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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07510

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06/04

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA-07510 (June 2004)
NASA
Superseding NASA-07510
(December 2003)

SECTION 07510

BUILT-UP BITUMINOUS ROOFING
06/04

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers asphalt and coal-tar built-up roofing systems and nonmetallic flashing systems.

Drawings must include details for all flashing systems, roof drains, roof-edge vents for roof insulation, and other construction features of the roofing system.

On flat roofs without parapet, the roof periphery must be provided with a 5 inch 125 millimeter cant and an over-the-apex fascia detail to prevent winddriven roof water from flooding the vulnerable junction of roofing system and metal gravel stop.

Metal flashing and pitch pans are specified in Section 07600, "Flashing and Sheetmetal."

Roof insulation is specified in Section 07220, "Roof and Deck Insulation."

Parenthetical material indicates a choice and must be edited as appropriate for the project.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M	(2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C 208	(1995; R 2001) Standard Specification for Cellulosic Fiber Insulating Board
ASTM D 113	(1999) Standard Test Method for Ductility of Bituminous Materials
ASTM D 1227	(1995; R 2000) Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 1863	(2003) Standard Specification for Mineral Aggregate Used on Built-Up Roofs
ASTM D 2178	(1997a) Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D 226	(1997a) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 227	(1997a) Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 249	(1989) Standard Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules
ASTM D 2626	(1997b) Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing
ASTM D 312	(2000) Standard Specification for Asphalt Used in Roofing
ASTM D 371	(1989) Standard Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; Wide Selvage
ASTM D 41	(1994; R 2000e1) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 450	(1996; R 2000e1) Standard Specification for Coal-Tar Pitch used in Roofing, Dampproofing, and Waterproofing

ASTM D 4586	(2000) Standard Specification for Asphalt Roof Cement, Asbestos Free
ASTM D 5	(1997) Standard Test Method for Penetration of Bituminous Materials
ASTM D 517	(1998) Standard Specification for Asphalt Plank
ASTM D 6	(1995; R 2000e1) Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds
ASTM E 903	(1996) Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
ASTM E 96	(2000e1) Standard Test Methods for Water Vapor Transmission of Materials

1.2 SYSTEM DESCRIPTION

1.2.1 Roofing System

Contractor shall provide a roofing system with [asphalt] [coal-tar pitch] bitumen and [aggregate] [smooth surface] surfacing on a:

- [concrete deck [without] [with] insulation]
- [lightweight concrete deck [without] [with] insulation]
- [precast-gypsum deck [without] [with] insulation]
- [cast-in-place gypsum deck [without] [with] insulation]
- [wood deck [without] [with] insulation]
- [metal deck with insulation]

1.2.2 Minimum Material Weights (Per 100 Sq Ft) 10 Sq Meter)

NOTE: Select roof assembly materials and quantities to suit project requirements.

Coal-tar assembly:

[Sheathing paper] [base sheet]	[_____ pounds kilogram]
[Pitch mopping] [adhesive] to receive insulation	[_____ pounds kilogram]
Vapor barrier	[_____ pounds kilogram]
Asphalt mopping to receive base sheet	[_____ pounds kilogram]
Roof insulation	[_____ pounds kilogram]

Tar-saturated roofing felts ([_____]plies)	[_____] pounds kilogram
Pitch moppings between felts ([_____]at[_____] pounds) kilogram)	[_____] pounds kilogram
Flood coat	[_____] pounds kilogram
[Gravel] [slag] [aggregate] surfacing	[_____] pounds kilogram
Approximate total weight	[_____] pounds kilogram

Asphalt assembly:

[Sheathing paper] [base sheet]	[_____] pounds kilogram
[Asphalt mopping] [adhesive] to receive insulation	[_____] pounds kilogram
Asphalt mopping to receive base sheet	[_____] pounds kilogram
Roof insulation	[_____] pounds kilogram
Vapor barrier	[_____] pounds kilogram
Asphalt-saturated roofing felts ([_____]plies)	[_____] pounds kilogram
Asphalt moppings between felts ([_____]at[_____] pounds) kilogram)	[_____] pounds kilogram
Cap sheet	[_____] pounds kilogram
Flood coat	[_____] pounds kilogram
[Gravel] [slag] [aggregate] surfacing	[_____] pounds kilogram
Approximate total weight	[_____] pounds kilogram

1.3 SUBMITTALS

**NOTE: Review submittal description (SD) definitions
in Section 01330, "Submittals," and edit the
following list to reflect only the submittals
required for the project. Submittals should be kept
to the minimum required for adequate quality
control. Include a columnar list of appropriate
products and tests beneath each submittal
description.**

