

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07220

ROOF AND DECK INSULATION

06/04

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALIFICATIONS FOR ROOF AND DECK INSULATION WORK
- 1.4 DELIVERY AND STORAGE OF MATERIALS

PART 2 PRODUCTS

- 2.1 THERMAL INSULATION MATERIALS (OR UNDERLAYMENT)
 - 2.1.1 Rigid Board
 - 2.1.2 Poured Insulation
- 2.2 SHEATHING PAPER
- 2.3 VAPOR BARRIER
 - 2.3.1 Polyvinylchloride Sheet
 - 2.3.2 Roofing Felts
 - 2.3.3 Base Sheet
- 2.4 FASTENING MATERIALS
 - 2.4.1 Adhesives
 - 2.4.1.1 Insulation or Underlayment
 - 2.4.1.2 Polyvinyl-Sheet
 - 2.4.1.3 Felt or Base Sheet
 - 2.4.2 Fasteners
- 2.5 BITUMINOUS PLASTIC CEMENT
- 2.6 ASPHALT-BASE EMULSION

PART 3 EXECUTION

- 3.1 GENERAL REQUIREMENTS
- 3.2 PREPARATION
 - 3.2.1 Protection of Property
 - 3.2.2 Preparation of Surfaces
- 3.3 APPLICATION
 - 3.3.1 General Procedures
 - 3.3.2 Heating Bitumens
 - 3.3.3 Vapor-Barrier Application
 - 3.3.4 Insulation Application
- 3.4 ACCEPTANCE

-- End of Section Table of Contents --

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA-07220 (June 2004)
NASA
Superseding NASA-07220
(December 2003)

SECTION 07220

ROOF AND DECK INSULATION
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 roof vapor barriers (where required), thermal insulation (or underlayment) applied to roof decking systems as required by the project.

Drawings must indicate the following:

Location and extent of roof insulation (or underlayment) work required

Nominal thickness and name of insulation (or underlayment), as required

Roof insulation (or underlayment) venting systems

Vents are specified in Section 07530, "Single Ply Membrane Roofing;" and Section 07510, "Built-Up Bituminous Roofing."

Vapor barriers must be indicated for high-humidity areas and wherever the winter fresh-air make-up is less than 30 cfm 1 cubic meter per minute per occupant. Vapor barriers shall be applied to the winter-heated side of the construction.

Where vapor barriers are used, design details must provide for continuous venting of the barrier-insulation-membrane sandwich at the entire periphery, at all curbs, and at other places as required by the project.

Insulated metal panels are specified in Section 07400, "Roofing and Siding Panels."

Thermal insulation for plumbing, heating, ventilating, and air-conditioning systems is specified in Division 15, "Mechanical."

Vapor barriers are not required on steel decks. When a vapor barrier is mopped on the deck, asphalt

primer shall be used; bituminous plastic cement shall be used at eaves and rakes.

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 C 1289 (2001) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- ASTM C 150 (2002ae1) Standard Specification for Portland Cement
- ASTM C 208 (1995; R 2001) Standard Specification for Cellulosic Fiber Insulating Board
- ASTM C 209 (1998) Standard Test Methods for Cellulosic Fiber Insulating Board
- ASTM C 317/C 317M (2000) Standard Specification for Gypsum Concrete
- ASTM C 332 (1999) Standard Specification for Lightweight Aggregates for Insulating Concrete
- ASTM C 552 (2003) Standard Specification for Cellular Glass Thermal Insulation
- ASTM C 726 (2000a) Standard Specification for Mineral Fiber Roof Insulation Board
- ASTM C 728 (1997e1) Standard Specification for Perlite Thermal Insulation Board
- ASTM D 1190 (1997) Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
- ASTM D 1227 (1995; R 2000) Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
- ASTM D 1751 (1999) Standard Specification for Preformed Expansion Joint Filler for

	Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004) Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
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 2626	(1997b) Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing
ASTM D 2822	(1991; R 1997e1) Standard Specification for Asphalt Roof Cement
ASTM D 312	(2000) Standard Specification for Asphalt Used in Roofing
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 E 96	(2000e1) Standard Test Methods for Water Vapor Transmission of Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-200	(1993e) Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement
-------------	--

1.2 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:

- Thermal Insulation Materials
- Sheathing Paper
- Vapor Barrier
- Fastening Materials
- Bituminous Plastic Cement
- Asphalt-Base Emulsion

SD-04 Samples

Contractor shall submit the following samples:

Three of each type of Fasteners

Three 1-quart 1 liter containers of Adhesives.

