UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 21 23

LOOSE FILL THERMAL INSULATION

08/23

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 CERTIFICATIONS
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 Concerns

PART 2 PRODUCTS

2.1 LOOSE FILL INSULATION
2.1.1 Recycled Materials
2.1.2 Prohibited Materials
2.1.3 Reduced Volatile Organic Compounds (VOC) for Insulation Materials
2.2 SILL SEALER INSULATION
2.3 BLOCKING
2.4 VAPOR RETARDER
2.5 PRESSURE SENSITIVE TAPE

PART 3 EXECUTION

3.1 EXISTING CONDITIONS
3.2 PREPARATION
3.2.1 Blocking at Attic Vents and Access Doors
3.2.2 Blocking Around Heat Producing Devices
3.2.3 Protection of Ventilation System
3.3 INSTALLATION
3.3.1 Insulation
3.3.2 [Attics] [and] [Ceilings]

3.3.2.1 Frame Walls
3.3.2.2 Masonry Walls
3.3.2.3 Electrical Wiring
3.3.2.4 Cold Climate Requirement
3.3.2.5 Special Requirements for Ceilings
3.3.2.6 Installation of Sill Sealer
3.3.2.7 Access Panels and Doors
3.3.3 Installation of Vapor Retarder

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA	**UFGS-07 21 23 (August 2023)**

Preparing Activity: NAVFAC	**Superseding**
	UFGS-07 21 23 (May 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 07 21 23

LOOSE FILL THERMAL INSULATION
08/23

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NOTE: This guide specification covers the requirements for loose fill cellulosic and mineral fiber insulation materials in attics, ceilings, and framed walls and mineral granular in masonry walls.

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: Design must meet the requirements of UFC 1-200-02, "High Performance and Sustainable Building Requirements" which invokes the requirements with UFC 3-101-01, "Architecture". UFC 1-200-02 and UFC 3-101-01 make references throughout to ASHRAE 90.1 and IgCC documents governing energy efficiency and requirements for the components of building envelope design including moisture control and thermal performance.
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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. Location and size of attic ventilation openings where required.

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NOTE: Attic Ventilation

Provide net, unobstructed ventilation areas to attics over insulated ceilings as recommended by International Building Code (IBC) paragraph 1202.2 Roof Ventilation, UFC 1-200-02, High Performance and Sustainable Building Requirements, "Optimize Energy Performance" and "Enhance Indoor Environmental Quality", and as follows:

1. 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.

2. 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.

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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.
****

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 C516	(2019) Standard Specification for Vermiculite Loose Fill Thermal Insulation
ASTM C549	(2018) Standard Specification for Perlite Loose Fill Insulation
ASTM C665	(2023) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C739	(2021a) Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation
ASTM C764	(2019) Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM C1015	(2017) Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation
ASTM D3575	(2020) Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers
ASTM D3833/D3833M	(1996; R 2019) Standard Test Method for Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2022a; E 2023) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E136	(2022) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C

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	(2023) 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)

16 CFR 1209	Interim Safety Standard for Cellulose Insulation
16 CFR 1404.4	Requirements to Provide Performance and Technical Data by Labeling - Notice to Purchasers
29 CFR 1910.134	Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

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.

****

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

Loose Fill Insulation; G[, [_____]]

Recycled Content for Insulation Materials; S

[Sill Sealer Insulation

] Vapor Retarder

Pressure Sensitive Tape

SD-07 Certificates

Indoor Air Quality for Insulation Materials; S

SD-08 Manufacturer's Instructions

Loose Fill Insulation

[1.3 CERTIFICATIONS

****

NOTE: Include this paragraph when a fiberglass loose fill insulation product is desired, for which Greenguard certified products are available through national manufacturers. For use of mineral wool or cellulose insulation, for which certified products are not as widely available, editor must first confirm the availability of Greenguard certified products prior to including this paragraph.

****

Submit required indoor air quality certifications and validations in one

submittal package.

Provide product 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 from certification body.

]1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to the site in original sealed containers or packages, each bearing manufacturer's name and brand designation, referenced specification number, type, and class, as applicable; recommended method of installation (pneumatic or pouring); minimum net weight of insulation; coverage charts; R-values; and, for cellulose insulation, a label certifying that the product meets Consumer Product Safety Commission (CPSC) Interim Safety Standard for Cellulose Insulation, 16 CFR 1209, and cautionary label regarding potential fire hazard as required in 16 CFR 1404.4.

