Preparing Activity: NAVFAC

Superseding
UFGS-07 22 00 (February 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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08/23

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SECTION 07 22 00

ROOF AND DECK INSULATION
08/23

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NOTE: This guide specification covers the requirements for insulation materials used below low-slope built-up roofing and single ply roofing systems.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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Insulation materials applies to both organic and inorganic materials used for thermal protection as part of roofing assemblies or under decks.

In new construction, provide at least a 1 in 24 (40 mm per 1 M)(1/2 inch per foot) slope in the structural deck and use non-tapered insulation. When it is clearly impracticable to provide the required slope or in reroofing where there is insufficient slope, tapered insulation may be used. Also, use tapered insulation for the construction of saddles and crickets to provide slope to drains.

Insulation for steep-slope roof systems including

metal, shingles, slate and tile, and for prefabricated metal buildings is not included in this section. Insulation for Inverted Roof Membrane Assembly (IRMA) (Protected Roof Membrane (PMR)) is not included in this Section. Insulating sheathing, other materials which are not primarily thermal insulating materials, and insulating concrete are also not included. Such products are classified according to their primary use, and should be specified under the appropriate sections. Spray-applied polyurethane foam roof insulation is specified in Section 07 57 13 SPRAYED POLYURETHANE FOAM (SPF)

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NOTE: On the drawings, show:

1. Extent and locations of work.

2. Dimensions when space limitations or construction features govern thickness of insulation materials.

3. Details at cants, edge strips, nailers, curbs, roof penetrations, and wall junctions.

4. Location and spacing of wood nailers.

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NOTE: UFC 1-200-02 promotes the use of cool roofing, and increased energy conservation through additional insulation. Design cool roofs following the requirements of UFC 3-110-03 "Roofing", Chapter, Cool Roofs. Design insulation for cool roofs to meet at a minimum the ASHRAE 90.1 Chapter 5 zone requirements. Poor design of cool roofs has resulted in unintended consequences such as condensation below the roofing membrane. Coordinate cool roof design with the mechanical engineer on the project to provide appropriate roof assembly, insulation thickness, surface finishes appropriate to the geographic location and humidity requirements of the project. Verify dewpoint and design the roof assembly accordingly.

Design mechanically-fastened single-ply roof systems following the requirements in UFC 3-110-03 "Roofing." Condensation on the underside of mechanically fastened systems can result in ice buildup in winter, mold growth on the facers, moisture dripping into the interior, and replacement of the roof with less than four years of service. See Appendix B of UFC 3-110-03 for more information.

****

PART 1 GENERAL

1.1 REFERENCES

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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 Reference Identifier (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.

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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.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM C208	(2022) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C578	(2022) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C728	(2017a; R 2022) Standard Specification for Perlite Thermal Insulation Board
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1278/C1278M	(2017) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM C1289	(2023) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1902	(2022) Standard Specification for Cellular Glass Insulation Used in Building and Roof Applications

ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D312/D312M	(2016a) Standard Specification for Asphalt Used in Roofing
ASTM D2178/D2178M	(2015a; R 2021) Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4586/D4586M	(2007; R 2018) Asphalt Roof Cement, Asbestos-Free
ASTM D4601/D4601M	(2004; R 2020) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D4897/D4897M	(2016) Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM 4450	(1989) Approval Standard for Class 1 Insulated Steel Deck Roofs
FM 4470	(2022) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2021) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2021) Fire Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

UNDERWRITERS LABORATORIES (UL)

UL 1256	(2002; Reprint Jul 2013) Fire Test of Roof Deck Constructions
UL 2818	(2022) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Insulation Board Layout and Attachment; G[, [_____]]

Verification of Existing Conditions; G[, [_____]]

SD-03 Product Data

Insulation; G[, [_____]]

Cover Board; G[, [_____]]

Fasteners; G[, [_____]]

Sheathing Paper; G[, [_____]]

Moisture Control; G[, [_____]]

[Asphalt Products; G[, [_____]]

] Recycled Content For Insulation; S

SD-05 Design Data

Wind Resistance; G[, [_____]]

SD-06 Test Reports

Flame Spread Rating; G[, [_____]]

SD-07 Certificates

Installer Qualifications; G[, [_____]]

Certificates Of Compliance For Felt Materials; G[, [_____]]

Indoor Air Quality For Insulation; S

Acceptable Foam Blowing Agents; S

SD-08 Manufacturer's Instructions

Nails and Fasteners; G[, [_____]]

Roof Insulation; G[, [_____]]

1.3 SHOP DRAWINGS

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NOTE: Specify shop drawings for wood nailers when nailers are required for securing insulation on roofs sloped 1 in 24 (40 mm per 1 M) (1/2 inch per foot) or more.

Include requirement for backnailing of felts when specified for built-up roofing.

****

Submit insulation board layout and attachment indicating methods of attachment and spacing of fasteners on each board, transitions, tapered components, thicknesses of materials, and closure and termination conditions. Show locations of ridges, valleys, crickets, interface with,

and slope to, roof drains. Base shop drawings on verified field measurements and include verification of existing conditions.[Show wood nailers.][Show location and spacing of wood nailers required for securing of insulation [and backnailing of roofing felts]].

1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for cover board or coatings, and precautions for flammability and toxicity. Include data to verify compatibility of sealants with insulation.

1.5 MANUFACTURER'S INSTRUCTIONS

Include field of roof, perimeter, and corner attachment requirements.

Provide a complete description of installation sequencing for each phase of the roofing system. Include weatherproofing procedures.

1.6 QUALITY CONTROL

Provide certification of installer qualifications from the insulation manufacturer confirming the specific installer has the required qualifications for installing the specific roof insulation system(s) indicated.

Provide certificates of compliance for felt materials.

[1.7 WIND RESISTANCE REQUIREMENTS

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NOTE: FM Approval Guide includes requirements for fasteners for 1-60, 1-90, and 1-120 classifications for resistance to wind uplift pressures. Refer to UFC 3-301-01 "Structural Engineering" for wind loads and specify FM approval accordingly. Note, FM approval numbers do not correspond to wind speeds. Refer to FM Data Sheets for wind design.

