
USACE / NAVFAC / AFCEA / NASA UFGS-07 21 13 (May 2011)

Preparing Activity: NAVFAC Superseding
UFGS-07 21 13 (August 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2012

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 21 13

BOARD AND BLOCK INSULATION

05/11

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SUSTAINABLE DESIGN CERTIFICATION
- 1.4 DELIVERY, STORAGE, AND HANDLING
 - 1.4.1 Delivery
 - 1.4.2 Storage
- 1.5 SAFETY PRECAUTIONS
 - 1.5.1 Respirators
 - 1.5.2 Other Safety Considerations

PART 2 PRODUCTS

- 2.1 BLOCK OR BOARD INSULATION
 - 2.1.1 Thermal Resistance
 - 2.1.2 Fire Protection Requirement
 - 2.1.3 Other Material Properties
 - 2.1.4 Premolded Concrete Masonry Insert
 - 2.1.5 Recycled Materials
 - 2.1.6 Prohibited Materials
- 2.2 VAPOR RETARDER AND DAMPPROOFING
 - 2.2.1 Vapor Retarder in Frame Walls and Roofs
 - 2.2.2 Dampproofing for Masonry Cavity Walls
 - 2.2.3 Vapor Retarder under Floor Slab
- 2.3 PRESSURE SENSITIVE TAPE
- 2.4 PROTECTION BOARD OR COATING
- 2.5 ACCESSORIES
 - 2.5.1 Adhesive
 - 2.5.2 Mechanical Fasteners

PART 3 EXECUTION

- 3.1 EXISTING CONDITIONS
- 3.2 PREPARATION
 - 3.2.1 Blocking Around Heat Producing Devices

- 3.3 INSTALLATION
 - 3.3.1 Insulation Board
 - 3.3.2 Electrical Wiring
 - 3.3.3 Cold Climate Requirement
 - 3.3.4 Continuity of Insulation
- 3.4 INSTALLATION ON WALLS
 - 3.4.1 Installation using Furring Strips
 - 3.4.2 Installation on Masonry Walls
 - 3.4.3 Adhesive Attachment to Concrete and Masonry Walls
 - 3.4.4 Mechanical Attachment on Concrete and Masonry Walls
 - 3.4.5 Protection Board or Coating
- 3.5 INSTALLATION ON UNDERSIDE OF CONCRETE FLOOR SLAB
 - 3.5.1 Mechanically Fastened Systems
 - 3.5.2 Adhesively Bonded Systems
- 3.6 PERIMETER AND UNDER SLAB INSULATION
 - 3.6.1 Manufacturer's Instructions
 - 3.6.2 Insulation on Vertical Surfaces
 - 3.6.3 Insulation Under Slab
 - 3.6.4 Protection of Insulation
- 3.7 VAPOR RETARDER
- 3.8 ACCESS PANELS AND DOORS

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-07 21 13 (May 2011)

Preparing Activity: NAVFAC Superseding
UFGS-07 21 13 (August 2010)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2012

SECTION 07 21 13

BOARD AND BLOCK INSULATION 05/11

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 items(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).

NOTE: This guide specification is intended for both retrofit of existing buildings and new construction.

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.

NOTE: On the drawings, show:

1. Locations where insulation will 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.

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 one 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 one 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.

PART 1 GENERAL

1.1 REFERENCES

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

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

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

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

ASTM INTERNATIONAL (ASTM)

ASTM C1289	(2012) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C165	(2007) Standard Test Method for Measuring Compressive Properties of Thermal Insulations
ASTM C203	(2005a; R 2012) Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C272/C272M	(2012) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
ASTM C552	(2012) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	(2011b e1) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2012a) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM C930	(2005) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D1621	(2010) Compressive Properties of Rigid Cellular Plastics
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2010) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E154	(2008a) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs,

	on Walls, or as Ground Cover
ASTM E84	(2012a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2010) Standard Test Methods for Water Vapor Transmission of Materials
GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)	
GEI	Greenguard Standards for Low Emitting Products
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 211	(2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2012) National Fuel Gas Code
NFPA 70	(2011; Errata 2 2012) National Electrical Code
SCIENTIFIC CERTIFICATION SYSTEMS (SCS)	
SCS	Scientific Certification Systems (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

1.2 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated 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 submittals requiring Government approval on Army projects, a code of up to three characters within

the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

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

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Block or board insulation[; G][; G, [____]]

Vapor retarder

Pressure sensitive tape

Protection board or coating

Accessories

Certification

SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

[1.3 SUSTAINABLE DESIGN CERTIFICATION

Product shall be third party certified by GEI Greenguard Indoor Air Quality Certified, SCS Scientific Certification Systems Indoor Advantage or equal. Certification shall be performed annually and shall be current.]

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 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.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload 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.

1.5 SAFETY PRECAUTIONS

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.