The following shall be submitted in accordance with Section 01330,
"Submittals," in sufficient detail to show full compliance with the
specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Adhesive
- Asphalt Primer
- Asphalt
- Coal-Tar Pitch
- Base Sheets
- Roofing Felts
- Cap Sheets
- Fasteners
- Sheathing Paper
- Bituminous Plastic Cement
- Cants
- Aggregate, Surfacing
- Polyvinylchloride Sheet Vapor Barrier
- Asphalt-Base Emulsion
- Roof Walkways
- Roof Vents
- Nails

SD-04 Samples

Contractor shall submit three samples, 12-inches 300 millimeter by the width of the roll for each of the following items:

- Polyvinylchloride Sheet Vapor Barrier
- Roofing Felts
- Base Sheets
- Mineral-Surfaced Roll Roofing
- Insulation

SD-06 Test Reports

Test reports for the following items:

- Aggregate, Surfacing
- Roof Cutout

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with referenced standards contained in this section.

- Roofing Felts
- Flashing
- Bitumen
- Insulation
- Adhesive
- Base Sheets
- Cap Sheets

SD-08 Manufacturer's Instructions

Manufacturer's installation instructions shall be submitted for the following items:

- Roofing
- Flashing

Cant Strips
Valleys
Walkway
Roof Vent

SD-11 Closeout Submittals

Warranty

1.4 DELIVERY, HANDLING, AND STORAGE

Roofing materials shall be on the project site before work is begun.

Materials shall be delivered to the site in the manufacturer's unbroken labeled packages. Felt rolls shall be labeled to indicate grade, weight, and type of saturant. Original packaging shall not be disturbed until materials are to be applied. Liquid materials shall be used directly from the fully labeled cans in which they were shipped by the manufacturer. Only approved roofing materials may be brought to or stored at the site.

Roofing materials shall be stored and protected from contact with soil, rain, or snow. Felt rolls and roll roofing shall be stacked on end and stored in an area maintained at no lower temperature than 50 degrees F 10 degrees C for at least 24 hours before laying.

Not more than a 1-day supply of insulation or felts shall be stored on the roof at any time. This 1-day supply shall be stacked on pallets and completely covered with plastic sheet whenever work is interrupted or when there is precipitation of any kind. Plastic sheeting shall be securely fastened to the pallets so as to be completely weathertight. Materials not so protected shall be permanently removed from the site.

Materials temporarily stored on the roof shall be distributed to stay within the indicated live-load limits of the roof construction which is [] pounds per square foot. Ample bases shall be provided under equipment to distribute the weight to conform to these live-load limits. Storage locations shall be approved.

PART 2 PRODUCTS

NOTE: Specifier should coordinate text relating to insulation and adhesives with Section 07220, "Roof and Deck Insulation," to avoid possible discrepancies or redundancies.

The finished surface for low-slope (less than 2:12) roofs shall have a minimum solar reflectance of 65 percent at initial installation and 50 percent after 3 years of exposure when tested in accordance with ASTM E 903.

The finished surface for high-slope (2:12 and greater) roofs shall have minimum solar reflectance of 25 percent at initial installation and 15 percent after 3 years of exposure when tested in accordance with ASTM E 903.

2.1 ADHESIVE FOR APPLICATION OF INSULATION

Adhesive for application of [insulation] [or] [underlayment] to steel decks shall be nonflammable (except for foamglass) and shall meet the

requirements of the Underwriters Laboratories, Inc., for a metal roof-deck construction assembly. Label of the Underwriters Laboratories, Inc., will be acceptable evidence. In lieu of the label, the Contractor may submit a written certificate from any approved nationally recognized testing organization, adequately equipped and competent to perform such services, stating that the adhesive conforms to the requirements, including methods of testing, of the Underwriters Laboratories, Inc.

2.2 ADHESIVE FOR APPLICATION OF POLYVINYL VAPOR BARRIER

Adhesive for the application of film polyvinyl sheet vapor barrier shall be rubber-base water-resistant material with a nontoxic vehicle especially prepared for application of polyvinyl-sheet membrane to roof decks. Holding power of the adhesive shall be not less than 100 pounds per square inch 690 kilopascal. Adhesive shall be certified by the manufacturer, on the basis of tests by an independent testing laboratory, to have a tunnel flame spread of not more than 10 when applied to a noncombustible surface.

2.3 ASPHALT-PRIMER

Asphalt primer shall conform to ASTM D 41.

2.4 ASPHALT

[Bitumen for roofs shall be asphalt conforming to ASTM D 312, Type IV.]

[Bitumen for roofs shall be asphalt conforming to ASTM D 312, Type IV, except that:

Ductility at 40 degrees F 4 degrees C measured in accordance with ASTM D 113, with an extension rate of 0.98 inch 24.9 millimeter per minute, shall be not less than 1.17 inches 29.7 millimeter.