****

The complete roof system assembly must be rated and installed to resist wind loads [indicated] [calculated in accordance with ASCE 7] and validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Coordinate with roof covering attachment requirements and submit wind resistance test certification, attachment patterns for field, perimeter, and corner roof areas along with perimeter and corner boundary dimensions.

]1.8 FIRE PERFORMANCE REQUIREMENTS

1.8.1 Insulation in Roof Systems

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NOTE: Include this requirement when insulation is installed over plywood, wood planks other than nominal 50 mm 2 inch thick, tongue-and-groove type, or steel deck.

Coordinate fire performance in insulated roof

systems. At a minimum, comply with ICC IBC and UL1256. If the roof assembly requires FM approval, choose the bracketed options.

Thermal barriers are required for nearly all roofing applications where foam plastics are present. Confirm specific project requirements with ICC IBC. For roofing applications, smoke development rating does not apply. The elimination of the thermal barrier is allowed only under very specific conditions therefore do not eliminate unless specifically verified with applicable life safety codes.

****

Comply with the requirements of ICC IBC [or UL 1256] [or FM 4450][or FM 4470]. Roof insulation must have a flame spread rating of 75 or less when tested in accordance with ASTM E84. Additional documentation of compliance with flame spread rating is not required when insulation of the type used for this project as part of the specific roof assembly is listed and labeled as FM Class 1 approved.[Only roof assemblies that pass FM 4450 are permitted.]

1.8.2 Thermal Barrier Requirements

Separate [polyurethane][or][polystyrene] insulation from a [combustible][steel]deck with a thermal barrier of glass mat gypsum roof board or other approved barrier material in accordance with the requirements of the ICC IBC[or FM 4450][or FM 4470][or UL 1256].[Only roof assemblies that pass FM 4450 are permitted.]

****

NOTE: Specify insulated roof assemblies in accordance with UFC 1-200-01 "DoD Building Code", Fire and Smoke Protection section, and UFC 3-600-01 "Fire Protection Engineering for Facilities". Where requirements conflict between UFCs and IBC, UFC 3-600-01 takes precedence; edit the following section accordingly.

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1.8.3 Fire Resistance Ratings for Roofs

Provide in accordance with ICC IBC Chapter 7 and Table 721.1(3) Min [Fire and Smoke] Protection For Floor and Roof Systems.

1.9 CERTIFICATIONS

Provide products certified to meet indoor air quality requirements by UL 2818(Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification documentation from certification body.

1.10 DELIVERY, STORAGE, AND HANDLING

1.10.1 Delivery

Deliver materials to the project site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible

information:

a. Name of manufacturer

b. Brand designation

c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification

[d. Asphalt flashpoint (FP), equiviscous temperature (EVT), and finished blowing temperature (FBT).

] Deliver materials in sufficient quantity to allow continuity of the work.

1.10.2 Storage and Handling

Store and handle materials in accordance with manufacturer's printed instructions. Protect from damage, exposure to open flame or other ignition sources, wetting, condensation, and moisture absorption. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment.[Store felt rolls on ends. For the 24 hours immediately before application of felts, store felts in an area maintained at a temperature no lower than 10 degrees C 50 degrees F above grade and having ventilation on all sides.] Replace damaged material with new material.

1.11 ENVIRONMENTAL CONDITIONS

As per manufacturer's recommendations or Government's instructions, do not install roof insulation during inclement weather or when air temperature is below 4 degrees C 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

1.12 PROTECTION

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NOTE: Where built-up roofing is applied over insulation, delete paragraphs FLAME HEATED EQUIPMENT through DRIPPAGE OF BITUMEN. Delete paragraphs FLAME HEATED EQUIPMENT, SPECIAL PROTECTION, and DRIPPAGE OF BITUMEN when roofing system or insulation does not require hot asphalt or torches for application.
****

[1.12.1 Flame Heated Equipment

1.12.1.1 Fire Protection

Locate melt kettles no closer than 8 meters 25 feet from buildings or combustible materials. Do not place kettles or other flame-heated equipment on roofs. Provide and maintain two approved 4-A:40-B:C fire extinguishers within 8 meters 25 feet of each operating kettle. Fire extinguishers, operations and locations must comply with NFPA 1 Section Tar Kettles. Equip asphalt (tar) kettles with tight fitting lids.

1.12.1.2 Operational Requirements

Equip kettles with automatic thermostatic control capable of maintaining asphalt temperature. Calibrate and maintain controls in working order for the duration of the work. Equip kettles with means of agitation and ensure they are operating as necessary to produce a controlled uniform temperature throughout kettle contents to prevent spot heating. Do not heat contents above flash point. Do not place flame heated equipment on the roof.

][1.12.2 Special Protection

Provide special protection as approved by the insulation manufacturer.

][1.12.3 Drippage of Bitumen

Seal joints in and at edges of deck as necessary to prevent drippage of asphalt into the building or onto adjacent surfaces.

]1.12.4 Completed Work

Cover completed work with cover board for the duration of construction. Avoid traffic on completed work particularly when ambient temperature is above 27 degrees C 80 degrees F. Replace crushed or damaged insulation prior to roof surface installation.

PART 2 PRODUCTS

****

NOTE: Specify sustainable materials in accordance with UFC 1-200-02 "High Performance and Sustainable Building Requirements." Reduce the environmental impact of materials by specifying products that have a lesser or reduced effect on human health and the environment such as low emitting materials and materials with high recycled content. Consider product life cycle and travel distances when compared with competing products or services serving the same purpose.

****

2.1 INSULATION

2.1.1 Insulation Types

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NOTE: Specify all types of insulation listed as Contractor options, except where method of construction or special requirements prohibit use. Install thermal barrier of glass mat gypsum roof board or suitable roof insulation board directly on roof deck when polystyrene board will be applied over decks constructed of materials other than poured-gypsum; poured-concrete; nominal 50 mm 2 inch thick, tongue-and-groove wood plank or precast roof deck panels; or planks approved by FM as noncombustible roof deck construction.

