



State of Ohio  
Weatherization Program  
Standards

Section **EFFECTIVE INSULATION  
METHODS**

Subject **Site-Built Homes**

*GENERAL PRACTICES 1507-1.1*

All insulation methods require the insulation to fit snugly into the cavity being insulated. There must be no areas missed and the insulation should fit tightly to the wall, ceiling, floor, duct or pipe being insulated. Air will bypass the insulation or wash behind the insulation where there are any sags or gaps. This will result in the reduced effectiveness of the insulation.

**correct installation  
important**  
1507-1.1a

Insulation can be installed by several methods. Batt insulation can be installed by fastening the tabs with staples, by friction fitting the batts snugly in the cavity, or by simply laying the batt down. Loose fill insulation can be installed by blowing it in loosely, by drilling 1" holes and blowing it into a cavity until the cavity is full (blow to refusal), or by drilling a larger hole and inserting a tube into the cavity. The tube is then removed slowly as the cavity fills. This last method results in a densely packed insulation.

**installation methods**  
1507-1.1b

All persons installing, cutting, and handling fiberglass, cellulose, or rockwool insulation must wear masks or respirators, eye protection and gloves while working with the material (see sections 1401-1409).

**personal protective  
equipment**  
1507-1.1c

Each application may have several installation methods which will do the job. Choosing the most effective, least costly method which results in the highest performance of the insulation is a very important challenge for the weatherization installer staff. Some jobs will require the installers to use several methods on the same retrofit. Blown insulation is usually less expensive than batt insulation and cellulose is usually less expensive than fiberglass. Cellulose is, on the other hand, heavier than fiberglass making fiberglass preferable in places where the strength of the ceiling is in question. Cellulose, also, should never come in contact with metal roofing. Moisture is usually an important issue in decision making, and fiberglass is a better choice should water ever come in contact with the insulation. Techniques exist for blowing insulation in wall cavities which are covered on only one side.

**choose the  
appropriate method**  
1507-1.1d

**vapor retarder/fire rating**

1507-1.1e

Install vapor retarders on the side of the wall which will be warm in the winter. Vapor retarders must have a perm rating of less than one. Vapor barrier paint, 4 mil polyethylene sheeting, kraft paper, and foil are acceptable vapor retarders. No vapor retarder with a flame spread of greater than 25 (see appendix A, material standards) may be left uncovered. Sheet rock or another acceptable fireproofing material must cover the vapor retarder.

**bulk moisture**

1507-1.1f

Protect the insulation and the structure from moisture damage by repairing, flashing, or adding sealant to areas which may be prone to leaking such as roofs, wall vents, roof vents, sidewall plugs, window/door trim and sills, etc.

**batt insulation (stapled)**

1507-1.1g

Install faced batt insulation with the vapor retarder on the side which will be warm in the winter. Cut the insulation to fit snugly on all sides and around wiring, pipes, and other obstacles. Fit the insulation so it is tight against the warm in winter side. Install the insulation without compressing the batt. Fold the tabs out and staple along the tab on the face of the wall stud.

**batt insulation (friction fit)**

1507-1.1h

Install faced batt insulation with the vapor retarder on the side which will be warm in the winter. Cut the insulation to fit snugly on all sides and around wiring, pipes, and other obstacles. Fit the insulation so it is tight against the warm in winter side. Install the insulation without compressing the batt. The insulation must be mechanically fastened with wire supports or woven wire underneath the insulation. Woven plastic (manufactured specifically for insulation support) may be used provided the material allows for air movement and it has the structural strength for the load it will carry. Note that fabric air infiltration barriers such as Tyvec and other house wrap materials are not intended to be used for horizontal applications.

**batt insulation (laying)**

1507-1.1i

Install faced batt insulation with the vapor retarder on the side which will be warm in the winter. Cut the insulation to fit snugly on all sides and around wiring, pipes, and other obstacles. Fit the insulation so it is tight against the warm in winter side. Install the insulation without compressing the batt. When installing more than one layer of batt insulation, lay the second or any subsequent layer perpendicular to the preceding layer, thus criss-crossing the layers.

For applications on flat surfaces such as open attics, install the insulation to the manufacturers specifications for the R-value required. Always install the amount of insulation required, rather than the depth, as settling will vary depending on the air setting on the blowing equipment.

**blown cellulose (open)**  
1507-1.1j

Dense pack cellulose should be used for all sidewall cavities, floored attic areas, attic slopes, shallow shed roofs and other closed cavities where 2 ½ to 4 lbs. per cubic foot is required. Install the insulation using a tube inserted to the top (or bottom) of the cavity. Blow insulation to refusal, slowly withdrawing the tube as the cavity fills.