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

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 Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 LOOSE FILL INSULATION

****

NOTE: Cellulose insulation can absorb more moisture than mineral fiber. Include both insulation types in locations where moisture is not a problem. Specify mineral fiber for damp locations. Specify vermiculite or perlite only for masonry cavities or concrete block cores.

****

Provide loose fill insulation conforming to [one of] the following:

****

NOTE: The flame spread and smoke development rating will depend on the building occupancy in the areas

where the insulation is located.

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.

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

[a. Mineral Fiber Loose Fill: ASTM C764, Type I, for pneumatic application, or II, for poured application, category [1] [2].

][b. Cellulosic or Wood Fiber Loose Fill: ASTM C739 or 16 CFR 1209.

][c. Granular Mineral Loose Fill: ASTM C516 type II vermiculite or ASTM C549 types II or IV perlite.

] **********
NOTE: Design must meet the requirements of UFC 1-200-02, "High Performance and Sustainable Building Requirements" which invokes the requirements within UFC 3-101-01, "Architecture". UFC 1-200-02 and UFC 3-101-01 make references throughout to ASHRAE 90.1 and IgCC documents governing energy efficiency and requirements for the components of building envelope design including thermal performance.

Select R-Value for Thermal Insulation required to meet the energy target/budget. Show R-Value on Drawings.
****

The R-Value must be as indicated on drawings. The R-value must be the value the product achieves after settlement.

2.1.1 Recycled Materials

****
NOTE: Certain insulation products are required to conform to the U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG) for Construction Products; the recycled content thresholds in this paragraph are based on the stated EPA requirements. These requirements can be found at https://www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products. A resource that can be used to identify products with recycled content is the "Comprehensive Procurement Guidelines (CPG)" page within the EPA's website at https://www.epa.gov/. Other products with recycled content are also acceptable when meeting all requirements of this specification. Research shows

the products are available from U.S. national manufacturers above the minimum recycled content stated. Some manufacturers and regions have higher percentages.
****

Based on material composition, provide insulation materials containing the following minimum percentage of recycled material content:

Rockwool: 75 percent slag

Fiberglass: 20 percent glass cullet

Cellulose: 75 percent post-consumer paper

Provide data identifying percentage of recycled content for insulation materials.

2.1.2 Prohibited Materials

a. Asbestos-containing materials

b. Urea Formaldehyde containing materials

c. Ammonium Sulfate containing material

2.1.3 Reduced Volatile Organic Compounds (VOC) for Insulation Materials

Provide certification of indoor air quality for insulation materials.

[2.2 SILL SEALER INSULATION

****
NOTE: Polyethylene foam sill sealer can be used to reduce air leakage between the foundation wall and sill plate. The sill sealer can also be used as a seal around window and door frames.
****

Provide polyethylene foam sill sealer [89] [139] [190] [241] millimeters [3.5] [5.5] [7.5] [9.5] inches in width with the following characteristics:

Physical Properties	Test Method	Measurement
Nominal Thickness	ASTM D3575	4.76 mm 3/16 inch
Compressive Strength	ASTM D3575	8.27 kPa 1.2 psi
- Vertical Direction	Suffix D	
Tensile Strength	ASTM D3575	220 kPa 32 psi
	Suffix T	

]2.3 BLOCKING

Wood, metal, unfaced mineral fiber blanket material in accordance with

ASTM C665, Type I, or other approved materials. Provide only non-combustible materials (based on determination by ASTM E136 for blocking around chimneys and heat producing devices.

[2.4 VAPOR RETARDER

****

NOTE:

1. Determine the need for a water vapor retarder and its required permeance value based on a project and climate specific moisture analysis as required by UFC 3-101-01 Architecture. For further guidance see ASHRAE Handbook of Fundamentals, Chapter 25 "Heat, Air, and Moisture Control in Building Assemblies - Fundamentals", Chapter 26 "Heat, Air, and Moisture Control in Building Assemblies - Material Properties"; and ASTM C755, "Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation". The need for a vapor retarder and its' permeance must be evaluated in the moisture analysis with the Air and Moisture Barrier system specified. 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 permeance of 5.72 by 10-8 g/Pa.s.m2 one 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.

As a schematic understanding and not to supersede the determination requirements stated above; within the United States, vapor retarders are typically installed on the warm side of insulation in the Department of Energy's Climate Zones, cold climate zones of 5, 6, 7 and Marine 4. In warm climate zones of 1, 2, 3, and 4 avoid the use of very low, less than 1 Perm vapor retarders on interior face of walls.