Weight loss on heating for 5 hours at 450 degrees F 232 degrees C shall be less than 0.5 percent when tested in accordance with ASTM D 6.

Penetration, when tested in accordance with ASTM D 5 at 32 degrees F, 7 ounces 0 degrees C, 1.96 newton, 60 seconds, shall be at least 6; at 77 degrees F, 3.5 ounces 25 degrees C, .98 newton, 5 seconds, the minimum shall be 25.]

[Mineral-Surfaced Roll Roofing, Asphalt shall conform to ASTM D 312, Type I, II, III, or IV, as indicated, with the following modifications:

Type I shall be modified for a softening point between 135 to 151 degrees F on slopes from 1/2 to 1 in 12.

Type II shall be for use on slopes from 1/2 to 1-1/2 in 12.

Type III shall be for use on slopes from 1 to 3 in 12.

Type IV shall be for use on slopes from 2 to 6 in 12].

[Steep asphalt shall conform to ASTM D 312, Type III.]

Minimum penetration at 32 degrees F, 7 ounces 0 degrees C, 1.96 newton, 60 seconds for asphalt which has been oven-aged at 400 degrees F for 5 hours shall be not less than 3 when tested in accordance with ASTM D 5. This shall also be the minimum penetration for any asphalt sample taken

from the roof or from a test cut.

2.5 COAL-TAR PITCH

Coal-tar pitch shall conform to ASTM D 450, Type I (modified to meet air-pollution control requirements).

2.6 BASE SHEETS

[Perforated base sheets shall be asphalt-saturated organic felt conforming to ASTM D 2626.]

[Base sheet shall be asphalt-saturated and coated organic felt conforming to ASTM D 2626.]

[Base sheet shall be asphalt-impregnated glass-fiber felt conforming to ASTM D 2178, Type [IV] [VI].]

2.7 ROOFING FELTS

[Roofing felt shall be asphalt-saturated organic felt conforming to ASTM D 226, No. [15] [30], [plain] [perforated].]

[Roofing felt shall be coal-tar-saturated organic felt conforming to ASTM D 227 No. 15.]

[Roofing felt shall be asphalt-impregnated glass fiber conforming to ASTM D 2178, Type [IV] [VI].]

2.8 CAP SHEETS

Cap sheets shall be [asphalt roll roofing conforming to ASTM D 249.] [wide selvage asphalt roll roofing conforming to ASTM D 371, with a [17 inch] [or] [19 inch] selvage.]

2.9 SHEATHING PAPER

Sheathing paper shall be rosin-sized weighing not less than 5 pounds per 100 square feet 2.5 kilogram per 10 square meter or unsaturated felt weighing approximately 7-1/2 pounds per 100 square feet 3.7 kilogram per 10 square meter.

2.10 BITUMINOUS PLASTIC CEMENT

Plastic cement shall conform to ASTM D 4586, Type II [Class I] [Class II].

2.11 FASTENERS

Roofing Nails shall be [nonferrous] [cement-coated] [galvanized] with [_____] inch 25 millimeter diameter heads (annular or spiral-threaded for plywood deck) of sufficient length for maximum penetration into the deck or wood nailer.

Self-clinching nails shall have a minimum holding capacity of 20 pounds 90 newton per fastener when driven.

Insulation holddown clips, as recommended by the insulation manufacturer and approved, shall be used at the roof perimeter in addition to the asphalt adhesive.

2.12 CANTS

Cants shall be made from treated fiberboard and shall reduce the angle covered into two equal angles. Fiberboard shall conform to ASTM C 208, treated for moisture resistance by an integral treatment with wax or with bituminous impregnation.

2.13 AGGREGATE, SURFACING

Gravel or slag aggregate shall conform to ASTM D 1863.

Grading of aggregate at the time of application shall conform to the following:

Percentage passing a 5/8 inch 16 millimeter sieve and retained on a 1/4 inch 6.3 millimeter sieve; not less than 100

NOTE: In lieu of the above, one or more of the following materials may be used when blended to the grading requirements of ASTM D 1863.

Aggregate shall be white crystalline marble, expanded clay, expanded slag, or expanded shale of at least 55 pounds per cubic foot 880 kilogram per cubic meter density and shall be light colored, opaque, with the surface dry and free from dirt or other foreign material. Testing the surfacing material shall be the responsibility of the Contractor.

2.14 POLYVINYLCHLORIDE SHEET VAPOR BARRIER

Polyvinylchloride sheeting shall be unplasticized virgin polyvinylchloride and shall be not less than 0.004 inch 0.10 millimeter thick with water-vapor permeance of not more than 0.10 0.058 Nanogram per pascal second square meter on a spot-by-spot basis, not as an average. Permeance shall be measured in accordance with ASTM E 96, Water Method.