**blown cellulose (dense)**  
1507-1.1k

This method may be used for all sidewall cavities, floored attic areas, attic slopes, shallow shed roofs and other closed cavities where 2 to 2 ½ lbs. per cubic foot is acceptable (such as where the structure cannot withstand dense pack). The insulation in this method is installed from a hole drilled in the center of the area to be insulated. Air currents carry the insulation to the edges of the cavity, so locating the hole properly is vitally important. Drill 1" holes, centered to the width of the cavity so that there is no more than 5 feet between the top and bottom rows. Locate the holes in small cavities in the center of the cavity.

**blown cellulose (loose)**  
1507-1.1l

This method may be used for all sidewall cavities, floored attic areas, attic slopes, shallow shed roofs and other closed cavities where the weight of the insulation and moisture are concerns. Blown fiberglass is acceptable when installed against metal roofing. The insulation in this method is installed from a hole drilled in the center of the area to be insulated. Install this as you would loose blown cellulose, but consider whether the blowing equipment is rated to blow fiberglass.

**blown fiberglass (loose)**  
1507-1.1m

For applications on flat surfaces such as open attics. Install the insulation to the manufacturers specifications for the R-value required. Always install the amount of insulation required, rather than the depth, as settling will vary depending on the air setting on the blowing equipment. Install it similar to loose blown cellulose, but consider whether the blowing equipment is rated to blow fiberglass.

**blown fiberglass (open)**  
1507-1.1n

**proper tube**  
1507-1.1o

Use 1 1/4" inside diameter hose which has a 1/8" wall thickness.

Hard industrial vinyl works best when the air temperature is above freezing.

Soft industrial vinyl works best when the air temperature is below freezing.

Attach the vinyl hose to a 2" insulation hose using an automotive exhaust reducer tapered from 2" OD to 1 3/4" or 1 1/2" OD. Secure the tube with hose clamps.

**estimation of blown material**  
1507-1.1p

Net area (sq.ft.) X cavity depth (ft.) = cubic feet

Cubic feet X lbs. per cubic foot = lbs. insulation needed

Lbs. of insulation needed divided by lbs. per bag = number bags needed

**remove siding**  
1507-1.1q

With any of the sidewall insulation methods, remove as many rows of siding as is necessary according to the method being used. Vinyl siding may be removed by un-hooking the bottom lip of the row using a siding zip tool which is manufactured for this purpose. Most wooden clapboards may be removed by cutting or removing the nails of the row to be removed and the row directly above it with a flat pry bar. Care must be taken so that the siding does not split. Cement board siding may be removed by cutting two rows of nails as was described above. Note: some cement board siding contains asbestos. Removing siding is allowable; drilling asbestos containing material is not allowed. Always wear personal protective equipment when handling asbestos containing material.

**probe cavities**  
1507-1.1r

The probe must be made of a non-conductive material. Probe both vertically and horizontally to determine the spacing of the wall studs and to determine the existence and location of fire stops or bracing. Probe all cavities.

**prep cavities**  
1507-1.1s

Seal all cavity openings with a permanent, air impermeable material to keep insulation from leaking out in the future and to address air movement. Temporarily seal tops of open cavities to prevent insulation escaping during installation.

*SIDEWALLS 1507-1.2*

**tubing method (exterior)**  
1507-1.2a

One row of exterior siding must be removed. Drill holes (drill size 2"-2 9/16") through the sub-siding. Replace the siding to match the original condition of the siding.

For interior drilling, the tubing method is preferable to the 2 hole method. Protect the customer's furnishings, carpets, etc. by covering the area with plastic sheeting. After drilling and insulating, holes in interior wall surfaces must be filled and returned to a finished condition. For wallpapered, textured or colored surfaces that cannot be matched, a chair rail molding may be used to cover the holes. Locate these holes accordingly.

**tubing method  
(interior)**  
1507-1.2b

For framing where the top or bottom plate (or both) are open, the insulation may be installed from the crawl space/ basement or the attic through the openings into the wall cavities. This may not be practical for hard to reach areas, but could save drilling time in some instances. Fiberglass batts should not be used in balloon framed structures.

**tubing method  
(balloon construction)**  
1507-1.2c

Windows may be drilled with a 1" hole at the sill and header at a location where the closed window will cover the holes. These holes must be filled with wooden plugs and sealed for water proofing. If this is not practical, locate holes above and below windows, etc. in the center of the cavity.

