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USACE / NAVFAC / AFCESA | **UFGS-07121 (May 2005)**

Preparing Activity: NAVFAC | **Replacing**
UFGS 07121N (September 1999)
UFGS 07132A (November 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005
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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07121

BUILT-UP BITUMINOUS WATERPROOFING

05/05

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SECTION 07121

BUILT-UP BITUMINOUS WATERPROOFING
05/05

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NOTE: This guide specification covers the requirements for membrane waterproofing.

Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the 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.
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NOTE: This specification is intended for use where local practice and experience indicates 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.
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PART 1 GENERAL

1.1 REFERENCES

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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.

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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 C 208	(1995; R 2001) Cellulosic Fiber Insulating Board
ASTM C 726	(2000a) Mineral Fiber Roof Insulation Board
ASTM D 1327	(2004a) Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
ASTM D 1668	(1997a) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D 173	(2003) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
ASTM D 2178	(2004) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D 41	(1994; R 2000e1) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 449	(2003) Asphalt Used in Dampproofing and Waterproofing
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos-Free
ASTM D 517	(1998; R 2003) Asphalt Plank

1.2 SUBMITTALS

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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.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [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-03 Product Data

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

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Protection board

[Prefabricated laminated asphalt waterproofing]

[Prefabricated copper fabric]

Membrane fabric

Reinforcing Fabric

SD-06 Test Reports

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

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Liquid asphalt

Submit certified laboratory reports on the results of tests performed on asphalt delivered to the construction site by bulk liquid asphalt tankers.

SD-08 Manufacturer's Instructions

Application

SD-11 Closeout Submittals

Asphalt shipment records

1.3 ENVIRONMENTAL CONDITIONS

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

1.4 DELIVERY AND STORAGE

1.4.1 Packaged Materials

Deliver materials in bundles, rolls, and sealed containers bearing the manufacturer's original labels. Asphalt shall be protected from freezing in a weathertight enclosure. Store materials in an enclosed area free from contact with soil and weather, and maintain at not less than 10 degrees C 50 degrees F for at least 24 hours before use. Reinforcement fabrics shall be protected from moisture damage and moisture absorption in a weathertight enclosure or shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover waterproofing materials. If material is dated for use or shelf life is indicated on the labels, remove outdated material from the jobsite. Damaged or deteriorated materials shall be removed from project site.

[1.4.2 Liquid Asphalt

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

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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. Liquid asphalt shall be used within 36 hours after loading in the transport tanker.

1.4.2.1 Asphalt Shipment Records

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

a. Manufacturer's name

b. Specification identification of asphalt.

c. Quantity of asphalt

d. Transport tanker was empty and free of foreign and noncompatible material at the time of loading

e. Date and time of loading

f. Temperature of asphalt at time of loading

]PART 2 PRODUCTS

2.1 BITUMEN

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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.
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Asphalt; ASTM D 449, Type [I] [II] [III].

2.2 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 (ASTM D 449) are used. Type II cement has a high softening point and has relatively low ductility and should be used where Type III asphalt (ASTM D 449) is used.
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ASTM D 4586, Type [I] [II] for asphalt.

2.3 MEMBRANE FABRIC

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

Felt or Fabric Material	Saturant or Impregnant	Specification
Glass (felt) mat	Asphalt	ASTM D 2178, Type III
Reinforcing glass fabric	Asphalt	ASTM D 1668, Type I
Reinforcing cotton fabric	Asphalt	ASTM D 173
Reinforcing woven burlap fabric	Asphalt	ASTM D 1327

2.3.1 Cotton Fabrics

Cotton fabrics shall be woven entirely of cotton conforming with ASTM D 173,

thoroughly and uniformly saturated with asphalt.

2.3.2 Woven Burlap Fabrics

Woven burlap fabrics shall be composed of 100 percent jute fiber and two cotton threads at each selvage conforming with ASTM D 1327, thoroughly and uniformly saturated with asphalt. The fabric mesh shall not be completely closed or sealed by the process of saturation. Sufficient porosity shall be maintained to allow successive moppings of the plying asphalt to seep through. The surface shall not be coated or covered with talc or any other substances that will interfere with the adhesion between fabric and plying asphalt. The fabric surface shall be uniformly smooth and free of irregularities, folds and knots. The finished woven burlap fabrics shall be free of ragged edges, untrue edges, breaks or cracks, and other visible external defects.

2.4 NAILS

Galvanized roofing nails.

2.5 PRIMER

ASTM D 41 for asphalt.

2.6 PROTECTION BOARD

ASTM D 517, plain, asphalt plank; ASTM C 208, construction grade building board, 12.7 mm 1/2 inch thick, asphalt saturated or coated; ASTM C 726, 11 mm 7/16 inch thick, covered on one side with waterproof paper or asphalt-saturated felt.

[2.7 PREFABRICATED LAMINATED ASPHALT WATERPROOFING

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

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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. Material and weight shall be 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].

][2.8 PREFABRICATED COPPER FABRIC SHOWER PANS

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NOTE: Prefabricated laminated asphalt membrane waterproofing and copper fabric shower pans may be included as a Contractor's option for shower pans.
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A factory-fabricated sheet of copper bonded to and between two layers of asphalt-impregnated fiberglass or cotton fabric. Copper sheet shall weigh [.92] [1.52] [2.14] kilograms per square meter [3] [5] [7] ounces per square foot.

]2.9 WOOD NAILERS

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NOTE: Where treated wood is specified in areas to be waterproofed, waterproofing should not be applied in contact with wood treated with oil or oil-borne preservatives which may leach through and destroy the effectiveness of the asphalt.
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Specified in Section 06100 ROUGH CARPENTRY.