2.15 ASPHALT-BASE EMULSION

Asphalt-base emulsion shall conform to ASTM D 1227, Type [_____].

2.16 ROOF WALKWAYS

[Asphalt planks shall be 36 by 72 inches by 1/2 inch 915 by 1830 millimeter by 13 millimeter thick, consisting of a homogeneous core of asphalt, plasticizers, and fillers bonded between two saturated and coated facing sheets, with the top side surfaced with ceramic granules. Planks shall conform to ASTM D 517, mineral-surfaced asphalt.]

[Roof walkways shall be pressure-treated or redwood duck boards. Duck boards shall be constructed of 1- by 4 inch 25 by 100 millimeter boards spaced 1/2 inch 13 millimeter apart and nailed to 2- by 4 inch by 8-foot 50 by 100 millimeter by 2400 millimeter stringers a maximum of 24 inches 600 millimeter apart.]

2.17 ROOF VENTS

Roof vents shall be of 22-gage 0.85 millimeter galvanized steel conforming

to ASTM A 653/A 653M and ASTM A 924/A 924M, G165 Coating Designation. Roof vents shall be cylindrical, not less than 6 inches 150 millimeter in diameter and 8 inches 200 millimeter high. A conical weather cap, cone-base diameter 12 inches 300 millimeter and cone height 6 inches 150 millimeter, shall be securely fastened to the top of each roof vent by galvanized strap brackets. At roof end of the vent, a 12 inch 300 millimeter flashing flange shall be securely brazed to the vent cylinder approximately 3/8 inch 10 millimeter from the end.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall verify that work of other trades that penetrates the roof deck or that requires men and equipment to traverse the roof deck has been completed.

Contractor shall examine deck surfaces for inadequate anchorage, foreign material, moisture, and unevenness that would prevent the execution and quality of application of built-up roofing system as specified.

Contractor shall not proceed with the roofing application until defects have been corrected.

Starting work designates acceptance of the surfaces by the Contractor.

3.2 PREPARATION

Flame-heated equipment shall be located and used so it will not endanger the structure, other materials on the site, or adjacent property. Fire extinguishers of an appropriate, approved type shall be provided and maintained by the Contractor.

Flame-heated equipment shall not be placed on the roof of any structure.

Before the start of work, the paving and the face of building walls adjacent to the hoist and kettles shall be protected and this protection shall be maintained for duration of work.

3.3 APPLICATION

3.3.1 General Procedures

Roofing installation shall be continuous, with all operations proceeding together. Base sheet and specified plies of felt shall follow shingle-fashion as a single composite operation.

Roofing shall not be applied when ambient temperature is below 50 degrees F 10 degrees C.

Interval between the base sheet application and succeeding plies shall not exceed 48 hours.

Before cessation of work on each working day or when work is interrupted due to rainfall or other causes, the roof shall be sealed against intrusion of water. Base sheet shall be brought to the edge of the insulation, dams shall be installed, and exposed felts shall be effectively glazed. Insulation or unglazed felts shall not be left exposed during rainfall or overnight.

Traffic over partially or completely finished roofing shall be only on planks or on plywood not less than 5/8 inch 16 millimeter thick and 2-feet 600 millimeter wide.

Bitumen quantities specified for laminating insulation, for attaching base sheets, for laminating successive plies of felts, or for flood coating shall be regarded as square-foot by square-foot square-meter by square-meter minimums, not as averages for areas.

Debris shall be removed from the roof at the end of each work day.

3.3.2 Heating Bitumens

NOTE: Select the proper heating for the type of bitumen being used for the project conditions.

Maximum bitumen temperature in kettle:

[Asphalt, Type I: 425 degrees F 218 degrees C]

[Asphalt, Types II, III, IV: 475 degrees F 246 degrees C]

[Coal-tar pitch: 425 degrees F 218 degrees C]

Bitumen heated above the specified maximum shall be discarded.

Minimum bitumen temperature at the time and point of application:

[Asphalt, Type I: 300 degrees F 149 degrees C]

[Asphalt, Types II, III, IV: 400 degrees F 204 degrees C]

[Coal-tar pitch: 350 degrees F 177 degrees C]

Contractor shall provide thermostatic controls and a visible thermometer on the kettle, shall maintain them in working order, and shall keep them calibrated.

Contractor shall use thermometers accurate within plus or minus 2 degrees F 1 degrees C and check temperatures every 30 minutes. When the temperature of the bitumens in the applicators falls below specified minimums, removal and replacement of the affected roofing may be required.

