SECTION 07 22 00
ROOF AND DECK INSULATION

SPEC WRITER NOTES:
1. Delete text in //   // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.
2. Follow the recommendations of the National Roofing Contractors Association "Roofing and Waterproofing Manual" for design criteria.
4. Insure positive slope to drains occur; minimum of 1:50 (1/4 inch per foot) without any "gutters" (no slopes) between drains.
5. Do not use on slopes over 1:12 (one inch per foot) unless text is edited for this.
6. Insure drains are located at points of maximum deflection; such as at midspans and at bottom of slopes.
7. This section is intended for use where insulation is under the roofing or waterproofing membrane.
8. Do not use polystyrene insulation under bituminous roofing or waterproofing membrane.
9. Anchor insulation to the deck. Do not specify loose laid insulation.
10. Coordinate with electrical. Do not allow conduit to be run in the insulation.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Roof and deck insulation, //substrate board,// //vapor retarder,// //and // //cover board// on new construction ready to receive roofing or waterproofing membrane.

B. Repairs and alteration work to existing roof insulation.

1.2 RELATED WORK

SPEC WRITER NOTE: Edit Related Work to reflect other sections relating directly to this section or referenced in this section.

A. General sustainable design documentation requirements: Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS.
B. Insulating Concrete Systems: Section 03 52 00, LIGHTWEIGHT CONCRETE
ROOF INSULATION.
C. Wood cants, blocking, and edge strips: Section 06 10 00, ROUGH
CARPENTRY.
D. Perimeter, rigid, and batt or blanket insulation not part of roofing
system: Section 07 21 13, THERMAL INSULATION.
E. Sheet metal components and wind uplift requirements for roof-edge
design: Section 07 60 00, FLASHING AND SHEET METAL.

1.3 APPLICABLE PUBLICATIONS

SPEC WRITER NOTES:
1. Update applicable publications to
current issue at time of project
specification preparation.
2. Update material requirements to agree
with applicable requirements (types,
grades, classes,) specified in the
referenced Applicable Publications.

A. Publications listed below form a part of this specification to the
extent referenced. Publications are referenced in the text by the basic
designation only. Editions of applicable publications current on date
of issue of bidding documents apply unless otherwise indicated.

B. American Society of Heating, Refrigeration and Air Conditioning
(ASHRAE):
90.1-07..................Energy Standard for Buildings Except Low-Rise
Residential Buildings

C. ASTM International (ASTM):
C208-08.................Cellulosic Fiber Insulating Board
C552-07.................Cellular Glass Thermal Insulation
C726-05.................Mineral Fiber Roof Insulation Board
C728-05.................Perlite Thermal Insulation Board
C1177/C1177M-08........Standard Specification for Glass Mat Gypsum
Substrate for Use as Sheathing
C1278/C1278M-07........Standard Specification for Fiber-Reinforced
Gypsum Panel
C1289-10.................Faced Rigid Cellular Polyisocyanurate Thermal
Insulation Board
C1396/C1396M-09........Standard Specification for Gypsum Board
D41-05.................Asphalt Primer Used in Roofing, Dampproofing,
and Waterproofing
D312-06..................Asphalt Used in Roofing
Polymer Modified Bituminous Sheet Materials
Used as Steep Roofing Underlayment for Ice Dam
Protection
D2178-04................Asphalt Glass Felt Used in Roofing and
Waterproofing
D2822-05................Asphalt Roof Cement
D4586-07................Standard Specification for Asphalt Roof Cement,
Asbestos-Free
E84-09..................Standard Test Method for Surface Burning
Characteristics of Building Material
F1667-05.................Driven Fasteners: Nails, Spikes, and Staples
D. FM Approvals: RoofNav Approved Roofing Assemblies and Products.
4450-89...............Approved Standard for Class 1 Insulated Steel
Deck Roofs
4470-10...............Approved Standard for Class 1 Roof Coverings
1-28-09...............Loss Prevention Data Sheet: Design Wind Loads.
1-29-09...............Loss Prevention Data Sheet: Above-Deck Roof
Components
1-49-09...............Loss Prevention Data Sheet: Perimeter Flashing
E. National Roofing Contractors Association: Roofing and Waterproofing
Manual
F. U.S. Department of Agriculture (USDA): USDA BioPreferred Catalog,
www.biopreferred.gov
H. U.S. Department of Commerce National Institute of Standards and
Technology (NIST):
DOC PS 1-09.............U.S. Product Standard for Construction and
Industrial Plywood
DOC PS 2-04.............Performance Standard for Wood-Based Structural-
Use Panels.

