

- 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 --

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.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

PART 1 GENERAL

1.1 REFERENCES

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

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

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

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1289	(2003) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 150	(2005) 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	(2003) Standard Specification for Mineral Fiber Roof Insulation Board
ASTM C 728	(2003) 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	(2005) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 41	(2005) 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 SUBMITTAL PROCEDURES 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.

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, Air Force, and NASA projects.

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

Government approval is required for submittals with a "G" 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.] Submit the following in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's data shall be submitted indicating percentage of recycle material in roof and deck insulation to verify affirmative procurement compliance.

Total weight and volume quantities of roof and deck insulation with recycle material shall be submitted.

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 liter 1-quart containers of Adhesives.

Three pieces, full thickness by 300 millimeter 12 inches 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 AFFIRMATIVE PROCUREMENT

Glass-Fiber and Mineral Wool/Fiber are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>)

EPA's recommended Recovered Materials Content Levels for building insulation.

Product	Material	Percent Of Post Consumer Materials	Percent Of Total Recovered Materials
Rock Wool	Slag		75
Fiberglass	Glass Cullet		20-25
Cellulose Loose Fill & Spray-on	Post Consumer Paper	75	75
Perlite Composite	Post Consumer Paper	23	23

Product	Material	Percent Of Post Consumer Materials	Percent Of Total Recovered Materials
Board			
Plastic Rigid Foam, Polyisocyanurate/Polyurethane			
Rigid Foam			9
Foam-in-Place			5
Glass Fiber Reinforced			6
Phenolic Rigid Foam			5
Plastic, Non- Woven Batt	Recovered and /or Post Consumer Plastics		100

The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

NOTE: 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 to Contracting Officer a written justification and supporting documentation for not procuring designated items containing recovered material using the Recovered Materials Determination Form.

For informational purposes, a list of known sources for roof and deck insulation using recycled material is provided in the EPA/CPG Supplier database at http://www.ergweb2.com/cpg4review/user/cpg_search.cfm.

Note that the Contractor is not limited to these sources. A product meeting CPG recycle requirements from other sources may be submitted for the Government's approval.

Contractor shall submit recycled material content data for roof and deck insulation indicating compliance with affirmative procurement.

Contractor shall submit total weight and volume quantities of roof and deck insulation with recycle material.

2.2 THERMAL INSULATION MATERIALS (OR UNDERLAYMENT)

2.2.1 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.

2.2.2 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 (43 kilopascal) (94 pounds) of portland cement to 1-1/2 bags (0.2 cubic meter) (6 cubic feet) of aggregate, and with a minimum compressive strength of 860 kilopascal 125 psi 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.]

2.3 SHEATHING PAPER

Sheathing paper shall be [rosin-sized weighing not less than 2.5 kilogram per 10 square meter 5 pounds per 100 square feet] [unsaturated felt weighing approximately 3.5 kilogram per 10 square meter 7-1/2 pounds per 100 square feet].

2.4 VAPOR BARRIER

2.4.1 Polyvinylchloride Sheet

Polyvinylchloride sheet vapor barriers shall be unplasticized virgin polyvinylchloride and shall be not less than 0.10 millimeter 0.004 inch thick, with water vapor permeance of not more than 0.06 nanogram per pascal-second square meter 0.10 on a spot-by-spot basis, not as an average. Permeance shall be measured in accordance with ASTM E 96, Water Method.

2.4.2 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 [____]].]

2.4.3 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.]

2.5 FASTENING MATERIALS

2.5.1 Adhesives

2.5.1.1 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.

2.5.1.2 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 670 kilopascal 100 psi.

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.

2.5.1.3 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].]

2.5.2 Fasteners

Roofing nails shall be [nonferrous] [cement-coated] [galvanized] with [_____] millimeter inch 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 90 newton 20 pounds per fastener, when driven.

Insulation holddown clips shall be as recommended by the insulation manufacturer and approved prior to installation.

2.6 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.

2.7 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 07550S MODIFIED BITUMINOUS MEMBRANE 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 16 millimeter 5/8-inch thick and 600 millimeter 2-feet wide.

Materials temporarily stored on the roof shall be distributed to stay within the live-load limits of the roof, which is [_____] pascal psf. 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 14 degrees C 25 degrees F.

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 1 degrees C 2 degrees F 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 1.6 liter per 10 square meter 0.4 gallon per 100 square feet 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 480 millimeter 19 inches. 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 100 millimeter and 400 millimeter 4 inches and 16 inches 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 100 millimeter 4 inches at edges and 150 millimeter 6 inches 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 50 millimeter 2 inches and nailed on 300 millimeter 12-inch centers with M45 1-3/4-inch 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 50 millimeter 2 inches and nailed as specified for the first ply. Other fastening devices may be used, provided the minimum holding force is 90 newton 20 pounds 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 150 millimeter 6-inch 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 75 millimeter 3 inches and not more than 100 millimeter 4 inches away from joints in the deck. Plies shall be lapped 480 millimeter 19 inches 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 --