3.3.3 Built-Up Roofing Application

Roofing shall be installed in accordance with the roofing manufacturer's specification for the roofing system required for the project and as specified below. Method of holddown used by the manufacturer in areas subject to hurricane winds shall be subject to approval prior to installation.

NOTE: The following must be retained for general installation criteria if not in conflict with the roofing manufacturer's approved specifications.

On a gypsum or wood deck, sheathing paper shall be applied as the first layer. Sheathing paper shall be attached with spot-applied adhesive on gypsum and mechanically attached on wood deck.

Heated bitumen shall be solid mopped under and between roofing felts with a complete uniform coating. Felt shall not touch felt. Roofing felts shall be laid parallel to the long dimension of the roof. Felts shall be broomed or pressed into the heated bitumen, providing tight smooth laminations without wrinkles, buckles, kinks, or fishmouths. Application of the roofing system shall be completed without pockets or blisters.

Kettlemen shall be in attendance at all times during the heating to ensure that the maximum temperature specified is not exceeded. Layers of roofing shall be laid in not less than 25 pounds 12.2 kilogram of asphalt [or coal tar] per square 10 square meter. Bitumen shall uniformly cover roof areas to be mopped to provide an effective bond. Asphalt primer for concrete and masonry surfaces to receive asphalt products shall be applied at a rate of not less than 1 gallon per square 4 liter per 10 square meter. Each course of roofing felts and base sheet, in addition to being mopped in hot bitumen, shall be lapped [and nailed] as specified by the manufacturer. Roofing, including the base sheet and roofing felts, shall immediately follow the insulation application as a continuous operation. Where roofing is applied either to the deck or over insulation and requires several calendar days for completion, the base sheet application may be completed over the surface area under the following three conditions:

Base-sheet laps shall be waterproofed with a solid application of hot bitumen.

Remaining plies of roofing shall be installed so that the base sheet is not left exposed to the weather longer than 1 week.

This method of application shall be proposed in writing in advance of the actual work and shall include a detailed schedule of the roofing contractor's operations. This method of application shall not be used in lieu of the continuous operation without prior approval.

Surface of the felts shall be carefully broomed-in with an 18- or 20 inch 460 or 500 millimeter wide, soft-fiber floor broom to obtain complete adhesion between plies and to eliminate air pockets. Method of mopping a half-sheet width and turning the sheet back to mop under the other half shall not be used. Workmen shall not walk on mopped surfaces when the bitumen is sticky. Each layer of roofing felt shall be carried up abutting vertical surfaces at least 4 inches 100 millimeter or to the top of the cant strip. At eaves and rakes, two layers of roofing felt shall be applied beneath the roll roofing with not less than a 9 inch 230 millimeter mopping on [roof decks for uninsulated decks] [and] [insulation] and turned back 9 inch 230 millimeter and mopped over the top roof ply. At eaves and rakes, the bottom layer of felt shall be applied in a 9 inch 230 millimeter wide strip of bituminous cement except that the bottom layer of felt shall be nailed in lieu of applying with bitumen when the roll roofing is applied without bitumen. Gravel stops, specified in Section 07600, "Flashing and Sheetmetal," shall be embedded in bituminous cement and nailed on top of the envelope formed by the felt turnback.

Nails and fasteners for securing roofing shall be the following types and shall be flush-driven through flat metal disks not less than 1 inch 25 millimeter in diameter. Metal disks may be omitted where heads of

fasteners are equivalent in size to the 1 inch 25 millimeter diameter disks:

Direct application to decks:

Wood: Roofing nails

Gypsum: Uncoated, headed, square-cut, or flathead bright nails or approved devices having a minimum holding power of 20 pounds 90 newton for each fastener when driven in the specific deck

Concrete: Roofing nails for embedded wood nailers or approved devices having a minimum holding power of 20 pounds 90 newton for each fastener when driven into nailable-concrete nailing strips

Insulating concrete: Uncoated, headed, square-cut, steel nails or approved devices having a minimum holding power of 20 pounds 90 newton for each fastener when driven in the specific concrete

Application over insulation, fastening to deck:

Wood: Roofing nails of sufficient length to penetrate not less than 3/4 inch 19 millimeter into the deck

Gypsum: Uncoated, headed, square-cut or flathead bright nails, or approved devices having a minimum holding power of 20 pounds 90 newton for each fastener when driven in the specific deck

Concrete: Roofing nails of a sufficient length to penetrate not less than 3/4 inch 19 millimeter into wood nailers mounted flush with the deck, or approved fastening devices having a minimum holding power of 20 pounds 90 newton for each fastener when driven into nailable-concrete nailing strips.