1.4 PERFORMANCE REQUIREMENTS

SPEC WRITER NOTE: Modify minimum R-value
requirement in paragraph below to
 correspond to Project requirements.
A. Thermal Performance: Provide roof insulation meeting minimum overall average R-value of 33, with minimum R-value at any location of 10.

B. FM Approvals: Provide roof insulation complying with requirements in FM Approvals 4450 and 4470 as part of specified roofing system, listed in FM Approvals "RoofNav" as part of roofing system meeting Fire/Windstorm Classification in Division 07 roofing section.

1.5 QUALITY CONTROL

A. Requirements of Division 07 roofing section for qualifications of roofing system insulation Installer; Work of this Section shall be performed by same Installer.

B. Requirements of Division 07 roofing section for inspection of Work of this Section and qualifications of Inspector.

C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

SPEC WRITER NOTE: Retain applicable coordinating paragraphs related to uplift pressure and wind design below.

D. Requirements of roofing system uplift pressure design for specified roofing system.

E. Requirements of applicable FM Approval for specified roofing system insulation attachment.

F. Requirements of applicable Miami-Dade County approval for high-wind zone design.

SPEC WRITER NOTES:

2. Project's General Requirements should indicate goals for percentages of bio-
based, rapidly-renewable, and certified sustainable wood products.

G. Bio-Based Materials: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
   1. Asphalt and adhesive materials, each type.
   2. Roofing cement, each type.
   3. Roof insulation, each type.
   4. Substrate board, each type.
   5. Cover board, each type.
   6. Fastening requirements.
   7. Insulation span data for flutes of metal decks.

C. LEED /and Federal Sustainable Design// Submittals:
   1. Product Data for Credit IEQ 4.1: For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
   2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

   SPEC WRITER'S NOTE: Retain paragraph below when retaining requirement for use of Federally-mandated products under Quality Control Article above.


D. Shop Drawings: Include plans, sections, details, and attachments.
   1. Nailers, cants, and terminations.
   2. Layout of insulation showing slopes, tapers, penetration, and edge conditions.

E. Samples:
   1. Roof insulation, each type.
2. Nails and fasteners, each type.

F. Certificates:
   1. Indicating type, thermal conductance, and minimum and average thickness of insulation.
   2. Indicating materials and method of application of insulation system meet the requirements of FM Approvals for specified roofing system.

G. Laboratory Test Reports: Thermal values of insulation products.

H. Layout of tapered roof system showing units required.

I. Documentation of supervisors' and inspectors' qualifications.

1.7 DELIVERY, STORAGE AND MARKING

A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation requirements.

SPEC WRITER NOTE: Update material requirements to agree with applicable requirements (types, grades, classes,) specified in the referenced Applicable Publications.

1.8 QUALITY ASSURANCE:

A. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84, or shall have successfully passed FM Approvals 4450.

1. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports.

2. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the particular type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approvals "RoofNav."

3. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

PART 2 - PRODUCTS

SPEC WRITER NOTES:
1. Update material requirements to agree with applicable requirements (types,
grades, classes), specified in the referenced Applicable Publications.

2. Edit Part 2 after required materials and methods of assembly have been determined through review and editing of Part 3.

