UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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02/16, CHG 2: 08/20

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-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA	**UFGS-07 21 13 (February 2016)** **Change 2 - 08/20**

Preparing Activity: NAVFAC	**Superseding** **UFGS-07 21 13 (May 2011)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 07 21 13

BOARD AND BLOCK INSULATION
02/16, CHG 2: 08/20

****
NOTE: This guide specification covers the requirements for board and block thermal insulation.

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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NOTE: This guide specification is intended for both retrofit of existing buildings and new construction.
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NOTE: Specify board-type insulations for masonry and concrete walls and under concrete floor slabs. Also specify board-type insulation where the type of construction favors their economical usage and their application would be less difficult than blanket or loose fill insulations.
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NOTE: On the drawings, show:

1. Locations where insulation must be used.

2. Thermal resistance value (R-Value) for each location.

3. Location of vapor retarder, if required.

4. Method of attachment of insulation board.

5. Location and size of attic ventilation openings where required.

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NOTE: Attic Ventilation

1. Provide net, unobstructed attic ventilation areas over insulated ceilings as recommended by ASHRAE Handbook of Fundamentals, Chapter 21, and as follows:

2. For attics with vapor retarder, provide 0.1 square meter 1 square foot of net ventilation area for each 30 square meters 300 square feet of attic floor area.

3. For attics without vapor retarder, provide 0.1 square meter 1 square foot of net ventilation area for each 15 square meters 150 square feet of attic floor area.

4. For insulation of cathedral ceilings, provide at least a 50 mm 2 inch gap between upper face of insulation and underside of roof sheathing. Provide ventilation openings at bottom and top of ventilated cavity; show on drawings.

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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 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.

ASTM INTERNATIONAL (ASTM)

ASTM C165	(2007; R 2017) Standard Test Method for Measuring Compressive Properties of Thermal Insulations
ASTM C203	(2005; R 2012) Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C272/C272M	(2016) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2020) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM C1289	(2020) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building

	Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E154/E154M	(2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2020) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2021) National Fuel Gas Code
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	(2010) Puncture Test of Container Board

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

****

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-03 Product Data

Manufacturer's Standard Details; G[, [_____]]

Block or Board Insulation; G[, [_____]]

Vapor Retarder; G[, [_____]]

Pressure Sensitive Tape; G[, [_____]]

Protection Board or Coatings; G[, [_____]]

Accessories including sealants; G[, [_____]]

Recycled Content for Block or Board Insulation; S

SD-07 Certificates

Block or Board Insulation; G[, [_____]]

Vapor Retarder; G[, [_____]]

Protection Board or Coating; G[, [_____]]

Draft Special Warranties; G[, [_____]]

Final Special Warranties; G[, [_____]]

Indoor Air Quality For Block Or Board Insulation; S

SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

1.3 MANUFACTURER'S DETAILS

Submit manufacturer's standard details indicating methods of attachment and spacing, transition and termination details, and installation details. Include verification of existing conditions.

1.4 PRODUCT DATA

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

[1.5 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.

]1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.6.2 Storage

Inspect materials delivered to the site for damage and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling. 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. Comply with manufacturer's recommendations for handling, storage, and protection of materials before and during installation.

1.7 SAFETY PRECAUTIONS

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NOTE: Include the first paragraph below only for installations in which mineral fibers are released into the atmosphere, such as where mineral fiber boards are cut on the job site.

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[1.7.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by the National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) and in accordance with 29 CFR 1910.134.

]1.7.2 Other Safety Considerations

Comply with the safety requirements of ASTM C930.

1.8 SPECIAL WARRANTIES

1.8.1 Guarantee

Guarantee insulation installation against failure due to ultraviolet light exposure for a period of three years from the date of Beneficial Occupancy or Substantial Completion. Submit draft and final guarantees in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS [and 01 78 23 OPERATION AND MAINTENANCE DATA].