Application over insulation [or] [underlayment], fastening into insulation [or] [underlayment]:

Steel: Nails and fasteners shall not penetrate through steel decks. Fastening devices for anchorage into insulation [or] [underlayment] shall be of an approved type providing not less than 20 pounds 90 newton holding power per fastener when driven in the insulation [or] [underlayment].

[Wood] [Gypsum] [Concrete]: Approved fastening devices having a minimum holding power of 20 pounds 90 newton each when driven into insulation.

Application into a wood roof nailer set flush with the surface of nonnailable insulation shall be with roofing nails.

3.3.4 Flashing Applications

Flashing shall be provided in the angles formed at walls and other vertical surfaces and where required to make the work watertight. Bituminous-plastic flashings specified shall be used, except where metal flashings are indicated or specified in Section 07600, "Flashing and Sheetmetal." Flashings shall be provided and installed immediately after the top ply of the roofing is placed and shall be returned and sealed or capped and sealed to waterproof edges and ends. Flashings shall be stepped where vertical surfaces abut sloped roof surfaces. Sheet metal reglet up to which base

flashings are installed shall be not more than 16 inches 400 millimeter nor less than 8 inches 200 millimeter above the roofing surfaces.

Base flashings shall consist of four layers of asphalt-saturated felt and one layer of mineral-surfaced roofing cemented together with bituminous cement. Masonry and concrete over which flashing is to be installed shall be primed with asphalt primer and allowed to dry. Layers of saturated felt and the mineral-surfaced roofing shall be evenly embedded in bituminous cement applied with a trowel, using not less than 50 pounds per square 54 kilogram per 10 square meter per layer. First layer of felt shall extend out onto the roofing at least 2 inches 50 millimeter, and each succeeding layer shall extend at least 2 inches 50 millimeter beyond the preceding layer. Layers shall extend up the vertical surface to the sheet metal reglets, or to the top of curb when sheet metal reglets are not required, and shall be secured at the top 8 inches 200 millimeter on center with nails or fasteners for securing roofing felts. Saturated-felt flashing sheets shall be approximately 5 feet 1525 millimeter in length and lapped not less than 6 inches 150 millimeter with laps staggered in each layer. Mineral-surfaced roofing strips shall be cut from the width of the material, and strips shall be of sufficient length to extend from the sheet metal reglet or curb onto the roof at least 2 inches 50 millimeter beyond the widest flashing sheet. Mineral-surfaced strips shall be installed with selvage edges at right angles to the cant. Selvage laps shall be well cemented and, where possible, shall be shingled in a direction away from the prevailing wind.

Layers of base flashing shall extend up the vertical surface to the sheet metal reglets, or to the top of curb when sheet metal reglets are not required, and shall be secured at the top 8 inches 200 millimeter on center.

Mineral-surfaced roofing strips shall be cut from the width of the material, and the strips shall be of sufficient length to extend from the sheet metal reglet or curb onto the roof at least 2 inches 50 millimeter beyond the widest flashing sheet. Mineral-surfaced strips shall be installed with selvage edges at right angles to the cant. Selvage laps shall be well cemented and, where possible, shingled in a direction away from the prevailing wind.

Strip flashings: Roof flanges of sheet metal flashings such as gravel stops, base flashings, and plumbing flashings furnished and installed under other sections of the specifications shall be stripped with layers of roofing felt. After installation of flashings over the top ply of roofing, two layers of roofing felt, 9- and 12-inches 225 and 300 millimeter wide, shall be successively mopped on top of the roof flange to form a waterproof joint between roofing and flashings.

Flashing for roof drains shall be in one piece and provided with a hole 1 inch 25 millimeter less in diameter than the size of the roof drain bell. Flange of the drain bell shall be cleaned of grease and dirt and shall be dry; then a layer of 15-pound asphalt-saturated felt shall be placed over the drain and cemented in place with plastic bituminous cement. Felt shall be neatly trimmed to the size of the bell opening. Five plies of roofing felt shall then be applied to the roof and sealed to the roof and to each other with plastic bituminous cement in the area adjacent to and immediately surrounding the roof drains. Underside of the lead flashing shall be evenly coated with plastic bituminous cement and pressed into place over the drain flange and roofing. Flashing shall be tapped into the bell to fit closely to the vertical wall of drain. Retaining ring shall be clamped in place. Two reinforcing plies of 15-pound asphalt saturated felt

shall be applied over the flashing with alternate moppings of hot asphalt or plastic bituminous cement so that the first ply extends not less than 3 inches 75 millimeter beyond the edge of the flashing and the second ply extends not less than 6 inches 150 millimeter beyond the edge of the flashing. Each ply shall extend to within 1/2 inch 13 millimeter of the roof drain retaining ring. *Top coating of asphalt and aggregate surfacing shall be carried over reinforcing plies to the retaining ring. Flashing for vent pipes shall be sealed into the roof in a similar manner.

