
USACE / NAVFAC / AFCEA / NASA UFGS-07 21 23 (August 2010)

Preparing Activity: NAVFAC Superseding
UFGS-07 21 23 (February 2010)
UFGS-07 21 23 (April 2006)
UFGS-07216 (August 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated July 2010

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08/10

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SECTION 07 21 23

LOOSE FILL THERMAL INSULATION 08/10

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.

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 and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of Technical Proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS 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: 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.

NOTE: Attic Ventilation

Provide net, unobstructed ventilation areas to
attics over insulated ceilings:

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.

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 C 1015 (2006) Standard Practice for Installation
of Cellulosic and Mineral Fiber Loose-Fill
Thermal Insulation

ASTM C 516 (2008) Vermiculite Loose Fill Thermal
Insulation

ASTM C 549	(2006) Perlite Loose Fill Insulation
ASTM C 665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 739	(2008) Cellulosic Fiber Loose-Fill Thermal Insulation
ASTM C 764	(2007) Mineral Fiber Loose-Fill Thermal Insulation
ASTM C 930	(2005) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D 3833/D 3833M	(1996; R 2006) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D 4397	(2009) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 136	(2009b) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 84	(2010) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 96/E 96M	(2005) Standard Test Methods for Water Vapor Transmission of Materials

GREENGUARD ENVIRONMENTAL INSTITUTE (GEI)

GEI	Greenguard Standards for Low Emitting Products
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2006; Errata 06-1; Errata 06-2) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2009; TIA 09-1; TIA 09-2) National Fuel Gas Code
NFPA 70	(2008; TIA 08-1) National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	Scientific Certification Systems (SCS)Indoor Advantage
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TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM (2006) 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

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. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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

Loose fill insulation

Sill sealer insulation

Vapor retarder

Pressure sensitive tape

Certification

SD-08 Manufacturer's Instructions

Loose Fill Insulation

[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 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 Smoking

Do not smoke during installation of loose fill thermal insulation.

1.5.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in **ASTM C 930**

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 MIL-HDBK-1008 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 material exposed to accessible spaces, but cover with a fire retardant finish.

- [a. Mineral Fiber Loose Fill: ASTM C 764, Type I, for pneumatic application, or II, for poured application, category [1] [2].]
- [b. Cellulosic or Wood Fiber Loose Fill: ASTM C 739 or 16 CFR 1209.]
- [c. Granular Mineral Loose Fill: ASTM C 516 type II vermiculite or ASTM C 549 types II or IV perlite.]

2.1.1 Thermal Resistance Value(s) (R-Values)

NOTE: Select R-Value required to meet energy target/budget as indicated in MIL-HDBK-1190, "Facility Planning and Design Guide."

The R-Value shall be as indicated. The R-value shall be the value the product achieves after settlement.

2.1.2 Recycled Material

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all the other requirements of this section. At the minimum, the recycled material content shall be:

Rockwool: 75 percent slag

Fiberglass: 20 to 25 percent glass cullet
Cellulose: 75 percent post-consumer paper

2.1.3 Prohibited Materials

- a. Asbestos-containing materials
- b. Urea Formaldehyde containing materials
- c. Ammonium Sulfate containing material

2.2 SILL SEALER INSULATION

ASTM C 665, Type I.

2.3 BLOCKING

Wood, metal, unfaced mineral fiber blanket material in accordance with ASTM C 665, Type I, or other approved materials. Provide only non-combustible materials (based on determination by ASTM E 136 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. For guidance see ASHRAE Handbook of Fundamentals, Chapter 20, "Thermal Insulations and Vapor Retarders;" ASTM C 755, "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 permeance 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 permeance 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.

NOTE: Do not specify polyethelene membrane and other combustibile 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 D 4397 and having a water vapor permeance of 57.5 ng/(Pa.s.sqm) or less when tested in accordance with ASTM E 96/E 96M.]

[b. Membrane with following properties:

Permeance: ASTM E 96/E 96M, [57.5] [_____] ng/Pa*s*sqm

[Maximum Flame Spread: ASTM E 84, [25] [50] [_____]]

[Combustion Characteristic: Meet ASTM E 136]

[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 D 4397 and having a water vapor permeance of one perm (grains/(h*ft2*in.Hg) or less when tested in accordance with ASTM E 96/E 96M.]

[b. Membrane with following properties:

Permeance: ASTM E 96/E 96M, [1] [_____] perm (grains/h*ft2*in.Hg

[Maximum Flame Spread: ASTM E 84, [25] [50] [_____]]

[Combustion Characteristic: Meet ASTM E 136]

[Puncture Resistance: TAPPI T803 OM

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

12.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of $\text{ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$ one perm (grains/h* $\text{ft}^2\cdot\text{in.hg}$) or less when tested in accordance with ASTM D 3833/D 3833M.

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 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 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 E 136, in addition to meeting all 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 C 1015, and manufacturer's instructions. Keep material dry and free of extraneous materials. 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 wiring between two layers of insulation.

[3.3.2.4 Cold Climate Requirement

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 --