Three pieces, full thickness by 12 inches 300 millimeter by the width of roll of Vapor Barrier and Insulation (or underlayment).

After approval, full-sized samples may be used in the construction, provided each sample is clearly identified and its location recorded.

SD-06 Test Reports

Test reports for water resistance and permeance shall be submitted for Vapor Barrier.

SD-07 Certificates

Certificates for the following items shall exactly identify each item by the designation that will appear on the packaging for that item. Certificates shall be submitted for all materials that are identified by a referenced specification.

- Fiberboard Roof Insulation
- Gypsum Board With (Without) Fiber Roof Insulation
- Mineral-Fiber Roof Insulation
- Fibrous-Glass Roof Insulation
- Expanded-Perlite Roof Insulation
- Polyisocyanurate Roof Insulation
- Phenolic Roof Insulation
- Concrete Roof Insulation
- Expansion Joint Filler Strips
- Compound
- Polyvinylchloride Sheet Vapor Barriers
- Roofing Felts
- Base Sheet
- Asphalt Primer

Steep Asphalt
Coal-Tar Pitch
Bituminous Plastic Cement
Asphalt-Base Emulsion

SD-08 Manufacturer's Instructions

Manufacturer's instructions for the following items shall indicate fastener and adhesive instructions for each type of installation.

Vapor Barrier
Roof Insulation
Fiberboard Roof Insulation

SD-11 Closeout Submittals

Warranty

1.3 QUALIFICATIONS FOR ROOF AND DECK INSULATION WORK

Roof and deck insulation shall be performed by Contractor personnel certified by the insulation manufacturer to install their products.

Insulating concrete contractor shall be certified in the application of the materials by the aggregate manufacturer.

1.4 DELIVERY AND STORAGE OF MATERIALS

Materials shall be delivered to the project site in their original, unopened packages or containers bearing labels identifying the manufacturer's name, brand name, material, and other information.

Materials shall be stored in their original, unbroken packages or containers in a weathertight and dry area and protected from damage until needed for use.

PART 2 PRODUCTS

2.1 THERMAL INSULATION MATERIALS (OR UNDERLAYMENT)

2.1.1 Rigid Board

[Fiberboard roof insulation, rigid type, shall conform to ASTM C 208 and ASTM C 209, with a maximum thermal conductance value of [____].]

[Mineral-wool or mineral-fiber roof insulation, rigid type, shall conform to ASTM C 726, with a maximum thermal conductance value of [____].]

[Fibrous-glass roof insulation shall conform to ASTM C 726, with a maximum thermal conductance value of [____].]

[Expanded-perlite roof insulation, rigid type, shall conform to ASTM C 728, with a maximum thermal conductance value of [____].]

[Cellular-glass insulation shall conform to ASTM C 552.]

NOTE: Polyisocyanurate roof insulation is one of the materials listed in the EPA's Comprehensive

Procurement Guidelines (CPG)
(<http://www.epa.gov/cpg/>). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (<http://nodis3.gsfc.nasa.gov>)

[Polyisocyanurate roof insulation shall conform to ASTM C 1289, with a maximum thermal conductance value of [____].]

Polyisocyanurate roof insulation shall contain a minimum content of 9 percent of recovered materials.

2.1.2 Poured Insulation

[Gypsum concrete roof shall conform to ASTM C 317/C 317M, Class A, with a maximum thermal conductance value of [____]. Water shall be potable.]

[Lightweight-concrete roof insulation shall have a maximum thermal conductance value of [____]. Aggregates shall conform to ASTM C 332, Group I; portland cement shall conform to ASTM C 150, Type IA or IIIA; water shall be potable. Lightweight-concrete design mix shall be 1 bag (94 pounds) (43 kilopascal) of portland cement to 1-1/2 bags (6 cubic feet) (0.2 cubic meter) of aggregate, and with a minimum compressive strength of 125 psi 860 kilopascal at 28 calendar days.]

Phenolic roof insulation and gypsum board with (without) fiber roof insulation shall meet referenced standards within this section.

NOTE: Bituminous type joint fillers are suitable for use with both hot-applied elastic and cold-applied mastic joint-sealing compound. Nonbituminous joint fillers are preferred for use with cold-applied elastomeric polymer sealing compound.