[1.5.1 Respirators

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

]1.5.2 Other Safety Considerations

Consider safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLOCK OR BOARD INSULATION

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

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

- [a. Cellular Glass: ASTM C552]
- [b. Extruded Preformed Cellular Polystyrene: ASTM C578]
- [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]
 - [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

 NOTE: Board and block thermal insulating materials have different thermal properties. Specify insulation to provide the R-Value required to meet the energy budget indicated in MIL-HDBK-1190, Facility Planning Design Guide. Indicate R-values on the project drawings. If not, specify in the appropriate blanks.

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

[As indicated] [Ceiling [R-_____] Wall [R-_____] Floor [R-_____]].

2.1.2 Fire Protection Requirement

 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 code for fire retardant classifications required, flame spread and smoke developed ratings and distance of insulation and vapor retarder from heat producing devices and other fire protection requirements, such as finish materials required in various occupancies.

NOTE: Do not use cellular plastic insulation exposed to the interior. Separate the insulation from the interior by at least a 15 minute fire separation. If no separation is provided, select cellular glass block insulation. Edit this paragraph and the paragraph entitled "Insulation on Vertical Surfaces" as required.

- [a. Flame spread index of [75] [100] [_____] or less when tested in accordance with [ASTM E84](#).]
- [b. Smoke developed index of [200] [150] [_____] or less when tested in accordance with [ASTM E84](#).]

2.1.3 Other Material Properties

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

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, kg/m² lbf/sft: [120] [4900] [25] [1000] when tested according to [ASTM C165](#).]
- [b. Flexural strength: Not less than [275] [_____] kPa [25] [_____] psi when measured according to [ASTM C203](#).]
- [c. 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 d. or e. below if only one material is allowed.

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

[ASTM C578](#). Install inserts in concrete masonry units at the masonry unit manufacturing plant. Provide insert with thickness 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:	23 percent

2.1.6 Prohibited Materials

Do not provide materials containing more than one percent of asbestos.

[2.2 VAPOR RETARDER AND DAMPPROOFING

NOTE:

1. Determine the need for a water vapor retarder and its required permance value based on a project 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 were considered materials having a permance of 5.72 by 10-8 g/Pa.s.m2 1 perm (grain/h*ft2*in.Hg) or less. However, that value may not be adequate for the particular construction 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 manufacturer as having a water vapor permance of no more than the required value can be used. Alternate materials include: Paints, 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.

4. Vapor retarders not only retard movement of water vapor into building envelope cavities, but also retard drying out of moisture that may have infiltrated the cavity. Accordingly, use vapor retarders only where their need is indicated by the moisture analysis.

2.2.1 Vapor Retarder in Frame Walls and Roofs

[a. 0.15 mm 6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 5.72 by 10-8g/Pa.s.m2 one perm or less when tested in accordance with ASTM E96/E96M.]

[b. Membrane with the following properties:

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

Maximum Flame Spread: ASTM E84: [25] [50] []

Combustion Characteristics: Passing ASTM E136

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.

] [2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder and having a water vapor permeance rating of 5.72 by 10-8 g/Pa.s.m2 one perm or less when tested 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.

Before installing insulation, ensure that all areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If installing perimeter or under slab insulation, check that the fill is flat, smooth, dry, and well tamped. If moisture or other conditions are found that do not allow the proper installation of the insulation, do not proceed but notify the Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Unless using insulation board that passes **ASTM E136** in addition to the requirements in Part 2, install non-combustible blocking around heat producing devices to provide 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 to be 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 by the Manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's installation instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

3.3.2 Electrical Wiring

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

[3.3.3 Cold Climate Requirement

Place insulation to 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 any thermal bridges or voids.

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

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 the

cores only 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. Put ends in moderate contact with adjoining insulation without forcing. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other services. Seal around cut-outs with sealant. Install board in wall cavities so that it leaves at least a nominal 25 mm one inch free 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 one 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, bend split prongs flush with 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 instructions. Install protection over all exterior exposed insulation board and down 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, bend split prongs flush with insulation. Butt all edges of insulation and seal with tape.

] 3.5.2 Adhesively Bonded Systems

Apply adhesive to underside of the 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 one square foot or less.

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

] 3.6 PERIMETER AND UNDER SLAB INSULATION

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

Provide R-Values and extent as indicated in the 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

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
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
0 to 555	0	0	0	0	0	0	0	0	0	0	0	0
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
* 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

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
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
0 to 2000	0	0	0	0	0	0	0	0	0	0	0	0
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
* 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).												

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

3.6.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

[3.6.2 Insulation on Vertical Surfaces

Install thermal insulation [as indicated.] [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] [as indicated]. [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 on vertical surfaces from damage during construction and back filling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight. [Install protection over entire exposed exterior insulation board.] [Provide protection extending at least 300 mm one foot below grade.]

] [3.7 VAPOR RETARDER

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

] [3.8 ACCESS PANELS AND DOORS

Affix insulation to all access panels greater than 0.1 square meter one square foot and all access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

] -- End of Section --