1.8.2 Warranty

Provide manufacturer's material warranty for all system components for a period of three years from the date of Beneficial Occupancy or Substantial Completion. Submit draft and final warranties in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS [and 01 78 23 OPERATION AND MAINTENANCE DATA].

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.

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2.1 BLOCK OR BOARD INSULATION

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NOTE: Select type of insulation board based on project design and application requirements regarding strength, vapor resistance, water absorption, and manufacturer's recommendations.

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Provide thermal insulating materials as recommended by manufacturer for each type of application indicated. Provide insulation with the following physical properties and in accordance with the following standards:

[a. Cellular Glass: ASTM C552

][b. Extruded Preformed Cellular Polystyrene: ASTM C578 REV A

][c. Mineral Fiber Block and Board: ASTM C612

][d. Unfaced Preformed Rigid Polyurethane and Polyisocyanurate Board: ASTM C591

][e. Faced Rigid Cellular Polyisocyanurate and Polyurethane Insulation: ASTM C1289 REV A

][(1) Type I Aluminum Foil on both major surfaces. [Class 1 - Non-reinforced core foam.] [Class 2 - Glass fiber reinforced core.]

][(2) Type II Fibrous felt or glass fiber mat membrane on both major surfaces of the core foam.

][(3) Type III Perlite insulation board on one major surface of the core foam and a fibrous felt or glass fiber mat membrane on the other major surface of the core foam.

][(4) Type IV Cellulosic fiber insulating board on the one major surface of the core foam and fibrous felt or glass fiber mat membrane on the other major surface of the core foam.

][(5) Type V Oriented strand board or water board on one major surface of the core foam and fibrous felt or glass fiber mat membrane or aluminum foil on the other major surface of the core foam.

][(6) Type VI Perlite insulation board on both major surfaces of the core foam.

]2.1.1 Thermal Resistance

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NOTE: Board and block thermal insulating materials have different thermal properties. Specify insulation to provide R-Values required to comply with UFC 3-101-01, Section Building Envelope Requirements. Indicate R-values on the project drawings or specify in the appropriate blanks herein.

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NOTE: Where board insulation is installed in masonry cavity walls, size the wall cavity to accommodate the insulation thickness required to provide the specified R-Value and a 25 mm 1 inch air space.

****

[Unless otherwise indicated, Ceiling R-[_____] Wall R-[_____] Floor [R-_____].

]2.1.2 Fire Protection Requirements

****
NOTE: Fire Safety Provisions

1. Most vapor retarder materials and some thermal insulations are combustible. Do not leave such material exposed to accessible spaces, but cover with fire retardant finish.

2. See UFC 3-600-01 Fire Protection Engineering for Facilities and local building codes for required fire retardant classifications, flame spread and smoke developed ratings, distance of insulation and vapor retarders from heat producing devices, and other fire protection requirements such as finish materials in various occupancies.
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****
NOTE: Do not use cellular plastic insulation exposed to the building interior. Separate the insulation from the interior according to the requirements of ICC IBC Chapter 26 Plastics Section 2603.4 Thermal Barrier or by a minimum of a 15 minute fire separation; comply with the most restrictive requirement. If no separation can be provided, select cellular glass block insulation instead of cellular plastic insulation. Edit this paragraph and the paragraph INSULATION ON VERTICAL SURFACES as required.
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****
NOTE: Specify insulated roof assemblies in accordance with UFC 1-200-01 Fire and Smoke Protection section, and UFC 3-600-01. Where requirements conflict between UFCs and IBC, UFC 3-600-01 takes precedence; edit the following section accordingly.
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a. Flame spread index of 75 or less when tested in accordance with ASTM E84.

b. Smoke developed index of [450] [200] [150] [_____] or less when tested in accordance with ASTM E84.

c. Provide insulated assemblies in accordance ICC IBC Chapter Fire and Smoke Protection Features.

2.1.3 Other Material Properties

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NOTE: Include only those properties that are required for the particular application.

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Provide thermal insulating materials with the following properties:

[a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than [170] [_____] kilopascals (kPa) [10] [_____] pounds per square inch (psi) when measured according to ASTM D1621.