[Expansion-joint filler strips shall be the nonextruding and resilient bituminous type conforming to ASTM D 1751.]

[Expansion-joint filler strips shall be the nonextruding and resilient nonbituminous type conforming to ASTM D 1752, Type I or II.]

NOTE: Choose one of the following paragraphs as applicable. Cold-applied mastic costs less.

[Compound shall be hot-poured elastic, conforming to ASTM D 1190.]

[Compound shall be cold-applied, two-component, elastomeric polymer, conforming to FS SS-S-200.]

2.2 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] [unsaturated felt weighing approximately 7-1/2 pounds per 100 square feet 3.5 kilogram per 10 square meter].

2.3 VAPOR BARRIER

2.3.1 Polyvinylchloride Sheet

Polyvinylchloride sheet vapor barriers 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 0.06 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.

2.3.2 Roofing Felts

Roofing felt shall be [asphalt-saturated organic felt conforming to ASTM D 226, No. 15 [plain] [perforated].] [coal tar-saturated organic felt conforming to ASTM D 227] [asphalt-impregnated glass fiber conforming to ASTM D 2178, Type [____]].

2.3.3 Base Sheet

Base sheet shall be [asphalt-saturated and asphalt-coated organic felt conforming to ASTM D 2626.] [asphalt-impregnated glass-fiber felt, conforming to ASTM D 2178.]

2.4 FASTENING MATERIALS

2.4.1 Adhesives

2.4.1.1 Insulation or Underlayment

Adhesive for application of insulation or underlayment to steel decks shall be nonflammable and shall meet the requirements of the Underwriters Laboratories, Inc., for a metal roof-deck construction assembly; the Contractor shall submit proof of such conformance. 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.

2.4.1.2 Polyvinyl-Sheet

Adhesive for application of film polyvinyl-sheet vapor barriers 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 psi 670 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.

2.4.1.3 Felt or Base Sheet

[Asphalt primer shall conform to ASTM D 41.]

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

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

2.4.2 Fasteners

Roofing nails shall be [nonferrous] [cement-coated] [galvanized] with [_____] inch millimeter diameter head [annular or spiral threaded for plywood deck] of sufficient length for maximum penetration into 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 shall be as recommended by the insulation manufacturer and approved prior to installation.

2.5 BITUMINOUS PLASTIC CEMENT

Plastic cement shall conform to ASTM D 2822 Type I, Class [_____] for asphalt-saturated felts and Type II, Class [_____] for coal-tar-saturated felts.

2.6 ASPHALT-BASE EMULSION

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

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Roof insulation shall be installed in accordance with approved descriptive data and as specified in Section 07510, "Built-Up Bituminous Roofing."

Contractor shall verify that all work that penetrates roof decks or that requires men and equipment to traverse a roof deck has been completed prior to underlayment or roof insulation installation.

Contractor shall examine deck surfaces for inadequate anchorage, foreign material, moisture, and unevenness, any condition which would prevent the execution and quality of application of underlayment or roof insulation system as specified shall be corrected before beginning work. Work shall not proceed with underlayment or insulation application until defects are corrected.

Insulation shall be installed only after building construction has progressed to the point that inclement weather will not damage or wet the insulation material.

Starting work designates acceptance of the surfaces by the Contractor.

Underlayment or insulation material shall be cut and fit as necessary to fully insulate small areas and to accommodate piping, scuttles, skylights, vents, and other construction penetrating the insulation material.

Vapor barriers shall be installed to provide a continuous vapor-barrier seal. Tears, breaks, or ruptures that might interfere with effectiveness of the vapor barrier shall be repaired.

3.2 PREPARATION

3.2.1 Protection of Property

Flame-heated equipment shall be located and used so it will not endanger the structure or 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 starting work, paving and faces of building walls adjacent to hoist and kettles shall be protected and this protection maintained for duration of work.

3.2.2 Preparation of Surfaces

Surfaces on which thermal insulation materials are to be applied shall be clean, smooth, dry, and free from projections which might puncture the vapor barriers. Condition of surfaces shall be inspected and approved [by the Contracting Officer] prior to the start of roof insulation work.

3.3 APPLICATION

3.3.1 General Procedures

Underlayment or insulation installation shall be continuous, with all operations proceeding together.

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. Insulation or underlayment shall not be left exposed during rainfall or overnight.