Note that the type of insulation may be dictated by

that required to receive the warranty from the roofing system manufacturer.

For NAVFAC SE projects, do not specify mineral fiber, glass fiber or cellular glass boards.

Roof insulation should be specified by thermal resistance (R-value) necessary to obtain required overall thermal transmittance (U-value) needed to satisfy design criteria for particular type of facility. Thickness of insulation will vary with type of material furnished in order to provide specified R-value. When thickness of insulating material is governed by space limitations or construction features, R-value and corresponding thickness should be coordinated with space available. Provide insulation of sufficient thickness to ensure that temperature of vapor retarder surface, when used, will be above dewpoint. R-value for insulation should never be less than R-value used in design of heating, ventilation and air conditioning systems.

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NOTE: Roof construction, air-to-air, may include finished ceilings provided ceilings extend over the entire roof area; and the space above the ceiling is neither vented to the exterior nor used as a return air plenum. Generally, roof insulation over mechanical rooms does not need to be increased in thickness when the mechanical room has no ceiling and the rest of the building has a ceiling. If designed roof insulation thickness varies over mechanical rooms or anywhere else in the building, confirm all dewpoints and coordinate locations of vapor barriers accordingly.

Designer will determine the required R-value and indicate on the drawings. Coordinate R-value with Energy Budget Analysis. The R-value of impermeable faced iso-foams and permeable faced polyisocyanurate components will be calculated using the aged R-value of 1.0 square meter K/W ("R" value 5.56) per 25 mm one inch of thickness; k = 0.31 W/m.k (k = 0.18).

The R-value of impermeable faced (ex. aluminum foil) polyisocyanurate components will be calculated using the aged R-value of 1.27 square meter k/w ("R" value 7.2) per 25 mm one inch of thickness; k = 0.24 W/m.k (k = 0.14).

Delete foil-faced board when roofing is single ply and fully adhered. Delete polystyrene and polystyrene composite when insulation will be applied with hot asphalt.

The recovered materials content levels specified below are based on the weight (not the volume) of

the materials in the insulating core, excluding skins or facings.

Insulation must be a standard product of the manufacturer and factory marked with the manufacturer's name or trademark, the material specification number, the R-value at 24 degrees C 75 degrees F, and the thickness. Minimum thickness as recommended by the manufacturer. Boards must be marked individually. The thermal resistance of insulation must not be less than the R-value shown on the drawings. Exclude chlorofluorocarbons (CFC's) in the insulation manufacturing process in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

****

Provide one, or an assembly of a maximum of three, of the following roof insulation materials. Provide roof insulation that is compatible with attachment methods for the specified insulation and roof membrane.

****

NOTE: Detailed information concerning U.S. Environmental Protection Agency (EPA) requirements on recycled/recovered materials is available at the following URL's: https://www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products and then click on the appropriate item from the list (building insulation, for example): https://www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products#01.

Using data from listed locations, fill in blank space (below and in subsequent paragraphs) for required percentage of recycled or recovered material. This is in accordance with the requirements of 40 CFR 247 and Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, which should be included in all projects.

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NOTE: Delete foil-faced board when fully adhered, cold-applied single ply roofing is specified.

Blistering of roofing membranes has occurred over some polyurethane and composite (polyurethane) board insulation, possibly due to either release of gases from polyurethane, moisture entrapped in facing or plying felt, differential movement between roofing membrane and polyurethane resulting from thermal stresses on the materials, or inadequate brooming and mopping. When hot-applied built-up, modified bitumen sheet, or Polyisobutylene (PIB) sheet roofing is installed over insulation, provide a thin layer of expanded perlite board insulation, or glass mat gypsum roof board over the top surface of the polyurethane board, embedded in solid asphalt

mopping with joints of perlite board, or glass mat gypsum roof board staggered in both directions with respect to the polyurethane board below. The same precautionary procedure should be followed when polyisocyanurate foam boards are specified even though there may not be documentation of similar problems with these types.

Require compressive strength of polyisocyanurate board to be 172 kPa 25 psi when used without a coverboard; 140 kPa 20 psi is allowed when a coverboard of 13 mm 1/2 in minimum is also included in the roofing system.
****

a. Polyisocyanurate Board: Provide in accordance with ASTM C1289 REV A [Type I, foil faced both sides] [or] [Type II, fibrous felt or glass mat membrane both sides], except minimum compressive strength of [172] [140] kilopascal (kPa) [25] [20] pounds per square inch (psi).

****
NOTE: Delete non-composite polystyrene board when insulation will be applied with hot asphalt or used under hot asphalt-applied roofing. This type of insulation is sensitive to hot asphalt, various solvents, and certain single ply roofing membranes.
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NOTE: Extruded polystyrene insulation board is flexible enough for use on arched roofs. For this application, each layer must be thin enough to permit the required bending and each layer must be mechanically fastened. Check individual manufacturer requirement prior to application.
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NOTE: Consider Polystyrene as a roof insulation in humid locations or project locations with Environmental Severity Classifications (ESC) of C3 thru C5. Humid locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations. Polystyrene has a high heat resistance (R) value, is dense enough for foot traffic, and will not absorb water. Foam glass has higher initial cost, therefore it is not often used as a roof insulation. When a higher compressive resistance is required than provided by the XPS types listed, insert the required type.
****

b. Extruded Polystyrene (XPS) Board: In accordance with ASTM C578 REV A, Type IV or X.

****
NOTE: Delete polystyrene composite board when

insulation will be applied with hot asphalt.
****

c. Composite Boards: Provide in accordance with ASTM C1289 REV A, [Type III, perlite insulation board faced on one side with fibrous felt or glass fiber mat membrane on opposite side.] [Type V, oriented strand board or waferboard on one side and fibrous felt or glass fiber mat membrane or aluminum foil on opposite side (Polyisocyanurate-perlite).]