][b. Mineral fiber board: Compressive strength: Minimum load required to produce a reduction in thickness of 10 percent kilograms per square meter (kg/m2) pounds per square foot (lbf/sf): [120] [4900] [25] [1000] when tested according to ASTM C165.

][c. Block-type insulation: Block-type insulation: Flexural strength: Not less than [275] [_____] kPa [25] [_____] psi when measured according to ASTM C203 REV A.

][d. Water Vapor Permeance: Not more than [6.3 by 10-8] [_____] g/Pa.s.m2 [1.1] [_____] Perms or less when measured according to ASTM E96/E96M, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.

]

****

NOTE: Specify allowable moisture content for rigid cellular plastic as absorption and for mineral fiber board as adsorption. Delete e or f. below if only one material is allowed.

****

[e. Water Absorption: Not more than [2] [_____] percent by total immersion, by volume, when measured according to ASTM C272/C272M.

][f. Water Adsorption: Not more than [1] [_____] percent by volume when measured in accordance with paragraph 14 of ASTM C553.

]2.1.4 Premolded Concrete Masonry Insert

Provide in accordance with ASTM C578 REV A. Provide inserts in concrete masonry units that are installed at the masonry unit manufacturing plant. Provide insert with thickness of not less than 32 mm 1 1/4 inches.

2.1.5 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum required recycled material contents (by weight, not volume) are:

Polyisocyanurate/Polyurethane:	9 percent
Phenolic Rigid Foam:	5 percent
Perlite Board:	75 percent post consumer paper

Provide data identifying percentage of recycled content for block or board

insulation.

2.1.6 Indoor Air Quality

Provide certification of indoor air quality for block or board insulation.

2.1.7 Prohibited Materials

Do not provide materials containing asbestos.

[2.2 VAPOR RETARDER AND DAMPPROOFING

****

NOTE:

1. Determine the need for a water vapor retarder and its required permeance value based on project requirements and climate specific moisture analysis. For guidance see ASHRAE Handbook of Fundamentals, Chapter 20, "Thermal Insulations and Vapor Retarders;" ASTM C755, "Selection of Vapor Retarders for Thermal Insulations;" and UFC 3-440-05N Tropical Engineering (for humid climates). The computer Program "MOIST" is a user friendly tool based on hourly weather data that provides information on moisture content of materials and on the duration of high moisture content excursions. Traditionally, vapor retarders for walls and roofs were considered materials having a permeance of 5.72 by 10-8 g/Pa.s.m2 1 Perm (grain/h*ft2*in.Hg) or less. Vapor retarders under slabs are typically specified as 1.14 by 10-8 g/Pa.s.m2 (0.2 Perm) or less. However, these values may not be adequate for a particular project or climate and in some instances a much lower value should be specified.

2. Vapor retarders, where required, can be provided as membranes or, alternatively, vapor retardant finishes labeled by the manufacturer as having a water vapor permeance of no more than the required value. Alternate materials include: coatings, vinyl wall coverings, or foil-faced gypsum board. Specify these in Sections 09 90 00, PAINTS AND COATINGS, Section 09 72 00, WALLCOVERINGS, or Section 09 29 00, GYPSUM BOARD, respectively and delete all paragraphs and references relating to vapor retarders from this section.

3. A vapor retarder is only effective if it prevents diffusion of water vapor as well as the passage of moisture laden air through openings and around material. Accordingly, proper installation to assure air tightness by sealing of joints, tears, and around utility penetrations is as important as proper selection of water vapor retarder materials. Coordinate specifications to comply with UFC 3-101-01 Architecture, Chapter 3 Building Envelope Requirements.

4. Vapor retarders not only retard movement of water vapor into building envelope assemblies and cavities, but also retard drying of moisture that may have infiltrated these areas. Therefore, use vapor retarders only when and where the moisture analysis indicates they are necessary.
****

2.2.1 Vapor Retarder in Framed Walls and Roofs

[a. 0.15 mm6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 5.72 by 10-8g/Pa.s.m2 1 Perm or less when tested in accordance with ASTM E96/E96M.