2.1 ADHESIVE MATERIALS

A. Adhesive Materials, General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

1. Liquid-type adhesive materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Plastic Foam Adhesives: 50 g/L.
   b. Multipurpose Construction Adhesives: 70 g/L.
   c. Fiberglass Adhesives: 80 g/L.
   d. Contact Adhesives: 80 g/L.
   e. Other Adhesives: 250 g/L.
   f. Nonmembrane Roof Sealants: 300 g/L.
   g. Sealant Primers for Nonporous Substrates: 250 g/L.
   h. Sealant Primers for Porous Substrates: 775 g/L.

B. Primer: ASTM D41.

C. Asphalt: ASTM D312, Type III or IV for vapor retarders and insulation.

D. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

E. Bead-Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

F. Full-Spread Applied Urethane Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

G. Roof Cement: Asbestos free, ASTM D2822, Type I or Type II, ; or, D4586, Type I or Type II.
2.2 ROOF AND DECK INSULATION

A. Roof and Deck Insulation, General: Preformed roof insulation boards approved by roofing manufacturer and listed as component of FM Approvals-approved roofing system.

SPEC WRITER NOTE: Retain one or more of insulation types below based on project requirements. If retaining more than one type, indicate locations of different types on drawings.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Cellular Glass Board Insulation: ASTM C552, Type IV, kraft-paper sheet faced.

D. Perlite Board Insulation: ASTM C728, expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.

E. Cellulosic Fiber Board Insulation: ASTM C208, Type II //Grade 1 for built-up asphalt or modified bitumen roofing// //Grade 2 for single-ply roofing//.

F. Tapered Roof Insulation System:
   1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
   2. Cut to provide high and low points with crickets and slopes as shown.
   3. Minimum thickness of tapered sections; 38 mm (1-1/2 inch).

G. Composite Nail Base Insulated Roof Sheathing:
   1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: polyisocyanurate thermal insulation ASTM C1289, Type V, insulation thickness as indicated, with oriented strand board laminated to top surface.
   2. Oriented Strand Board: NBS DOC PS 1, Exposure 1, //11 mm (7/16 inch)// //15.9 mm (5/8 inch)// thick.
   3. Bottom surface faced with felt facers.

2.3 INSULATION ACCESSORIES

A. Glass (Felt): ASTM D2178, Type VI, heavy duty ply sheet.

B. Cants and Tapered Edge Strips:

SPEC WRITER NOTE: Retain first paragraph below for FMG approved systems requiring
Wood cant strips at roof perimeter and major openings.

1. Wood Cant Strips: Refer to Division 06 Section "Rough Carpentry."
2. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
3. Tapered Edge Strips: 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
   c. Perlite Board: ASTM C728.

C. Vapor Retarder:
2. Self-Adhering Sheet Vapor Retarder: ASTM D1970, minimum of 1.0-mm- (40-mil-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive, or 0.76- to 1.0-mm- (30- to 40-mil-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 6 ng/Pa x s x sq. m (0.1 perm).

D. Substrate Board:

   SPEC WRITER NOTE: Select one or more paragraphs from below for roofing systems requiring support for a vapor retarder over steel deck, or where specific substrate board is required by specified fire-resistance-rated roof assembly design.

1. Type X gypsum board, ASTM C1396/C1396M, 16 mm (5/8 inch) thick.
2. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, 13 mm (1/2 inch) thick, Type X, 16 mm (5/8 inch) thick, factory primed.
3. Cellulosic-fiber-reinforced, water-resistant gypsum substrate, ASTM C1278/C1278M, 6 mm (1/4 inch) thick, 10 mm (3/8 inch) thick, 13 mm (1/2 inch) thick, 16 mm (5/8 inch) thick.
4. Perlite Board Insulation, ASTM C728, 19 mm (3/4 inch) thick, 25 mm (1 inch) thick.

