturer's printed instructions.

3.3.4 Protection of Surrounding Areas

Before starting waterproofing work, protect surrounding areas and surfaces from spillage and migration of asphalt onto other work. Provide non-combustible protective coverings at surfaces adjacent to hoists and kettles. Lap protective coverings at least 150 mm 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of asphalt work.[Protect drains and conductors from clogging with asphalt.]

3.3.5 Heating and Application of Bitumen Coatings

****

NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is constructed within 160 kilometers 100 miles of a bulk liquid asphalt manufacturer's plant.

****

Heat solid bitumen in kettle equipped with an automatic heating device or control unit for positive control of the specified temperature. Provide an accurate and clearly readable thermometer on all kettles. [Bulk liquid asphalt may be heated using the heating equipment in the transport tanker vehicle or transferred to kettles and heated as specified for solid bitumen.] Heat bitumen to flow freely but not above 190 degrees C 375 degrees F. Apply bitumen over the primer, between each ply and as a top coating at the rate of not less than 10 kilograms 20 pounds of asphalt per 10 square meters 100 square feet of surface.

[3.3.6 Membrane Waterproofing

****

NOTE: Where waterproofing must be applied to concrete or masonry walls where settlement is likely to occur, use fabric type instead of felt type.

Where rough masonry walls must be waterproofed, unless such walls can be made reasonably smooth with parging of cement mortar, only fabric type should be specified. To determine number of plies of membrane for vertical application and number of moppings required for different water pressures:

NOTE: Do not install this system in waterlogged soils. Add requirements for drying/dewatering and written verification of dryness (moisture testing) prior to installation; coordinate with Division 31 dewatering requirements.

Head of Water (in millimeters) (in feet)	**Plies of Membrane**	**Moppings**
300-1050 1-3	**2**	**3**
1051-3200 4-10	**3**	**4**
3201-7000 11-25	**4**	**5**
7001-15000 20-50	**5**	**6**

****

3.3.6.1 Below Grade Wall Waterproofing

Provide [1-ply] [2-ply] [3-ply] [4-ply] [5-ply] hot-applied asphalt membrane system for foundation walls. Install fabrics in accordance with manufacturer's printed installation instructions. Caulk joints before applying primer. Apply primer at a rate of 0.2 liters per square meter 1/2 gallon per 100 square feet. Overlap fabrics at ends and stagger a minimum of[250 mm10 inch for 1-ply] [480 mm19 inch for 2-ply] [610 mm24 inch for 3-ply] [685 mm27 inch for 4-ply] [750 mm30 inch for 5-ply] system. End-to-end taping is not acceptable. Firmly embed each fabric in a solid uniform coating of hot asphalt at a rate of [0.98 kg per square meter] [20 lbs. per 100 square feet] [_____] kg per square meter [_____] lbs. per 100 square feet. Allow asphalt to penetrate each fabric and to provide required adhesion. Avoid excessive applications of asphalt between fabrics in order to prevent slippage. Provide waterproofing system consisting of two or more fabrics with fabric reinforcement at corners, angles, over construction joints, and in locations where subject to increased stress.

[3.3.6.2 Floor Waterproofing

Apply primer at a rate of 0.2 liters per square meter 1/2 gallon per 100 square feet. Do not allow primer to puddle. Confirm primer is dry to the touch before application of asphalt. Where slab abuts walls, extend first reinforcing fabric a minimum of 150 mm 6 inches on slabs and 200 mm 8 inches on walls. At vertical corners, extend first fabric a minimum of 125 mm 5 inches from corners on each side. Lap second fabric with the first

fabric a minimum of 50 mm 2 inches. At floor drains, and elsewhere as indicated, extend fabric into a clamping device, set in a heavy coating of flashing cement, and securely clamp.

]]3.3.7 Fabric Membrane Reinforcement

Provide fabric membranes to reinforce felts at intersections. Provide reinforcement consisting of two plies of fabric membrane cemented in place and to each other with bituminous plastic cement not less than 2 mm 1/16 inch thick for each coating. At the intersection of slabs and vertical surfaces, extend the first ply at least 150 mm 6 inches on the slab and 100 mm 4 inches up the vertical surface. At intersections of two vertical surfaces, extend the first ply at least 250 mm 10 inches on each side of the intersection. Place second ply to lap the first by not less than 50 mm 2 inches.