**windows**  
1507-1.2d

Drill holes so that there is no more than 5 feet between top and bottom rows. Locate holes that are above and below windows, etc. in the center of the cavity. Sidewall plugs should match the color of the siding they are installed in. Sealant may be added to protect the walls and insulation from water damage. Note that 3.25 - 3.75 lbs. per cubic foot is required for sidewalls if a technical reason does not exist that prevents this density.

**two hole method**  
1507-1.2e

For multi-story buildings, either tubing or the two hole method is acceptable. Fiberglass batts should not be used in balloon framed structures. Insulation will spill between the floors. This spillage is acceptable and may actually help reduce air movement through bypasses. Specify additional insulation for this purpose.

**two story buildings  
(balloon construction)**  
1507-1.2f

For multi-story buildings, either tubing or the two hole method is acceptable. If there is concern about lack of insulation at the band joist, then blowing cellulose in the perimeter through the exterior, interior floor, or interior ceiling is acceptable if correct methods for the application being used are followed.

**two story buildings  
(platform  
construction)**  
1507-1.2g

*KNEEWALLS 1507-1.3***fiberglass batts**  
1507-1.3a

Seal bypasses in floor cavities leading into the kneewall attic, and exterior and interior wall cavities using an air-impermeable material. Fiberglass batts (R-19) must be secured with mechanical fasteners.

**blown cellulose**  
1507-1.3b

Install a fabric house wrap infiltration barrier along exposed kneewall framing. House wrap material should be cut and fastened to the roof in a way so the slope is continuous with the kneewall. House wrap material must be secured with staples (T-50) or another suitable fastener. Space fasteners no more than 3" apart. Pull the material tight between studs. 1/2" or 3/4" foam insulation board may also be used as an encapsulation barrier along exposed kneewall framing. It should fit snugly at the top plate, leaving a gap along the bottom plate. This gap is filled with a piece of fiberglass batting, serving as a pressure relief for the insulation installation. The insulation board is typically fastened with cap-nails or disks secured by screws. The cavities are tubed from the top, down. Access can be made using a common utility knife.

**bracing/house wrap material**  
1507-1.3c

Wall heights of 3 feet 6 inches or less require no additional bracing. Walls exceeding 3 feet 6 inches require a center horizontal band of either wood, metal, or plastic attached by either nails or screws to the studs. Securing straps need to be installed every 3 feet for walls over 6 feet.

**install insulation**  
1507-1.3d

Cut the house wrap to allow for access of a 2" hose. Blow insulation in slopes to refusal. Insulate the kneewall cavity as any other sidewall. Insulate just inside the floor/kneewall juncture with a plug of cellulose blown to refusal. Seal the access holes in the house wrap with small squares of belly patch to ensure barrier continuity. Insulate the flat open joist attic. Floored attics should be dense packed.

**kneewall door**  
1507-1.3e

Cover the kneewall door with insulation so that the effective R-value is equal the R-value of the kneewalls.

*ATTICS 1507-1.4***open joist**  
1507-1.4a

Seal the attic air leakage sites. Flag all junction boxes and add barriers to keep insulation from all heat producing devices. Correct all other existing hazards. Blow the insulation to the R-value specified.

Add a barrier to keep insulation away from the attic hatch (see 302-3.3c). Insulate the attic hatch to the same R-value as the attic.

**attic hatch**  
1507-1.4b

In attics previously insulated with batt insulation and where the soffits are vented, cut the batts back 2 feet from the eaves. Install vent baffles (if necessary). Insulate the area with blown insulation to ensure coverage over the outer wall top plate and to prevent wind washing under the existing batts. The quality of the installation of the existing batts should be verified before loose-fill insulation is installed on top. It may be necessary to remove or re-install improperly installed batts.

**existing batt**  
1507-1.4c

Access the cavities by drilling or removing the fascia. If drilling, the drill size should be 2" and the tubing method should be used. Use 2" plastic or wooden plugs. Blow insulation in each cavity area to refusal. Block the eave (if possible) to prevent insulation from spilling into the soffit.

**shed roof**  
1507-1.4d

#### *PERIMETER INSULATION 1507-1.5*

Moisture and air quality problems in the basement/crawl space must be corrected prior to the installation of perimeter insulation.

**moisture problems**  
1507-1.5a

Determine if the area will be a conditioned, unintentionally conditioned, or non-conditioned space upon the completion of weatherization. Perimeter insulation may be installed if the area will be a conditioned or unintentionally conditioned space.