][b. Membrane with the following properties:

(1) Water Vapor Permeance: ASTM E96/E96M: 5.72 by 10-8 g/Pa.s.m2 [1] [_____] Perm

(2) Maximum Flame Spread: ASTM E84: [25] [50] [_____]

(3) Combustion Characteristics: Passing ASTM E136

(4) Puncture Resistance: TAPPI T803 OM: [15] [25] [50]

][2.2.2 Dampproofing for Masonry Cavity Walls

[Bituminous material is specified in Section 07 11 13 BITUMINOUS DAMPPROOFING.] [Parging material is specified in Section 04 20 00 MASONRY.]

][2.2.3 Vapor Retarder under Floor Slab

a. Water vapor permeance: 1.14 by 10-8 g/Pa.s.m2 0.2 Perm or less when tested in accordance with ASTM E96/E96M.

b. Puncture resistance: Maximum load no less than 18 kilograms 40 pounds when tested according to ASTM E154/E154M REV A.

]]2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder(s). Match water vapor permeance rating for each vapor retarder specified. Provide tape in accordance with ASTM D3833/D3833M.

2.4 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

2.5 ACCESSORIES

2.5.1 Adhesive

As recommended by insulation manufacturer.

2.5.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation

manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

****

Note: For retrofit projects, inspect facility to determine conditions which may adversely affect execution of work or create safety hazard. Identify relevant conditions on the drawings and, if required, develop additional specification sections for corrective actions. Conditions that warrant investigation:

1. Discolorations or mold growth indicating previous water leaks.

2. Heat producing devices, such as recessed lighting fixtures, chimneys, and flues.

3. Faulty electrical systems:

(a) Lights dimming or flickering

(b) Fuses blowing

(c) Circuit breakers tripping frequently

(d) Electrical sparks and "glowing" from receptacles

(e) Cover plates on switches and outlets warm to touch.

****

Prior to installation, ensure all areas that are in contact with the insulation are dry and free of projections that could cause voids, compressed insulation, or punctured vapor retarders. For foundation perimeter or under slab applications, check that subsurface fill is flat, smooth, dry, and well tamped. Do not proceed with installation if moisture or other conditions are present, and notify the Contracting Officer of such conditions. Do not proceed with the work until conditions have been corrected and verified to be dry.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Provide noncombustible blocking at all spaces between heat producing devices and the floors, ceilings and roofs through which they pass. Provide in accordance with ICC IBC Section 2111.12 Fireplace Blocking and with the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 75 mm 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is placed above fixture or device, 600 mm 24 inches above fixture.

b. Masonry chimneys or masonry enclosing a flue: 50 mm 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.

c. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

d. Gas Fired Appliances: Clearances as required in NFPA 54.

e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified in writing by the chimney or flue manufacturer for use in contact with specific insulating materials.

3.3 INSTALLATION

3.3.1 Installation and Handling

Provide insulation in accordance with the manufacturer's printed installation instructions. Keep material dry and free of extraneous materials.

3.3.2 Electrical Wiring

Do not install insulation in a manner that would enclose electrical wiring between two layers of insulation.

[3.3.3 Cold Climate Requirement

Place insulation on the outside of pipes.

]3.3.4 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating thermal bridges and voids. Provide and verify continuity of insulative barrier throughout the building enclosure.

****

NOTE: Foil sided board reflects heat. Indicate on drawings the side on which the foil is to be faced. Coordinate use with mechanical designer.

NOTE: To avoid thermal bridging, verify the drawings provide a layer of continuous insulation over studs.

****

3.3.5 Coordination

Verify final installed insulation thicknesses comply with thicknesses indicated, R-values specified herein, and with the approved insulation submittal(s).

3.4 INSTALLATION ON WALLS

3.4.1 Installation using Furring Strips

Install insulation [between] [on] members as recommended by insulation manufacturer.