3.3.8 Keyed Joint Footings

Provide membrane flashing, neatly formed, to the contours of keyed joints in foundation wall footings. Extend flashing to the outside edge of the footing, and turn the flashing down 100 mm 4 inches. Continue the flashing through the joint to the inside of the walls and lap the flashing into the waterproofing membrane under the slab. Protect the flashing until it is lapped by the waterproofing membranes for the subsurface floor slabs and foundation walls. Provide flashing membrane made up of the same number and type materials as the waterproofing membrane or a thermoplastic material compatible with the waterproofing materials, as recommended by the manufacturer in writing.

3.3.9 Flashing Flanges

Prime flashing flanges of pipe sleeves and ducts penetrating the waterproofing membrane. Allow primer to dry. Provide flanges with two fabric membrane collars cemented in place and to each other with bituminous plastic cement. Extend collars 100 and 150 mm 4 and 6 inches, respectively, beyond the edge of the flanges, cover the flanges, and fit the flanges tight against the sleeve. Extend waterproofing connected to work exposed to weather to the back of the adjoining work, or counter flash to form a watertight connection.

3.3.10 Clamping Devices

At floor drains and elsewhere, as indicated, extend membrane into clamping device set in heavy coating of bituminous plastic cement, and clamp securely.

3.3.11 Reglets

Install continuous reglets [as specified in Section [07 60 00 FLASHING AND SHEET METAL] [_____]] to receive the exposed edges of membrane waterproofing. After placement of waterproofing, completely fill reglets with bitumen.

****

NOTE: Coordinate and specify field test protocol in accordance with UFC 3-110-03 Roofing. Electric field vector mapping (EFVM) is recommended for roofing systems covered by other materials that make them inaccessible for subsequent roof inspections.

Systems that would benefit from EFVM are assemblies such as vegetative, paver, and ballasted roofs. EFVM is not required on all roofing projects and due to cost, may increase roof total ownership cost. Evaluate costs versus benefits for the project and specify files test protocol accordingly.
****

3.4 FIELD TEST

3.4.1 Sampling and Testing of Bulk Liquid Asphalt

****
NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is constructed within 160 kilometers 100 milesof a bulk liquid asphalt manufacturer's plant.
****

Notify the Contracting Officer 5 working days prior to the delivery date of asphalt. Take a minimum of one quart sample of each shipment of bulk liquid asphalt when the shipment arrives at the construction site. Obtain samples in the presence of the Contracting Officer using clean one quart, friction lid cans. Label samples to indicate project contract number, location where used on project, and date and time of arrival of shipment from which sample is taken. Give samples to the Contracting Officer for safekeeping until picked up by the testing laboratory. Pay for the testing of the bulk liquid asphalt by an independent testing company. Samples tested that are found not in compliance with specified requirements will be rejected. Remove and replace with new materials all waterproofing components installed with asphalt from which the noncompliant samples were taken, at no cost to the Government.

3.4.2 Test of Membrane Waterproofing

Prior to concealment, plug the drain and cover membrane waterproofing on horizontal surfaces over finished spaces with [75] [100] mm [3] [4] inches of ponded water for 24 hours to test watertightness. Make careful measurement of the water level at the beginning and end of the 24-hour period. If water level falls, drain the water, and thoroughly dry and inspect the waterproofing membrane. Make repairs or replacement, as directed, and repeat test. Do not proceed with work that conceals membrane waterproofing before approval of test results.

3.5 PROTECTIVE COVERING

3.5.1 Vertical Surfaces

Protect membrane waterproofing against which backfill must be placed by providing protective covering pressed into the final mopping while the mopping of bitumen is still hot. Butt edges of protection board against adjacent edges of protection boards. Cover exposed surfaces with a coating of bitumen. Where surfaced fiberboard or mineral fiberboard is used, place surface side facing outward. Fit board around pipes and projections so as to cover the entire surface of the membrane waterproofing.

3.5.2 Horizontal Surfaces

Place protective covering over membrane immediately after application has thoroughly dried. Remove protective covering immediately before proceeding with work that will conceal the membrane waterproofing.

3.6 CLEAN UP

Use a cleaner recommended by the waterproofing manufacturer to clean other work surfaces that are stained with waterproofing material.

3.7 SCHEDULE OF MATERIALS

Some metric measurements in this section are based on mathematical conversion of inch-pound measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

Products	Inch-Pound	Metric
Protection Board	1/2 inch	12.7 mm
	7/16 inch	11 mm
Polyethylene Sheet	30 lbs.	13.6 kg
Laminated Sheet	0.40 lbs. per sq. ft	1.95 kg per sq. m
Copper Sheet	3 oz/sq ft	0.92 kg/sq m
	5 oz/sq ft	1.52 kg/sq m
	7 oz/sq ft	2.14 kg/sq m

-- End of Section --