3.3.5 Cant Strip Application

Cant strips shall be installed in the angles formed at wall and other vertical surfaces as backing for base flashings. Cant strips shall be laid in a solid coat of bituminous cement just prior to laying the roofing plies. Cants shall have a 5-1/2 inch 140 millimeter face dimension, shall be continuous, and shall be installed in as long lengths as practical. Cant strips shall not be required at locations where cast-in-place cants specified under other sections are integrally formed with the structural deck or roof fill.

3.3.6 Valley Application

Valleys: Roofing shall be applied at valleys and waterways in the following manner:

Base sheets shall continue across valleys and terminate at approximately 18 inches 460 millimeter from the valley.

Felt plies shall continue across valleys and terminate at approximately 12 inches 300 millimeter from the valley. Exposed laps shall terminate on a line approximately 12 inches 300 millimeter from, and parallel to, the gutter valley. Two plies of felt, 9 and 12 inches 225 and 300 millimeter wide, shall be successively mopped in over each felt line of the termination.

If the application can be completed without wrinkles, buckles, or fishmouths, and if side laps do not face the direction of drainage, roofing felts and base sheets may be laid continuously across or parallel to shallow valleys such as those formed by reverse-slope roofs. For this application, valleys shall be reinforced with one ply of felt, 36 inches 900 millimeter wide, centered on the valley gutter and laid in a solid mopping of asphalt over the top ply of roofing.

3.3.7 Mechanical Application

When mechanical roofing-application equipment is used, planks, plywood, or other approved protection shall be placed over the roof insulation or the roofing. Traffic shall be confined to the protected area. Felt machines shall contain a sufficient quantity of bitumen at the proper temperature to ensure no holidays in the bitumen.

3.3.8 Walkway Application

**NOTE: Drawings must indicate the areas where
walkways are required.**

[Asphalt plank walkway systems for the protection of the roofing membrane

shall be installed as indicated.

A heavy coating of hot asphalt shall be applied over the designated walkway areas and directly on the felt membrane. While the asphalt is still hot, asphalt planks shall be laid in. A 1/2 inch 13 millimeter space shall be allowed between adjacent boards for drainage.]

[Walkway systems for the protection of the roofing membrane shall be furnished and installed as indicated.

Duck boards shall be installed on 4 by 6 inch by 3 foot 100 by 150 millimeter by 900 millimeter long foundation boards spaced 4 feet 1220 millimeter apart. Foundation boards shall be installed in bitumen on the roof membrane.

After placing the boards, flood coating and aggregate surfacing of the roof shall be completed up to all edges of the installed planks.]

3.3.9 Roof Vent Application

NOTE: Where vapor barriers are required, roof vents must be included to prevent water accumulation in the roof sandwich.

Roof vents shall be provided on the minimum basis of one roof vent for each 1,200 square feet 110 square meter of roof area, with no point on the roof more than 45 feet 13.7 meter from a point of venting.

Roof vents shall be installed before the flood coat is applied. Contractor may, at his option, temporarily omit the flood coat and aggregate surfacing at the location of the roof vents. Such areas shall be not less than 30 inches 760 millimeter nor more than 48 inches 1220 millimeter in diameter and shall be effectively glazed-in when the adjacent surfaces are floodcoated.

NOTE: Select the following paragraph only when mineral fiberboard insulation is provided.

[To install roof vents in roofs with mineral-fiberboard insulation, a circular hole shall be cut through the membrane and the top layer of insulation but not into, the bottom layer of insulation. Hole shall snugly accept the vent cylinder.]

NOTE: Select the following paragraph only when cellular-glass insulation is required.

[Vents in roofs with cellular-glass insulation shall be installed astride one of the joints in the insulation to give it access to the chamfered venting channels. Roof flanges of the vents shall be flush with the end of the vent. Cap sheet of the top layer of insulation shall be removed within the circular area of the vent cylinder.]

Roof vent shall be set over the hole, with the flashing flange set in hot

steep asphalt. One ply 24 inches 600 millimeter square shall be set in a hot mopping of asphalt at a 20-pound-per-square 9.8 kilogram per 10 square meter rate, followed by a second ply 30 inches 760 millimeter square on top of the 24 inch 600 millimeter square, also set in a hot mopping of asphalt at a 20-pound-per-square 9.8 kilogram per 10 square meter rate. Over the top ply, the flood coat and aggregate surfacing shall be applied to match surrounding areas.