3.4.2 Installation on Masonry Walls

****

NOTE: Use the first paragraph below for insulation on the outside or inside of masonry walls. Use the second paragraph for insulating individual masonry units within their hollow cores. Insulating just the cores can lead to thermal bridges and condensation at the web locations of the masonry units.

****

[Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Place boards in moderate contact with adjoining insulation without forcing and without gaps. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other utilities. Seal around cutouts with sealant. Install insulation in wall cavities so that it leaves at least a nominal 25 mm 1 inch air space outside of the insulation to allow for cavity drainage.

][Insert premolded or board insulation into masonry unit hollow cores as recommended by the insulation manufacturer.

]3.4.3 Adhesive Attachment to Concrete and Masonry Walls

Apply adhesive to wall and completely cover wall with insulation.

[a. Full back bed method [or]

][b. Spot method: Provide at least six spots having diameter of approximately 100 mm 4 inches, located at each corner and mid points of each of the longer sides of each board.

][c. As recommended by the insulation manufacturer.

] d. Use only full back method for pieces of 0.1 square meter 1 square foot or less.

e. Butt all edges of insulation and seal edges with tape.

3.4.4 Mechanical Attachment on Concrete and Masonry Walls

Cut insulation to cover walls. Apply adhesive to wall and set clip or other mechanical fastener in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners and bend split prongs to provide a flush condition with the insulation. Butt all edges of insulation and seal with tape.

[3.4.5 Protection Board or Coating

Install protection board or coating in accordance with manufacturer's printed instructions. Install protection over all exterior exposed insulation and to 300 mm 1 foot below grade.

]3.5 INSTALLATION ON UNDERSIDE OF CONCRETE FLOOR SLAB

[3.5.1 Mechanically Fastened Systems

Size insulation to cover underside of slab. Apply adhesive to slab and set fasteners in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners and bend split prongs to provide a flush condition with the insulation. Butt all edges of insulation and seal with tape.

][3.5.2 Adhesively Bonded Systems

Apply adhesive to underside of slab and completely cover wall with insulation.

[a. Full back bed method [or]

][b. Spot method: Provide at least six spots having a diameter of approximately 100 mm 4 inches, located at each corner and mid-point of each of the longer sides.

][c. As recommended by insulation manufacturer.

] d. Use full back method for insulation pieces 0.1 square meter 1 square foot or less.

e. Butt all edges of insulation and seal with tape.

]3.6 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls, slab edges in slab-on-grade, or floating slab construction.

****

NOTE: Provide for and coordinate foundation draining as required by insulation manufacturer.

Provide R-Values and extent in accordance withthe following Table EXTENT AND R-VALUE FOR PERIMETER AND UNDER-SLAB THERMAL INSULATION.

EXTENT AND R-VALUE FOR PERIMETER AND UNDER SLAB THERMAL INSULATION												
Weather Region by Heating Degree Days (Base 18 deg. C)	Minimum Required R-Values For Perimeter Insulation per Position and Width											
	Unheated Slab						Heated Slab					
	Millimeters Vertical			Millimeters Horizontal			Millimeters Vertical			Millimeters Horizontal		
	600	900	1200	600	900	1200	600	900	1200	600	900	1200
Over 4150	NP*	NP*	1.06	NP*	NP*	2.64	NP*	NP*	1.41	NP*	NP*	2.99
3601 to 4150	1.41	1.06	.70	3.17	2.71	1.97	1.76	1.41	1.06	3.52	3.06	2.32
3046 to 3600	1.41	1.06	.70	3.17	2.71	1.97	1.76	1.41	1.06	3.52	3.06	2.32
2491 to 3045	1.41	1.06	.70	3.17	2.71	1.97	1.76	1.41	1.06	3.52	3.06	2.32
1941 to 2490	1.41	1.06	.70	3.17	2.71	1.97	1.76	1.41	1.06	3.52	3.06	2.32
1526 to 1940	1.34	1.02	.70	2.99	2.46	1.90	1.69	1.37	1.06	3.34	2.82	2.25
1111 to 1525	1.27	.99	.70	2.69	2.32	1.80	1.62	1.34	1.02	3.04	2.68	2.15
556 to 1110**	1.13	.85	.70	2.18	1.87	1.51	1.48	1.20	1.06	2.53	2.22	1.87
0 to 555	0	0	0	0	0	0	0	0	0	0	0	0

* NP: Not Permitted

** Perimeter Insulation is not required in weather regions 8 and 11 where there are less than 830 Heating Degree Days (18 degrees C).