****
NOTE: Do not specify perlite board in high wind areas.
****

d. Expanded Perlite Board: Provide in accordance with ASTM C728. Minimum 19 mm 3/4 inch thick when both top and bottom surfaces must be in contact with asphalt.

****
NOTE: Cellular glass roof insulation is not widely used due to its high cost. It is most commonly used in cold storage facilities and other areas where excessive amounts of moisture would degrade the insulating capabilities of other types of insulation. Select and insert the Type based on the compressive resistance and thermal resistance requirements for the roof.
****

e. Cellular Glass Boards: ASTM C1902, Type [____].

2.1.2 Recycled Materials

Provide thermal insulation materials containing recycled content. Unless specified otherwise, the minimum required recycled content for listed materials are:

Perlite Composition Board:	23 percent postconsumer paper
Polyisocyanurate/polyurethane:	9 percent recovered material
Cellular Glass Insulation:	60 percent recovered content
Fiberglass Insulation:	25 percent recovered content
Fiber (felt) or Fiber composite:	75 percent recovered content

Provide data identifying percentage of recycled content for insulation.

2.1.3 Indoor Air Quality

Provide certification of indoor air quality for insulation.

2.1.4 Prohibited Materials

Products that contain high ozone depleting or high Global Warming Potential (GWP) blowing agents are prohibited. For a list of acceptable substitute foam blowing agents for the type of insulation used see https://www.epa.gov/snap/foam-blowing-agents. Provide validation of

acceptable foam blowing agents that no prohibited materials are used.

2.1.5 Insulation Thickness

As necessary to provide the thermal resistance (R-value) indicated[for average thickness of tapered system]. Base calculation on the R-value for aged insulation.[For insulation over steel decks, satisfy both specified R-value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature].

[2.1.6 Tapered Roof Insulation

****

NOTE: Sloping substrate (structure) is the preferred method to achieve primary roof slope, however tapered insulation may be used when sloping substrate is not feasible. Where tapered roof insulation is used on a substrate sloped 1 in 48 (20 mm per 1 M) (1/4 inch per foot) and greater, insulation having a slope of 1 in 48 (20 mm per 1 M) (1/4 inch per foot) in the same direction as the substrate slope may be specified. Otherwise, specify tapered insulation having a slope of 1 in 24 (40 mm per 1 M) (1/2 inch per foot).

****

One layer of the tapered roof insulation assembly must be factory tapered to a slope of not less than one in [24] [48] [20 mm] [40 mm] per 1 M [1/4] [1/2] inch per foot. Factory fabricate mitered joints from two diagonally cut boards or one board shaped to provide required slopes.

][2.1.7 Cants and Tapered Edge Strips

****

NOTE: Generally, cant strips are not required for single ply roofing systems. However, if cant strips are necessary, coordinate their location with mechanical drawings to ensure that no projections, such as vent pipes and braces, will be constructed through cant strips or within 250 mm 10 inches from them. Specify wood cants, edge strips, and pressure preservative treatment in Section 06 10 00 ROUGH CARPENTRY.

****

Provide preformed cants and tapered edge strips of the same material as the roof insulation. When unavailable, provide pressure-preservative treated wood, or rigid perlite board cants and edge strips as recommended by the roofing manufacturer for the specific application, unless otherwise indicated. Face of cant strips to incline at 45 degrees with a minimum vertical height of 100 mm 4 inches. Taper edge strips at a rate of 85 to 125 mm per meter one to 1 1/2 inch per foot down to approximately 3 mm 1/8 inch thick.

][2.2 COVER BOARD

****

NOTE: Provide cover boards over roof insulation for hot-mopped, torched-down, or adhesive-applied

roofing membrane. Cover boards may also be used for thermal barriers under the roof insulation.
****

For use as a thermal barrier (underlayment), fire barrier (overlayment), or cover board for hot-mopped, torched-down, or adhesive-applied roofing membrane over roof insulation.

[2.2.1 Glass Mat Gypsum Roof Board

****
NOTE: Specify glass mat gypsum roof board as a Contractor's option to wood fiberboard, expanded perlite, or other suitable material, when an underlayment or overlayment is required for the roof insulation board.
****

ASTM C1177/C1177M, 0 Flame Spread and 0 Smoke Developed when tested in accordance with ASTM E84, 3450 kPa 500 psi, Class A, non-combustible, [6][13][16] mm [1/4][1/2][5/8] inch thick, 1220 by 2440 mm 4 by 8 feet board size.

][2.2.2 Fiber-Reinforced Gypsum Board Panels

Provide non-glass-faced fiber-reinforced gypsum board panels in accordance with ASTM C1278/C1278M.

][2.2.3 High Density Wood Fiber Board

****
NOTE: High density wood fiber board provides improved impact resistance to roof covers but is hygroscopic in nature.
****

Provide high density wood fiber board, Grade 2 in accordance with ASTM C208 with a transverse load of 53.4 N 12 lbf.

]][2.3 BITUMENS

****
NOTE: Where insulation is installed under roofing that does not require hot asphalt and vapor retarder is not required, delete ASPHALT PRIMER, ASPHALT ROOF CEMENT, and ASPHALT-SATURATED FELT BASE SHEET FOR SINGLE LAYER APPLICATION. Always mechanically secure first layer of insulation to steel decks. For installation over steel and other decks not requiring vapor retarders or where asphalt is not used in installing insulation, specify only mechanical fastening of insulation. Coordinate requirements of this section with section specifying the roofing; requirements must meet manufacturer's requirements to obtain the roofing system warranty.
****

[2.3.1 Asphalt Primer

Provide in accordance with ASTM D41/D41M.

][2.3.2 Asphalt

Provide in accordance with ASTM D312/D312M, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and mechanical spreader application must be indicated on each container.

][2.3.3 Asphalt Roof Cement

Provide in accordance with ASTM D4586/D4586M, Type I, for horizontal surfaces and surfaces sloped from 0 by 76 mm per 1 M 0 to 3 inches per foot. Type II for vertical and surfaces sloped more than 76 mm per 1 M 3 inches per foot.

