
USACE / NAVFAC / AFCEA UFGS-07121N (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 22 December 2004

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SECTION 07121

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09/99

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SECTION 07121

BUILT-UP BITUMINOUS WATERPROOFING 09/99

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

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: This guide 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 Specifications.

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.

ASTM INTERNATIONAL (ASTM)

| | |
|-------------|--|
| ASTM C 208 | (1995; R 2001) Cellulosic Fiber Insulating Board |
| ASTM C 726 | (2000a) Mineral Fiber Roof Insulation Board |
| ASTM D 1668 | (1997a) Glass Fabrics (Woven and Treated) for 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

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-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.

Protection board

[Prefabricated laminated asphalt waterproofing]

[Prefabricated copper fabric]

Membrane fabric

SD-06 Test Reports

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.

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-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. 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. If material is dated for use or shelf life is indicated on the labels, remove outdated material from the jobsite.

1.4.2 Liquid Asphalt

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

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 D 449, Type [I] [II] [III].

2.2 BITUMINOUS PLASTIC CEMENT

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.

ASTM D 4586, Type [I] [II] for asphalt.

2.3 MEMBRANE FABRIC

The following requirements shall apply:

| <u>Felt or Fabric Material</u> | <u>Saturant or Impregnant</u> | <u>Specification</u> |
|--------------------------------|-------------------------------|-----------------------|
| Glass (felt) mat | Asphalt | ASTM D 2178, Type III |
| Reinforcing glass fabric | Asphalt | ASTM D 1668, Type I |

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

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

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:

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

**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 shall weigh
 [.92] [1.52] [2.14] kilograms per square meter [3] [5] [7] ounces per
 square foot.

]2.9 WOOD NAILERS

**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.**

Specified in Section 06100N 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

**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.

Surfaces to be treated shall be clean and dry, smooth and free from deleterious and excess materials and projections. [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.] 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

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

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

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

[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 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 heat controls and means of agitation to ensure controlled uniform temperature throughout contents to prevent spot heating. Do not heat contents above flash point.ext

3.3.3 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.

3.3.4 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 |

Provide membrane waterproofing consisting of [[_____] plies of felt and [_____] moppings of bitumen on horizontal surfaces] [and] [[_____] plies of felt and [_____] moppings of bitumen on vertical surfaces] applied over priming coat. Install membrane using the shingle method so that the specified number of plies are installed in a single operation by providing the width of edge laps specified. [Achieve two-ply waterproofing by lapping each ply approximately one-half over the preceding ply.] [Achieve three-ply waterproofing by lapping each ply approximately two-thirds over the preceding ply.] [Achieve four-ply waterproofing by lapping each ply approximately three-quarters over the preceding ply.] [Achieve five-ply waterproofing by lapping each ply approximately four-fifths over the preceding ply.] Use appropriate width starting strips of felt at the starting line to provide the specified number of plies at the edge. Lay each ply in separate sheets or unroll closely behind the mopping of bitumen, and brush into place so that voids or air pockets do not develop.

3.3.5 Exterior Vertical Surfaces

Start each ply at the bottom, placed vertically in hot bitumen, and complete prior to applying the next ply. Overlap plies downward. Lap each ply 100 mm 4 inches at the end. Stagger end laps not less than 450 mm 18 inches in relation to the preceding layer. Extend the membranes from 50 mm 2 inches from the outer edge of footing, across the top of footing, and up foundation wall to approximately 100 mm 4 inches below finished grade. Tops of the membranes shall be [secured and protected as indicated.] [nailed to treated wood nailers set flush with the face of the wall and covered with two plies of fabric reinforcement. Nail 200 mm 8 inches on center on a line 38 mm 1 1/2 inches below the top of the membranes.]

3.3.6 Horizontal Surfaces

Apply waterproofing membranes for floor slabs to a primed, smooth surface base slab. Apply felts shingle fashion in moppings of hot bitumen. [Carry membrane up abutting vertical surfaces to the level [indicated] [of finish floor], [approximately 13 mm 1/2 inch below the top edge of base].] [Extend felts to intersections with interior surfaces of foundation walls.] After all plies and reinforcing membranes have been installed, cover the entire surface uniformly with hot bitumen applied at the rate specified.

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. 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.

3.3.9 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.

3.3.10 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

**NOTE: Insert appropriate Section number and title
in the blank below using format per UFC 1-300-02.**

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

**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.**

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 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:

| <u>Products</u> | <u>Inch-Pound</u> | <u>Metric</u> |
|--------------------|-------------------------|-------------------|
| 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 --