EXTENT AND R-VALUE FOR PERIMETER AND UNDER SLAB THERMAL INSULATION												
Weather Region by Heating Degree Days (Base 65 deg. F)	Minimum Required R-Values For Perimeter Insulation per Position and Width											
	Unheated Slab						Heated Slab					
	Inches Vertical			Inches Horizontal			Inches Vertical			Inches Horizontal		
	24	36	48	24	36	48	24	36	48	24	36	48
Over 15000	NP*	NP*	6.0	NP*	NP*	15.0	NP*	NP*	8.0	NP*	NP*	17.0
13001 to 15000	8.0	6.0	4.0	18.0	15.4	11.2	10.0	8.0	6.0	20.0	17.4	13.2
11001 to 13000	8.0	6.0	4.0	18.0	15.4	11.2	10.0	8.0	6.0	20.0	17.4	13.2
9001 to 11000	8.0	6.0	4.0	18.0	15.4	11.2	10.0	8.0	6.0	20.0	17.4	13.2
7001 to 9000	8.0	6.0	4.0	18.0	15.4	11.2	10.0	8.0	6.0	20.0	17.4	13.2
5501 to 7000	7.6	5.8	4.0	17.0	14.0	10.8	9.6	7.8	6.0	19.0	16.0	12.8
4001 to 5500	7.2	5.6	4.0	15.3	13.2	10.2	9.2	7.6	6.0	17.3	15.2	12.2
2001 to 4000**	6.4	4.8	4.0	12.4	10.6	8.6	8.4	6.8	6.0	14.4	12.6	10.6
0 to 2000	0	0	0	0	0	0	0	0	0	0	0	0
* NP: Not Permitted												
** Perimeter Insulation is not required in weather regions 8 and 11 where there are less than 3000 Heating Degree Days (65 degrees F).												

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3.6.1 Manufacturer's Instructions

Layout insulation, tape edges, provide vapor retarder and other required accessories to protection against vermin, insects, and damage in accordance with manufacturer's printed instructions.

[3.6.2 Insulation on Vertical Surfaces

Provide thermal insulation [on exterior of foundation walls] [on grade beams] [partially] [below grade] [and] [on edges of slabs-on-grade.] Fasten insulation with [adhesive] [or] [mechanical fasteners].

][3.6.3 Insulation Under Slab

Provide insulation horizontally under [entire] slab on grade [for a distance of [_____] mm feet from the edge of slab]. [Turn insulation up at slab edge, and extend full height of slab.] Install insulation on top of vapor retarder and turn retarder up over the outside edge of insulation to top of slab.

][3.6.4 Protection of Insulation

Protect insulation from damage during construction and back filling by application of protection board or a coating. Do not leave installed vertical insulation unprotected overnight. Protect installed insulation from weather, including rain and ultraviolet light, from mechanical abuse, compression, and dislocation. [Install protection over entire exposed exterior insulation board.] [Extend protection at least 300 mm 1 foot below grade.]

][3.7 VAPOR RETARDER

Apply vapor retarder continuous across all surfaces. Overlap all joints at least 150 mm 6 inches and seal with pressure sensitive tape. Seal at sills, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

][3.8 ACCESS PANELS AND DOORS

Attach insulation to all access panels greater than 0.1 square meter 1 square foot and all access doors in insulated floors and ceilings. Use insulation with same R-Value as that for the floor or ceiling in which each panel occurs.

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