**determine usage**  
1507-1.5b

Insulate the perimeter with R-11 vinyl faced insulation or equivalent material (based on R-value, cost, and code concerns).

**R-value**  
1507-1.5c

Seal any existing ventilation to the conditioned crawlspace/ basement area.

**ventilation**  
1507-1.5d

Install a vapor retarder/ground cover over any exposed earth. This vapor retarder must extend at least 6 inches up the foundation. Overlap any seams at least 6". Seal all joints with sealant.

**vapor retarder/ground cover**  
1507-1.5e

**install insulation**  
1507-1.5f

Install the insulation from the sillbox (including the bandjoist) to the crawlspace floor. The crawl space wall insulation shall extend vertically and horizontally a minimum total distance of 24" linearly from the outside finished ground level. The insulation must be mechanically fastened and all joints sealed with tape. The bottom edge must be weighted so that a tight fit against the wall is maintained.

*FLOOR INSULATION 1507-1.6***moisture problems**  
1507-1.6a

Moisture and air quality problems in the crawl space/ basement must be corrected prior to the installation of floor insulation.

**determine usage**  
1507-1.6b

Determine if the area will be a conditioned, unintentionally conditioned, or non-conditioned space upon the completion of weatherization. Floor insulation may be installed only if the area will be a non-conditioned space.

**vapor retarder/ground cover**  
1507-1.6c

Install a vapor retarder/ground cover over any exposed earth. This vapor retarder must extend at least 6 inches up the foundation. Overlap any seams at least 6" and seal all joints with sealant.

**ventilation**  
1507-1.6d

Where necessary, add ventilation to equal 1 sq. foot for every 1500 sq. feet of floor area. Ventilation may be disregarded if the area is dry and well drained. There must also be no evidence of standing water in the area and a complete ground cover must be installed if venting will be omitted.

**protect from freezing**  
1507-1.6e

Any water pipe located in a non-conditioned area must be protected from freezing when the floor above that area is insulated. Heat tape may be added if the temperature in the non-conditioned area stays near the outdoor temperature.

**R-value**  
1507-1.6f

Insulate the floor cavity with R-19 insulation.

**install insulation**  
1507-1.6g

Cut the insulation to fit snugly at all sides and cut the insulation to fit around bracing strips. Install the insulation horizontally from the sillbox (including the bandjoist).

Mechanically fasten the insulation if a vapor retarder is present. Tiger Claws (a.k.a. Lightning Rods or wire supports) or Insul-Strap may be used to support the insulation. Care must be taken to cut supports to the appropriate length in order to avoid over-compressing the insulation during installation.

**install insulation (con't)**  
1507-1.6g

Install woven plastic support material over the area to be insulated. This material is manufactured specifically for insulation support and is typically used for mobile homes. Ensure a tight fit of this material and brace as necessary. Note that fabric air infiltration barriers such as Tyvec and other house wrap materials are not intended to be used for horizontal applications. 1/2” or 3/4” foam insulation board may also be used as an encapsulation barrier. This material is typically supported by cap-nails or disks secured by screws. Blow fiberglass insulation to refusal following manufactures installation specifications. Cellulose should not be used in this application.

**blown insulation**  
1507-1.6h

*PIPE INSULATION 1507-1.7*

The first 6 feet of both the hot and cold water lines coming from the domestic water heater must be insulated with commercially available foam or fiberglass pipe insulation.

**hydronic heating pipes**  
1507-1.7b

Steam pipes require insulation rated for use on such pipes. All hot water supply pipes must be insulated with commercially available foam or fiberglass pipe insulation. Any hot water return pipes must be insulated with commercially available foam or fiberglass pipe insulation if they are located in a non-conditioned area.

**protect from freezing**  
1507-1.7c

Any water pipe located in a non-conditioned area must be protected from freezing when the floor above that area is insulated. Heat tape may be added if the temperature in the non-conditioned area stays near the outdoor temperature.

*DUCT INSULATION 1507-1.8*

**seal first**  
1507-1.8a

Seal all duct work in accordance with section 301-5 prior to installing insulation.

**R-value**  
1507-1.8b

Insulate the ducts with R-6 vinyl or foil-backed duct insulation.

**installation**  
1507-1.8c

**installation (con't)**  
1507-1.8c

The insulation must be mechanically fastened and all joints sealed with tape.

**new work**  
1507-1.8d

All new work must meet NFPA and local codes. A minimum of R-6 flex duct is allowable, however, rigid duct board may only be used to insulate over square metal ducts.