]][2.4 SHEATHING PAPER FOR WOOD DECKS

Rosin-sized building paper or unsaturated felt weighing not less than 2.5 kilograms per 10 square meters 5 pounds per 100 square feet.

]2.5 MOISTURE CONTROL

****

NOTE: Vapor retarder should be specified only where:

1. Outside, average January temperature is below 4 degrees C 40 degrees F, and expected winter interior relative humidity is 45 percent or greater;

2. Roofing system will be subject to continuing excessively high interior humidity; and

3. Results of detailed analysis indicate potential roofing problem resulting from water-vapor infiltration.

Delete Contractor's option for single-layer vapor retarder for roofs over areas having excessively high interior humidity such as swimming pools and laundries. Generally, vapor retarder should be in direct contact with deck. However, compute dewpoint temperature and location and locate vapor retarder below dewpoint location. Avoid use of vapor retarder over steel decks unless vapor retarder is determined to be absolutely necessary. Do not specify wood fiberboard or any type of insulation that is highly sensitive to moisture for layer directly on steel deck. Glass mat gypsum roof board is not sensitive to moisture and may be used in such situations. Specify installation of insulation over vapor retarder using hot asphalt to avoid puncturing vapor retarder. Combination of two or more layers of insulation should be of such thickness that dewpoint temperature will occur above vapor retarder located directly over first layer of insulation. Topside venting should always be provided by

insulation vents and perimeter edge vents when vapor retarder is used. Specify venting requirements in roofing membrane specification section.

Unless otherwise directed, do not specify vapor retarder for projects in the NAVFAC SE area.
****

[2.5.1 Vapor Retarder

[2.5.1.1 Asphalt Saturated Felt Base Sheet for Single Layer Application

Provide in accordance with ASTM D4601/D4601M, weighing not less than 17.5 kilograms per 10 square meters 35 pounds per 100 square feet.

][2.5.1.2 Asphalt-Coated Glass Felt

Provide in accordance with ASTM D2178/D2178M, Type [IV] [VI].

]][2.5.2 Ventilating Felt for [Poured] [Precast] Concrete Decks

****
NOTE: Specify ventilating felt for new and existing concrete decks suspected of having retained moisture to aid in dissipation of any moisture retained in concrete. Do not consider this a vapor retarder.
****

Provide in accordance with ASTM D4897/D4897M, Type II, non-perforated, with spot mopping holes where specified.

]2.5.3 Organic Roofing

Provide in accordance with ASTM D226/D226M, Type I.

2.6 FASTENERS

Provide flush-driven fasteners through flat round or hexagonal steel or plastic plates. Provide zinc-coated steel plates, flat round not less than 35 mm 1 3/8 inch diameter, hexagonal not less than 0.4 mm 28 gage. Provide high-density plastic plates, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 75 mm 3 inches in diameter. Fully recess fastener head into plastic plate after it is driven. Form plates to prevent dishing. Do not use bell or cup shaped plates. Provide fasteners in accordance with insulation manufacturer's recommendations for holding power when driven, or a minimum of [178] [534] N [40] [120] pounds each in steel deck, whichever is the higher minimum. Provide fasteners for steel or concrete decks in accordance with FM APP GUIDE (https://www.approvalguide.com/) for Class I roof deck construction, and spaced to withstand uplift pressure of [2.87] [4.3] [_____] kPa [60] [90] [_____] pounds per square foot.

2.6.1 Roofing Nails for Wood Decks

Barbed 3 mm 11 gage, zinc-coated nails with 11 to 16 mm 7/16 to 5/8 inch diameter heads or annular ring shank, square head, one piece composite nails. Provide nails long enough to penetrate wood deck at least 16 mm 5/8 inch without protruding through underside of decking.

2.6.2 Fasteners for Plywood Decks

Annular ring shank, square head, one-piece composite nails long enough to penetrate into plywood decks approximately 13 mm 1/2 inch without protruding through underside of decking.

2.6.3 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws in accordance with FM 4450 and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of [2.87] [4.31] [_____] kPa [60] [90] [_____] psf in accordance with FM APP GUIDE.

2.6.4 Fasteners for Poured Concrete Decks

Approved hardened fasteners or screws to penetrate deck at least 25 mm one inch but not more than 38 mm 1 1/2 inches, in accordance with FM 4470, and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand an uplift pressure of [2.87] [4.31] [_____] kPa [60] [90] [_____] psf in accordance with FM APP GUIDE.

[2.7 FOAM ADHESIVE

****
NOTE: Include foam adhesive as an option when applying insulation over a concrete roof deck, or where a base layer is mechanically fastened and subsequent layers are installed with low-rise foam adhesive.
****

Foam adhesive as recommended by the insulation manufacturer for adhering the insulation to concrete surfaces or underlying insulation layers and resist the required wind uplift pressure. Product must be compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

]2.8 [WOOD][ENGINEERED METAL FRAMING] NAILERS

****
NOTE: When roof slope exceeds 1 in 24 (40 mm in 1 M) (1/2 inch per foot), insulating materials beneath built-up roofing should be both mopped and held in place by treated wood nailers. Non-nailable decks should be provided with surface-applied nailing strips of same thickness as insulation. See built-up bituminous roofing specifications for requirements on nailing of roofing felts. For all insulated roof decks, treated wood nailers should be applied at eave edgings and sides of roofs and around curbs and elsewhere as necessary to provide nailing for gravel stops and flashings. Refer to FM Data Sheets for method of attachment of nailers. A water-borne preservative treatment should be specified in Section 06 10 00 ROUGH CARPENTRY for wood which will be in contact with bituminous materials.

Wood nailers are prohibited on heat or torch-applied roofing systems. Select engineered metal framing option for metal roofing systems or torch-applied roof systems.
****

[Pressure-preservative treated wood as specified in Section 06 10 00 ROUGH CARPENTRY.] [Provide galvanized steel or aluminum engineered metal framing for use as nailers and attached to substrate with self-tapping screws.]