PART 3 EXECUTION

3.1 INSPECTION OF SURFACES

Before starting the work, inspect all surfaces to 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 will prevent satisfactory application. Start application after such defects and conditions have been corrected.

3.2 PREPARATION OF SURFACES

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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.
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Surfaces to be treated shall be clean and dry, smooth and free from deleterious and excess materials and projections. [Masonry surfaces shall be free of oil, grease, dirt, laitance, loose and broken material, frost, debris and other contaminants.] [Concrete surfaces shall be 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, and then carefully fill with portland cement mortar, strike flush, and permit to dry.] Cut off or grind smooth high spots. [Mortar joints in masonry walls shall be flush and free of extraneous mortar.] [Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.] Give surfaces to receive asphalt membrane waterproofing a priming coat of asphalt primer. Apply priming coat at a rate not less than 4 liters per 10 square meters one gallon per 100 square feet, covering the entire surface to be waterproofed. Allow primer to dry before applying waterproofing.

3.3 APPLICATION

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

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Install 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.]

[3.3.1 Prefabricated Pan

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

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[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. Install pan in accordance with the manufacturer's printed instructions.

]3.3.2 Protection of Surrounding Areas

Before starting the waterproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. [Drains and conductors shall be protected from clogging with asphalt.]

3.3.2.1 Fired Kettles

Melt kettles for bitumen shall not be closer than 8 meters 25 feet to buildings or combustible materials. Provide minimum of two 9 kilogram 20 pound ABC all-purpose type extinguishers at melting kettle and area of hot material application. Equip kettles with automatic thermostatic control capable of maintaining asphalt temperature. Controls shall be calibrated and maintained in working order for duration of work. Equip kettles with means of agitation to ensure controlled uniform temperature throughout contents to prevent spot heating. Do not heat contents above flash point.ext

3.3.2.2 Heating and Application of Bitumen Coatings

NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is to be 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.

3.3.3 Membrane Waterproofing

NOTE: Where waterproofing must be applied to concrete or masonry walls in waterlogged soils or 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:

Head of Water (in millimeters)	Plies of Membrane	Moppings
300-1050	2	3
1051-3200	3	4
3201-7000	4	5
7001-15000	5	6

Head of Water (in feet)	Plies of Membrane	Moppings
1-3	2	3
4-10	3	4
11-25	4	5
20-50	5	6

3.3.3.1 Below-Grade Wall Waterproofing

Waterproofing for foundation walls shall consist of a [1-ply] [2-ply] [3-ply] [4-ply] [5-ply] hot-applied asphalt membrane system. Fabrics shall be installed using the "shingle" method. Joints shall be caulked prior to primer applications. Primer shall be applied at a rate of 0.2 liters per square meter (1/2 gallon per 100 square feet). 1/2 gallon per 100 square feet. Fabrics shall be overlapped at ends and staggered a minimum [250 mm 10 inch for 1-ply] [480 mm 19 inch for 2-ply] [610 mm 24 inch for 3-ply] [

685 mm 27 inch for 4-ply] [750 mm 30 inch for 5-ply] system. End-to-end taping is not acceptable. Each fabric shall be firmly embedded into 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) [20] [_____] pounds per 100 square feet by pressing with broom. Fabrics shall not touch fabrics. Hot asphalt shall penetrate each fabric to provide the required adhesion. Asphalt between fabrics shall not be excessive to prevent slippage. Waterproofing system consisting of two or more fabrics shall be provided with fabric reinforcement at corners, angles, over construction joints, and in locations where waterproofing fabrics are subject to unusual stress.

[3.3.3.2 Floor Waterproofing

Primer shall be applied at a rate of 0.2 liters per square meter (1/2 gallon per 100 square feet). 1/2 gallon per 100 square feet. Primer shall not be left in puddles. Primer shall be dry to the touch before application of asphalt. Where slab abuts walls, first reinforcing fabric shall extend 150 mm 6 inches minimum on slab and 200 mm 8 inches on wall. At vertical corners, first fabric shall extend minimum 125 mm 5 inches from corner on each side. Second fabric shall lap the first fabric 50 mm 2 inches minimum. At floor drains, and elsewhere as indicated, the fabric shall extend into a clamping device, set in a heavy coating of flashing cement, and securely clamped.

]3.3.4 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.

3.3.5 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. The flashing membrane shall be 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.

3.3.6 Flashing Flanges

Prime flashing flanges of the sleeves of pipes and ducts penetrating the waterproofing membrane. Allow primer to dry. Strip flanges in 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 connecting with work exposed to the weather back of same, or counter flash to form a

watertight connection.

3.3.7 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.

3.3.8 Reglets

Install continuous reglets [as specified in Section [07600 FLASHING AND SHEET METAL] [_____]] to receive the exposed edges of membrane waterproofing. After placement of waterproofing, completely fill reglets with bitumen.

3.4 FIELD TEST

3.4.1 Sampling and Testing of Bulk Liquid Asphalt

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NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is to be constructed within 160 kilometers 100 milesof a bulk liquid asphalt manufacturer's plant.
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Notify the Contracting Officer one working day 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. The Contractor shall pay for the testing of the bulk liquid asphalt. Samples tested which are found not to be in conformance with specification requirements will constitute grounds for rejection. Remove and replace with new materials all waterproofing installed with asphalt from which the nonconforming samples were taken.

[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. Work which conceals membrane waterproofing shall not proceed before approval of test results.

]3.5 PROTECTIVE COVERING

3.5.1 Vertical Surfaces

Protect membrane waterproofing against which backfill is to 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 which will conceal the membrane waterproofing.

3.6 CLEAN-UP

Surfaces of other work which are stained with waterproofing materials shall be cleaned with a cleaner recommended by waterproofing manufacturer.

3.7 SCHEDULE

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 --