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

Materials temporarily stored on the roof shall be distributed to stay within the live-load limits of the roof, which is [_____] psf pascal. Ample bases shall be provided under equipment to distribute the weight to conform to the live-load limits.

3.3.2 Heating Bitumens

Asphalt shall be heated and applied at its respective Equiviscous Temperature (EVT) plus or minus 25 degrees F 14 degrees C.

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

calibrated.

Foreman shall carry immersion thermometers accurate within plus or minus 2 degrees F 1 degrees C and shall frequently check temperatures. If the temperature of the bitumens in the applicators is below specified amounts, removal and replacement of the effected roofing may be required.

3.3.3 Vapor-Barrier Application

Polyvinylchloride sheet vapor barriers shall be applied as follows:

[Vapor barriers shall be applied to the deck by adhesive applied in ribbons at a minimum rate of 0.4 gallon per 100 square feet 1.6 liter per 10 square meter in accordance with the printed instructions of the manufacturer.]

[Vapor-barrier seaming may be either by heat welding or by adhesive bonding as recommended by the manufacturer. Application of adhesive shall be by a multiple-nozzle wheeled applicator.]

Vapor-barrier installation shall proceed progressively directly ahead of the advancing insulation installation. Work shall be organized to eliminate walking over the vapor barrier; traffic over the installed vapor barrier shall be confined to areas where plywood sheets have been laid to protect the vapor barrier.

Felt-type vapor barriers shall be as follows:

[Vapor barriers shall be two layers of No. 15 asphalt-saturated felt. Lap plies shall be 19 inches 480 millimeter. First ply shall be embedded and the edges lapped in full hot application of steep asphalt.]

NOTE: The following shall be included for nailable decks.

[Each ply shall be nailed 4 inches and 16 inches 100 millimeter and 400 millimeter from bottom to edge; nails shall be staggered. Each ply shall be broomed-in to complete embedment.]

[Vapor barrier shall be one layer of base sheet. Lap plies shall be 4 inches 100 millimeter at edges and 6 inches 150 millimeter at ends. Base sheet and lapped edges and ends shall be embedded in full hot application of steep asphalt.]

On gypsum: Directly over the gypsum surface, the first vapor-barrier ply shall be laid dry with edges lapped 2 inches 50 millimeter and nailed on 12-inch 300 millimeter centers with 1-3/4-inch M45 headed square-cut nails or flatheaded bright nails through metal disks. Second ply shall be solidly mopped over the first ply with joints broken between plies. In addition to mopping, the edges shall be lapped 2 inches 50 millimeter and nailed as specified for the first ply. Other fastening devices may be used, provided the minimum holding force is 20 pounds 90 newton each in the deck when driven.

On concrete: Where asphalt-saturated felts are used over poured-in-place concrete, the first ply shall be channel- or spot-mopped in place over asphalt primer. Where coal-tar-saturated

felts are used, the first ply shall be channel- or felt-mopped directly over the concrete deck. Channel mopping shall be done in one direction with approximately 6-inch 150 millimeter spacing between strips and with ends left open. Spots in spot-mopping shall be spaced uniformly, without closed pockets between spots.

On decks composed of precast units: Hot bitumen shall be channel-mopped to not less than 3 inches 75 millimeter and not more than 4 inches 100 millimeter away from joints in the deck. Plies shall be lapped 19 inches 480 millimeter and solid-mopped between plies.

3.3.4 Insulation Application

Insulation shall be installed in accordance with the manufacturer's requirements and as specified below. Method of holddown used by the manufacturer in areas subject to hurricane velocity winds shall be subject to approval prior to installation.

Total nominal thickness shall be installed in [_____] layer(s). Care shall be taken not to rupture the vapor barrier during installation of insulation. No more insulation shall be installed at one time than can be protected from wetting or other damage by installation of roofing membranes on the same day or prior to rain or dew.

Layer to receive the roofing membrane shall be installed with longitudinal joints parallel to the short dimension of the roof. Joints shall be staggered in each layer. First layer and between layers shall be solid-mopped. Membrane shall be laid with edges in moderate contact, but not forced into place. End joints shall be staggered.

Vapor-barrier felts shall be laid perpendicular to the roof slope.

Joints of insulation board shall be taped, if required by manufacturers of insulation and roofing.

Temporary water cutoffs shall be installed at the completion of each day's work and removed upon resumption of work.

3.4 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 --