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

****
NOTE: Unless otherwise directed, do not refer to vapor retarders for projects in the NAVFAC SE area. Vapor retarder may be specified for heated buildings where the average January temperature is below 5 degrees C 40 degrees F and the expected interior winter humidity exceeds 45 percent. Vapor retarder will be specified for heated buildings where a high humidity condition is expected, such as indoor swimming pool or laundry.

Where a vapor retarder is to be installed, the designer will make sure that the computations show that the dew point is on the cold side of the vapor retarder. Computations should use recognized methods in agreement with ASHRAE Handbook, Fundamentals.
****

Ensure surfaces are clean, smooth, and dry prior to application.[Ensure surfaces receiving vapor retarder are free of projections that might puncture the vapor retarder.] Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The [Contractor must] [Contracting Officer will] inspect and approve the surfaces immediately before starting installation. Prior to installing [vapor retarder] [ventilating felt] [insulation], perform the following:

[a. Examine wood decks to ascertain that deck boards have been properly nailed in accordance with IBC and wind uplift requirements and that exposed nail heads have been set.

][b. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

][c. Examine precast concrete decks to ensure that joints between precast units are properly grouted and leveled to provide suitable surfaces for installation of [ventilating felt] [vapor retarder] [and] insulation.

][d. In the presence of the Contracting Officer perform the following

surface dryness test on concrete substrates:

(1) Foaming: When poured on the deck, one pint of asphalt when heated in the range of 176 to 204 degrees C 350 to 400 degrees F, does not foam upon contact.

(2) Strippability: After asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from surface, do not consider surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been re-tested by method above and found dry.

][e. Prior to installing any roof system on a concrete deck, moisture test the deck in accordance with ASTM D4263. The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

]3.1.2 Surface Preparation

To correct defects and inaccuracies in roof deck surface to eliminate poor drainage from hollow or low spots, perform the following:

a. Provide wood nailers of the same thickness as the insulation at eaves, edges, curbs, walls, and roof openings for securing of cant strips, gravel stops, [gutters,] flashing flanges, and curbs.[On decks with slopes of one in 12 (80 mm per 1 M) (one inch per foot) or more, install wood nailers perpendicular to slope for securing insulation [and for backnailing of roofing felts]. Space nailers in accordance with approved shop drawings.]

[b. Fill or cover cracks or knot holes larger than 13 mm 1/2 inch in diameter in wood decks as necessary to form an unyielding surface.
]

****

NOTE: Include the following requirements when a vapor retarder is required over wood deck or when insulation is applied directly to the wood deck with hot asphalt.

****

[c. Cover wood decks with a layer of rosin-sized building paper or unsaturated felt. Lap sides and ends not less than 75 mm 3 inches. Nail sufficiently to prevent tearing or buckling during installation.

][d. Cover steel decks with a layer of insulation board of sufficient width to span the width of a deck rib opening, and in accordance with fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement in accordance with FM APP GUIDE. Locate insulation joints parallel to ribs of deck on solid bearing surfaces only, not over open ribs.

][e. Solidly apply asphalt primer to [poured] [precast] concrete decks at the rate of 4 liters per 10 square meters one gallon per 100 square feet of roof surface[, stopping approximately 100 mm 4 inches from joints between precast concrete units]. Allow primer to dry thoroughly.[Place felt strips, 100 mm 4 inches or more in width, over joints, 50 mm 2 inches on each side, between precast concrete

units in a heavy coating of cold-applied asphalt roof cement.]

]3.2 INSTALLATION OF VAPOR RETARDER

****

NOTE: Unless directed otherwise, do not specify a vapor retarder for projects in the NAVFAC SE area.

Vapor retarder may be specified for heated buildings where the average January temperature is below 5 degrees C 40 degrees F and the expected interior winter humidity exceeds 45 percent. Vapor retarder will be specified for heated buildings where a high humidity condition is expected, such as indoor swimming pool or laundry.

Where a vapor retarder is to be installed, the designer will make sure that the computations show that the dew point is on the cold side of the vapor retarder. Computations should use recognized methods in agreement with ASHRAE Handbook, Fundamentals.

****

Install vapor retarder in direct contact with [roof deck surface] [ventilating felt] [insulation]. Unless otherwise specified, vapor retarder must consist of [either] two plies of No. 15 asphalt-saturated felt, two plies of asphalt-coated glass felt[, or one layer of asphalt-saturated felt base sheet]. Lay vapor retarder at right angles to direction of slope. Install first ply of felt [or base sheet] as specified herein for the specific deck. Apply second ply of 2-ply vapor retarder system using asphalt at rate of 10 to 18 kgs per 10 square meters 20 to 35 lbs per 100 square feet, applied within plus or minus 15 degrees C 25 degrees F of EVT. Do not heat asphalt above asphalt's FBT or 275 degrees C 525 degrees F, whichever is less. Use thermometers to check temperatures during heating and application. Completely seal side and end laps. Asphalt must be visible beyond all edges of each ply as it is being installed. Lay plies free of wrinkles, buckles, creases or fishmouths. Do not walk on mopped surfaces while asphalt is sticky. Press out air bubbles to obtain complete adhesion between surfaces. At walls, eaves, rakes, and other vertical surfaces, extend vapor retarder organic felts or separate plies 225 mm 9 inches, with not less than 225 mm 9 inches on the substrate, and the extended portion turned back and mopped in over the top of the insulation. At roof penetrations other than walls, eaves and rakes, and vertical surfaces, extend vapor retarder or separate plies 225 mm 9 inches to form a lap folded back over the edge of the insulation. Provide asphalt roof cement under the vapor retarder for at least 225 mm 9 inches from walls, eaves, rakes and other penetrations.

[3.2.1 Vapor Retarder on Poured or Precast Concrete Decks

Evenly mop primed substrate with asphalt at a rate of 10 to 18 kgs per 10 square meters 20 to 35 lbs per 100 square feet before installing vapor retarder. Lay first ply of two-ply system with each sheet lapping 480 mm 19 inches over the preceding sheet. Lap ends not less than 100 mm 4 inches. Stagger laps a minimum of 300 mm 12 inches.[For a vapor retarder consisting of one layer of asphalt base sheet, provide side and end laps not less than 100 mm 4 inches. Stagger laps a minimum of 300 mm 12 inches. Cement base sheets together with a solid mopping of asphalt.]