3.4 FIELD TESTING OF ROOF CUTOUT SAMPLES

3.4.1 Roof Cutout Samples

After completion of the application of roofing felts, but prior to the application of the flood coat, not less than two sample cutouts of the roofing shall be taken from the deck for each 50, 100 square foot 10 square meter sections or less at directed locations. Cutout samples shall be visually examined for free water between plies or skips in bitumen application between plies and then weighed to determine the total amount of bitumen used, exclusive of the flood coat. Samples shall be 1 foot by 1 foot 305 millimeter by 305 millimeter in area, accurately cut to a template. Thickness and weight of the samples shall be as specified for the applicable condition.

Not less than two samples shall be cut from the roof of each wing of the building covering 100, 100 square foot 10 square meter sections or less. One sample shall be taken each day on which approximately 25, 100 square foot 10 square meter sections have been laid. An additional sample shall be taken for each 25, 100 square foot 10 square meter section or fraction thereof over 25, 100 square foot 10 square meter section.

Sample-cutting device shall be square and properly sized as indicated above. Device may be a self-cutting type or a metal template capable of being secured to the roof for use with a sharp roofing knife. Cutting edges of the device or knife shall be kept clean by washing in a proper solvent after each cut.

Weight of the sample shall be not less than [_____].

Complete sampling operation, except weighing, shall be performed without additional cost to the Government. Scales to weigh the samples will be furnished by the Contracting Officer.

Scales for weighing samples will be portable, graduated, and accurate to 1/2 ounce 14 gram.

Free water between plies or the absence of bitumen between plies shall be cause for removal of the affected portions of the roof and their replacement in a dry condition. Where only bitumen deficiencies are found, the deficient areas shall have an additional ply of felt applied in a full mopping of bitumen. Correction of the above deficiencies shall be made at no additional cost to the Government.

If there is a deficiency of bitumen in 25 percent of the total deck area, the Contractor shall add an additional ply of felt over the entire deck in a full mopping of the specified bitumen.

Immediately after being weighed, the sample shall be replaced and tamped into position in the cutout area, which meanwhile has been flooded with hot bitumen; the area shall then be covered with three plies of felt hot mopped

in place, with the first ply overlapping the cutout area 3 inches 75 millimeter on all sides and each succeeding ply overlapping the preceding ply 3 inches 75 millimeter on all sides.

Should it become impossible to immediately replace the cutout sample in the roof, a new section of equivalent size and structure shall be substituted. A dry sheet the same type as the cutout shall be placed in the bottom of the cutout before flooding to prevent dripping bitumen through the deck.

Contracting Officer may waive taking roof cutout samples at his discretion, and the credit involved shall be returned to the Government.

3.4.2 Testing Procedures

Roof samples will be sent to a recognized testing laboratory where a piece of each sample measuring 4 by 12 inches 100 by 300 millimeter will be cut off, plainly identified, and retained by the laboratory for not less than 6 months.

The remaining part of the 1-foot by 1-foot 305 millimeter by 305 millimeter samples will be qualitatively and quantitatively tested to determine compliance with the requirements of these specifications.

If test results show compliance with the requirements of these specifications, the Government will pay for the testing. If the test results indicate quantitative or qualitative deficiencies, the following procedure shall be automatically invoked:

Contractor shall pay for the test that revealed the deficiency.

Four locations peripheral to the original location of the deficient cut and approximately 10 feet 3100 millimeter therefrom shall be designated. Additional cuts shall be taken at these locations to determine whether the deficiency was strictly local or whether a larger area was involved. Contractor shall be responsible for the costs of this testing. Contractor shall repair the roof as specified at no additional cost to the Government.

After an area of deficiency has been identified, an application of additional felts and asphalt, an additional flood coat, or both, will be required, depending upon the nature and magnitude of the deficiencies. In either case, the aggregate surfacing must be completely removed. If flood coating alone is required, deeply embedded aggregate may be flooded in. If additional felts are required, aggregate too deeply embedded to remove shall be complete.

3.5 ACCEPTANCE

NOTE: Following a minimum of 90 calendar days operation (or installation), but no later than one year, the Systems Engineer/Condition Monitoring Office/Predictive Testing Group should inspect the installation using advanced monitoring technologies such as Infrared Imaging or Ultrasonic mapping. These technologies can identify insulation voids, insulation settling, and areas of moisture intrusion. Identification of insulation materials and locations is required to effectively identify

these types of problems. The Systems Engineer/Condition Monitoring Office/Predictive Testing Group needs to know the warranty expiration date, if there is a warranty, in order to perform the inspections within the prescribed time frame.

Prior to final acceptance, the Contractor shall provide construction (as-built) details [and warranty information] to the Contracting Officer. Construction details shall include, by building area, the material type, amount, and installation method. An illustration or map of the building may serve this purpose. Data shall have a cover letter/sheet clearly marked with the system name, date, and the words "As built insulation/material." Forward as-built [and warranty] information to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database.

-- End of Section --