E. Cover Board:

   SPEC WRITER NOTE: Typically retain one paragraph from four below for VA roofing systems. Cover board is required under single-ply membranes installed over plastic foam insulation board based upon NRCA recommendations, and also where required by FM Approvals assembly.
1. Glass-mat, water-resistant gypsum substrate, ASTM C1177/C1177M, 6 mm (1/4 inch) // 13 mm (1/2 inch) // 16 mm (5/8 inch) thick, factory primed.
2. Cellulosic-fiber-reinforced, water-resistant gypsum substrate, ASTM C1278/C1278M, 6 mm (1/4 inch) // 10 mm (3/8 inch) // 13 mm (1/2 inch) // 16 mm (5/8 inch) thick.
3. Cellulosic-fiber insulation board, ASTM C208, Type II, Grade 2, 13 mm (1/2 inch) thick.
4. Oriented Strand Board, DOC PS 2, Exposure 1, 11 mm (7/16 inch) thick.

2.4 FASTENERS
A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening substrate board to roof deck.
B. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Comply with requirements of Division 07 roofing section.

3.2 PREPARATION
A. Comply with requirements of Division 07 roofing section.

3.3 SUBSTRATE BOARD INSTALLATION

SPEC WRITER NOTES:
1. The National Roofing Contractors Association recommends substrate board be installed over steel deck. Use substrate board over steel deck on all VA new construction.
2. Utilize substrate board over steel deck to provide continuous support for vapor retarder where required.
A. Fasten substrate board to top flanges of steel deck to resist uplift pressures according to roofing system manufacturers instructions and requirements of FM Approvals listing for specified roofing system.

3.4 VAPOR RETARDER INSTALLATION

SPEC WRITER NOTES:
1. Review requirement for vapor retarders for use over decks to receive insulation for heated buildings where the January average means temperature
is below 4.5 °C (40 °F), the relative humidity is 45 percent or greater. Vapor retarders should typically be considered for heated portions of buildings where a high humidity condition is expected such as a kitchen, indoor swimming pool, or laundry.

2. As a general rule, follow NRCA procedures for determining if vapor retarders are required including venting and ASHRAE for calculations; however, under conditions of extreme humidity and cold weather conditions, the need for a vapor retarder is essential and water vapor transmission analysis is necessary. Insure that the vapor retarder is shown at all locations where required on the drawings.

A. General:

1. Install continuous vapor retarder on roof decks where indicated.

2. At vertical surfaces, turn up vapor retarder to top of insulation or base flashing.

3. At all pipes, walls, and similar penetrations through vapor retarder, seal openings with roof cement to prevent moisture entry from below.

4. Seal penetrations with roof cement.

B. Cast in Place Concrete Decks, Except Insulating Concrete:

1. Prime deck as specified.

2. Apply two plies of asphalt saturated felt mopped down to deck.

C. Precast Concrete Unit Decks Without Concrete Topping:

1. Prime deck as specified.

2. Apply two plies of asphalt saturated felt.

3. Mop to deck, keeping bitumen 100 mm (four inches) away from joints of precast units. Bridge joints with felt. Mop between plies as specified.

D. Steel Deck:

1. Material and method of application of roofing systems used on metal decks shall meet the requirements of FM Approvals for Class I-A Insulated Steel Roof Deck.

2. Attach substrate board and subsequent components to meet the requirements of FM Approval's "RoofNav" listing for specified system meeting Fire/Windstorm Classification indicated in Division 07 roofing section.
3. Locate the long dimension edge joints to have solid bearing on top of decking ribs; do not cantilever over rib openings or flutes.