][3.2.2 Vapor Retarder on Wood Decks

****

NOTE: A vapor retarder should be specified only where:

1. The outside, average January temperature is below 4 degrees C 40 degrees F, and the expected winter interior relative humidity is 45 percent or greater;

2. The roofing system will be subject to continuing excessively high interior humidity; and

3. The results of a detailed analysis indicate a potential roofing problem resulting from water-vapor infiltration.

Delete Contractor's option for a single-layer vapor retarder for roofs over areas having excessively high interior humidity such as swimming pools and laundries. Generally, the vapor retarder should be in direct contact with deck. However, compute dewpoint temperature and location and locate vapor retarder below dewpoint location. Avoid use of vapor retarder over steel decks unless vapor retarder is determined to be absolutely necessary. Do not specify wood fiberboard or any other type of insulation sensitive to moisture for the layer directly on steel deck. Glass mat gypsum roof board is not sensitive to moisture and may be used in such situations. Specify installation of insulation over vapor retarder using hot asphalt to avoid puncturing the vapor retarder. The combination of two or more layers of insulation must be of such thickness that the dewpoint temperature will occur above vapor retarder located directly over first layer of insulation. Topside venting should always be provided by insulation vents and perimeter edge vents when a vapor retarder is used. Specify venting requirements in roofing membrane specification section.

****

Lay first ply of two-ply system dry with each sheet lapping 50 mm 2 inches over the preceding sheet. Lap ends not less than 100 mm 4 inches. Stagger laps a minimum of 300 mm 12 inches. Nail felt at 150 mm 6 inch intervals alongside laps and install two rows of nails approximately 275 mm 11 inches apart down longitudinal center of each sheet, with nails staggered at 450 mm 18 inches on center.[For vapor retarder consisting of one layer of asphalt base sheet, lap each sheet 100 mm 4 inches over the preceding sheet. Provide end laps not less than 100 mm 4 inches and stagger laps a minimum of 300 mm 12 inches.] Cement side and end laps together with solid mopping of asphalt or heavy coat of asphalt roof cement. Nail side laps at 150 mm 6 inch intervals. Apply asphalt mopping at a rate of 10 to 18 kgs per 10 square meters 20 to 35 lbs per 100 square feet. Install two rows of nails approximately 275 mm 11 inches apart down longitudinal center of each sheet, with nails staggered at 450 mm 18 inches on center.

][3.2.3 Vapor Retarder on Steel Decks

Even mop the mechanically secured insulation surface with asphalt before installing vapor retarder. For a two-ply vapor retarder, install each sheet lapping 480 mm 19 inches over the preceding sheet. Lap ends not less than 100 mm 4 inches. Stagger the laps a minimum of 300 mm 12 inches. Cement felts together with solid mopping of asphalt. Apply asphalt moppings at rate of 10 to 18 kgs per 10 square meters 20 to 35 lbs per 100 square feet.[For a vapor retarder consisting of one layer of asphalt base sheet, lap each sheet 100 mm 4 inches over preceding sheet. Lap ends not less than 100 mm 4 inches, and stagger laps a minimum of 300 mm 12 inches. Cement base sheets together with solid mopping of asphalt.]

]3.2.4 Over Gypsum Insulating Concrete or Lightweight Insulating Concrete

****

NOTE: Some types of lightweight insulating concrete may require bottom side deck venting; edit this paragraph accordingly if bottom side venting is used.

****

Lay one ply of venting inorganic base sheet, without mopping, at a right angle to the slope with 100 mm 4 inch side laps and 150 mm 6 inch end laps. Bond laps with hot asphalt. Stagger end laps.[Nail base sheet 220 mm 9 inches on center at side laps and in 2 rows 270 mm 11 inches apart down the center of the sheet with nails 450 mm 18 inches on centers and staggered][attach to the concrete deck in accordance with uplift requirements]. Apply 2-ply vapor retarder over the base sheet as specified above.

3.2.5 Over Concrete Decks and First Layer of Insulation on Steel Decks

Apply 2-ply vapor retarder as specified above except delete the venting inorganic base sheet.

3.2.6 Over Structural Concrete on Non-Venting Support

Lay one ply of venting inorganic base sheet with mopping holes at a right angle to the slope with 100 mm 4 inch side laps and 150 mm 6 inch end laps then apply the vapor retarder as specified.

[3.3 INSTALLATION OF VENTILATING FELT

****

NOTE: Specify ventilating felt for new and existing concrete decks suspected of having retained moisture to aid in dissipation of any moisture retained in concrete. Do not consider this felt a vapor retarder.

Include bracketed phrase only when insulation is to be applied with hot asphalt.

****

Apply ventilating felt in accordance with manufacturer's printed instructions[, spot mopped with asphalt to concrete deck]. Extend over roof cants, up vertical surfaces and terminate under cap flashing. At roof edges terminate under outside edge of perimeter edge nailers or under

gravel stop fascia.

]3.4 INSULATION INSTALLATION

Apply insulation in two layers with staggered joints when total required thickness of insulation exceeds 13 mm 1/2 inch. Lay insulation so that continuous longitudinal joints are perpendicular to direction of [felts for the built-up] roofing, as specified in Section [_____], and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, provide joints of each succeeding layer that are parallel and offset in both directions with respect to the layer below. Keep insulation 13 mm 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface. Verify required slopes to each roof drain.

[3.4.1 Installation Using Asphalt

Firmly embed each layer in solid asphalt mopping; mop only sufficient area to provide complete embedment of one board at a time. Provide 10 to 18 kgs 20 to 35 lbs of asphalt per 10 square meters 100 square feet of roof deck for each layer of insulation. Apply asphalt when temperature is within plus or minus 15 degrees C 25 degrees F of EVT. Do not heat asphalt above asphalt's FBT or 275 degrees C 525 degrees F, whichever is less, for longer than 4 consecutive hours. Use thermometers to check temperatures during heating and application.