2. Vapor retarders, where required, can be provided as membranes or, alternatively, vapor retardant finishes labeled by manufacturer as having a water vapor permeance of no more than the required value can be used. Alternate materials include: foil-faced gypsum board. Specify these foil-faced gypsum boards in Section 09 29 00 GYPSUM BOARD, 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.

****

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NOTE: Do not specify polyethylene membrane and other combustible membranes where they will be exposed to occupied or accessible spaces. Such vapor retarders must be covered to provide fire safety as required by applicable building codes.

****

[a. 0.15 mm thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 57.2 ng/(Pa*s*m2) or less when tested in accordance with ASTM E96/E96M.

][b. Membrane with following properties:

Permeance: ASTM E96/E96M, 57.2 ng/(Pa*s*m2)

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

][Combustion Characteristic: Meet ASTM E136

][Puncture Resistance: TAPPI T803 OM

][- [15] [25] [50] Beach Units (1 Beach Unit is 0.0299 joules)
]]

[a. 6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of one perm (grains/(h*ft2*in.Hg) or less when tested in accordance with ASTM E96/E96M.

][b. Membrane with following properties:

Permeance: ASTM E96/E96M, [1] [_____] perm (grains/h*ft2*in.Hg

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

][Combustion Characteristic: Meet ASTM E136

][Puncture Resistance: TAPPI T803 OM

][- [15] [25] [50] Beach Units (1 Beach Unit is 2.205*10-10 foot/pounds)

]]]2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of 57.5 ng/(Pa*s*.m2 one perm (grains/h*ft2*in.hg) or less when tested in accordance with ASTM D3833/D3833M.

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 the touch.

****

Before installing insulation, verify that all surfaces 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 moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify the Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from covering, clogging, or restricting air flow through soffit vents at eaves. [Install permanent blocking around attic trap doors.] [Install permanent blocking to maintain accessibility to equipment or controls that require maintenance or adjustment.]

3.2.2 Blocking Around Heat Producing Devices

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 the 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 around flues and chimneys is not required if the insulation and vapor retarder, when provided, passed ASTM E136, in addition to meeting other requirements stipulated in Part 2. The blocking is also not required when chimneys are certified by the manufacturer for use in contact with insulating materials.

3.2.3 Protection of Ventilation System

Prior to installation of insulation, inspect existing HVAC equipment and ductwork to ensure that insulation will not infiltrate the air distribution/ventilation system. Where potential infiltration sources have been identified do not install insulation until repairs/modifications have been made to rectify the problem.

3.3 INSTALLATION

3.3.1 Insulation

****
NOTE: Include last sentence only in installations of mineral fiber or cellulose insulation.
****

Install and handle insulation in accordance with applicable provisions of ASTM C1015, and manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices. Use only pneumatic equipment compatible with insulation material. Operate equipment in accordance with the manufacturer's instructions. Do not tamp or rod insulation. [Install insulation using the amount (by weight) of material per square meter foot required to achieve the specified thermal resistance value.]

[3.3.2 [Attics] [and] [Ceilings]

Fill space between [and above] [ceiling joists] [and] [rafters] to provide the specified R-Value. For pneumatic installations, use lowest air pressure allowed by manufacturer's instructions. Do not blow insulation into electrical devices, [soffit vents,] [and] [mechanical vents] which open into attic or other spaces to receive insulation.

[3.3.2.1 Frame Walls

Completely fill wall cavities [except those which serve as air ducts for heating, ventilating, and air conditioning systems]. Locate entry holes in walls where required to permit the complete filling of wall cavities. After opening entry holes, check wall cavity for fire stops and other obstructions. When fire stops or other obstructions prevent complete filling of wall cavity, cut additional entry holes to fill the cavity. Close entry holes using materials compatible with original materials. [Seal entry holes in locations where they penetrate a vapor retarder.]

][3.3.2.2 Masonry Walls

Bring up granular insulation in not more than 600 mm 2 foot lifts as the wall is constructed. Allow the insulation to assume its natural density as it is placed.

]3.3.2.3 Electrical Wiring

Do not install insulation in a manner that would sandwich electrical conductors, that are not installed in conduit, between two layers of insulation.

[3.3.2.4 Cold Climate Requirement

****
NOTE: Include this paragraph in ASHRAE climate zones 4 and higher, as identified in ASHRAE 90.1.
****

Place insulation to the outside of all pipes.

][3.3.2.5 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents.

][3.3.2.6 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of masonry or concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

][3.3.2.7 Access Panels and Doors

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

]][3.3.3 Installation of Vapor Retarder

Apply continuous vapor retarder as indicated. Overlap 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. Do not install vapor retarders on both sides of insulation.

] -- End of Section --