3.5 RIGID INSULATION INSTALLATION

SPEC WRITER NOTES:
1. Calculate location of the dew point to determine the amount of insulation required over vapor retarder, if any. Insure sufficient R value cover occurs in the top layer of the insulation to prevent condensation occurring on the interior surface of the vapor retarder.
2. Insure the total insulation thickness will span flutes in metal deck.
3. Specify R value for each layer of insulation to avoid ambiguities.
4. Indicate type(s) of insulation required when more than one type is needed due to roofing system designs. Edit Part 2 to correspond to acceptable insulation types.
5. Use two layers, except on steel decks used for canopies or unheated structures.
6. Mechanical fasteners shall not extend through both layers of insulation over heated spaces.
7. Comply with International Building Code requirements regarding use of plastic insulation.
8. Use cellular glass or mineral fiber board for tapered edge strips at gravel stop in facilities with raised edge.
9. For tapered insulation systems, use minimum thickness at roof drains of 38 mm (1-1/2 inch).
10. Use crickets to eliminate "gutters" in roof slopes. Do not allow "flat areas" where ponding will occur. Provide dishes at drains, 13 mm (1/2 inch) deep. Coordinate to show on details.
11. Use cellular glass board for plaza at promenade decks.

A. Insulation Installation, General:
1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
2. Install roof insulation in accordance with requirements of FM Approval's Listing for specified roofing system.
3. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate prior to installation of insulation.

4. Cant Strips: Install //preformed insulation cant strips// wood cant strips specified in Division 06 Section ROUGH CARPENTRY// at junctures of roofing system with vertical construction.

   SPEC WRITER NOTE: Retain paragraph below for re-roofing projects.

5. Use same insulation as existing for roof repair and alterations unless specified otherwise.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the average thermal resistance "R" value of not less than that specified in Performance Requirements Article.

   SPEC WRITER NOTE: Verify sufficient "R" occurs over vapor retarder to prevent condensation, especially over insulating concrete decks.

2. Insulation on Metal Decks: Provide minimum thickness of insulation for metal decks recommended by the insulation manufacturer to span rib opening (flute size) of metal deck used. Support edges of insulation on metal deck ribs.

3. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.

   SPEC WRITER NOTE: Insure roof slopes high and low points are shown on the roof plan including crickets. Do not have "gutters" or level areas between drains. Insure drains are located at low points. Insure correct geometry is shown for slope.

4. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).

5. Use not less than two layers of insulation when insulation is 68 mm (2.7 inch) or more in thickness unless specified otherwise. Stagger joints minimum 150 mm (6 inches).
C. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer.

D. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt.

E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.

SPEC WRITER NOTE: Insulation is required to be mechanically anchored to steel decks. Delete non applicable text. Refer to FM Building Materials and Construction requirements for resistance to wind storm uplift. Where no windstorm requirement is required, use 1-60 requirement. Design for wind conditions of area where building is constructed.

F. Cut to fit tight against blocking or penetrations.

G. Cover all insulation installed on the same day; comply with temporary protection requirements of Division 07 roofing section.

H. Installation Method:

1. Adhered Insulation:
   a. Prime substrate as required.
   b. Set each layer of insulation firmly in solid mopping of hot asphalt.
   c. Set each layer of insulation firmly in ribbons of bead-applied insulation adhesive.
   d. Set each layer of insulation firmly in uniform application of full-spread insulation adhesive.

2. Mechanically Fastened Insulation:
   a. Fasten insulation in accordance with FM Approval's "RoofNav" requirement in Division 07 roofing section.
   b. Fasten insulation to resist uplift pressures specified in Division 07 roofing section.

3. Mechanically Fastened and Adhered Insulation:
   a. Fasten first layer of insulation according to "Mechanically Fastened Insulation" requirements.
   b. Fasten each subsequent layer of insulation according to "Adhered Insulation" requirements.

SPEC WRITER NOTE: Do not mechanically fasten cover board under singly ply membranes, in order to avoid potential
excessive wear and puncture of membrane at exposed cover board fasteners.

4. Cover Board: Install cover boards over insulation with long joints in continuous straight lines with staggered end joints. Offset cover board joints from insulation joints minimum 150 mm (6 inches). Fasten cover boards according to "Adhered Insulation"/"Mechanically Fastened Insulation" requirements.

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