][3.4.2 Installation Using Asphalt on Steel Decks

****
NOTE: Delete these requirements and include paragraph INSTALLATION USING ASPHALT when a vapor retarder is required over steel decks.
****

Secure first layer of insulation [and thermal barrier] to deck with piercing or self-drilling, self-tapping fasteners. Engage fasteners by driving them through insulation into top flange of steel deck. Use driving method prescribed by fastener manufacturer. Locate insulation joints parallel to ribs of deck on solid bearing surfaces only, not over open ribs. Secure succeeding layers with solid asphalt moppings. Where insulation is applied over steel deck, locate long edge joints so that they bear continuously on the steel deck. Insulation that can be readily lifted after installation is not considered adequately secured. Apply insulation only in quantities that can be entirely waterproofed the same day. Phased construction is not permitted. Apply impermeable faced insulation without damage to the facing.

][3.4.3 Installation of Protection for Asphalt Work

Before starting asphalt work, protect surrounding areas and surfaces from spillage and migration of asphalt onto other work. Provide non-combustible protective coverings at surfaces adjacent to hoists and kettles. Lap protective coverings at least 150 mm 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of asphalt work.

][3.4.4 Installation Using Only Mechanical Fasteners

****
NOTE: Delete these requirements and include paragraph INSTALLATION USING ASPHALT when a vapor retarder is required over steel decks.
****

Secure total thickness of insulation with penetrating type fasteners.

][3.4.5 Installation Using Mechanical Fasteners and Foam Adhesive

****
NOTE: Include this section when base layer is mechanically fastened and subsequent layers are installed with low-rise foam adhesive.
****

Secure first layer of insulation [and thermal barrier] to deck with piercing or self-drilling, self-tapping fasteners. Engage fasteners by driving them through insulation into top flange of steel deck. Use driving method prescribed by fastener manufacturer. Locate insulation joints parallel to ribs of deck on solid bearing surfaces only, not over open ribs. Secure succeeding layers with foam adhesive using installation procedures as recommended by the insulation manufacturer for adhering the insulation and resisting the required wind uplift pressure. Installation must bond insulation securely to substrates without damaging insulation and substrates.

][3.4.6 Installation on Concrete Substrates

Install using foam adhesive using installation procedures as recommended by the insulation manufacturer for adhering the insulation to concrete surfaces and resist the required wind uplift pressure. Installation must bond insulation securely to substrates without damaging insulation and substrates.

]3.4.7 Special Precautions for Installation of Foam Insulation

[3.4.7.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, install cover board over top surface of foam board insulation. Stagger joints of insulation with respect to foam board insulation below.

][3.4.7.2 Polystyrene Insulation

****
NOTE: Include these requirements when polystyrene insulation is used under fully adhered EPDM, CPE, PIB, or PVC roofing.
****

a. Over the top surface of non-composite polystyrene board, install 13 mm 1/2 inch thick high density wood fiberboard, 19 mm 3/4 inch thick expanded perlite board insulation, glass mat gypsum roof board, or other overlayment approved by roofing sheet manufacturer. Tightly butt and stagger joints of field applied overlayment board at least 150 mm 6 inches with respect to the polystyrene board below. Apply

150 mm 6 inch wide glass fiber roofing tape centered over joints and edges of overlayment board.

b. Where composite boards consisting of polystyrene insulation are provided, apply 150 mm 6 inch wide glass fiber roofing tape centered over joints and edges of composite board. Apply joint strips as recommended by roofing sheet manufacturer.

]3.4.8 Cant Strips

****
NOTE: Generally, cant strips are not required for single ply roofing systems, however, if cant strips are necessary, coordinate location with mechanical drawings to ensure that no projections, such as vent pipes and braces, will be constructed through or within 250 mm 10 inches of cant strips. Specify wood cants, edge strips, and pressure preservative treatment in Section 06 10 00 ROUCH CARPENTRY. Delete reference to asphalt application unless asphalt is used in applying the insulation.
****

Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips must bear on and be anchored to wood blocking. Fit cant strips flush to vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in [heavy mopping of asphalt or set in a heavy coating of asphalt roof cement] [an approved adhesive].

3.4.9 Tapered Edge Strips

****
NOTE: Delete reference to asphalt application unless asphalt is used in installing the insulation.
****

Where indicated, provide edge strips in the right angle formed by the juncture of roof and wood nailing strips that extend above the level of the roof. Install edge strips flush to vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install in [a heavy mopping of asphalt or set in a heavy coating of asphalt roof cement] [an approved adhesive].

3.5 PROTECTION

3.5.1 Protection of Applied Insulation

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

Completely cover each day's installation of insulation with finished roofing specified in [_____] on same day. Phased construction is not permitted. Protect open spaces between insulation and parapets or other

walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces is not permitted. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight in accordance with [indicated live load limits of roof construction] [a [_____] kg/sq. m psf live load limit]. Protect exposed edges of insulation with cutoffs at the end of each workday or whenever precipitation is imminent. Cutoffs must be two layers of bituminous-saturated felt set in plastic bituminous cement [or single ply] [or EPDM membrane] set in roof cement. Fill all profile voids in cutoffs to prevent trapping moisture below the membrane. Remove cutoffs when work resumes.

3.5.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.6 INSPECTION

Establish and maintain inspection procedures to assure compliance of the installed roof insulation with Contract requirements. Remove, replace, correct in an approved manner, any work found not in compliance. Quality control must include, but is not limited to, the following:

****

NOTE: When justified by the amount or criticality of the insulation and roofing involved, and when requirements for a roof insulation technician are not established for the Contractor Quality Control organization, add the following requirement at the end of this paragraph: "A roof insulation technician, responsible directly to the Contractor and experienced in the installation of roof insulation and related work, must perform the inspection functions and be on the site whenever roof insulation operations are in progress."

****

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM Data Sheets.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

j. Verification of required slope to each roof drain.

-- End of Section --