Fiberglass Insulation

A guide to proper installation

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Conductive Heat Transfer

Conductive heat transfer is the transfer of heat through a solid or between solids that are touching each other. Conduction is the heat transferred through the building assembly (floor, walls, ceiling) and insulation is used to slow it down. Examples of conductive heat transfer are heat loss/gain through the ceiling, through the walls, through the floor, through the windows and doors (all the building components that make up the building envelope). The resistance to heat flow is called the R-value and the conductance of heat flow is called the U-factor. These two are inversely related; the U-factor is 1 divided by the R-value and the R-value is 1 divided by the U-factor. R-value is for the resistance to heat flow and the U-factor is the conductance of heat flow.

Higher R-values provide more resistance to heat flow (are better) and lower U-factors conduct less heat (are better). Insulation works by trapping tiny air pockets which reduce the amount of surfaces touching each other. Insulation R-value is compromised by compression of the trapped air pockets and by air leakage around or through the insulation.

Fiberglass insulation comes in board, batt, loose-fill and sprayed-on applications. It has an R-value around 3.7 per inch of thickness, although batts come in R-11, R-13, R-15, R-19, R-21, R-25 and R-30.

Some brands of fiberglass irritate the skin and some do not; additionally, the International Agency for Research on Cancer has declared that insulating fiberglass is no longer considered to be a cancer causing agent. The key to fiberglass insulation is, like most building components, the installation. It must be installed without compression, splitting the batt around wires and pipes, and without any voids or gaps around obstructions (electrical boxes, blocking, bridging, etc).

Fiberglass and mineral wool batts can suffer from convective loops if airsealing measures are not taken and their performance can degrade due to the convective effect and moisture (as does cellulose). In mixed humid climates, unfaced batts should be used. In heating climates, the asphalt coated kraft paper faced batts should be used with the kraft paper facing the inside of the house. In hot humid climates, use unfaced batts or install the asphalt coated kraft paper faced batts with the kraft paper facing the outside of the house. This will act as a vapor retarder against the predominant vapor drive in each of those climates.

Fiberglass or mineral wool insulation should be installed according to the North American Insulation Manufacturers Association (NAIMA) standards. The following have been adapted from those standards and code requirements.

1. Install insulation that is dry and free of damage.
2. All building insulation shall be protected from high humidity conditions. In cases where glass fiber will dry naturally and regain its original R-value, insulation shall be allowed to dry thoroughly. Under conditions where the insulation will not dry thoroughly insulation shall be replaced.
3. Insulation shall be isolated from interior space by installing a continuous layer of air impervious material (air-barrier) between the insulation and the living space.
4. Unfaced building insulation shall not be installed in an exposed location/surface where it will be subject to human contact.
5. If new material is being added to insulation already in place, batts with no vapor retarders attached to it shall be used. In case such a product is unavailable the vapor retarder facing between layers of insulation shall be removed.
6. Insulation shall be installed snugly between framing members, leaving no gaps between framing members.
7. Insulation shall be cut to butt-fit around obstructions and penetrations, or the insulation shall be cut to the middle

of the batt's thickness and one flap shall be under the wire/pipe and the other over the wire/pipe. Insulation shall not be compressed to fit behind pipes or wires.

8. Bridging or cross bracing of ceiling or floor joists shall be insulated by splitting a batt vertically at the center and packing one half into the lower opening and the other half into the upper opening.
9. Junction boxes for wall switches and convenience outlets at outside walls shall be insulated between the rear of the box and the sheathing. Insulation shall be placed behind the junction box and if necessary, insulation shall be cut to fit snugly around it.
10. Insulation shall be placed between the piping in exterior walls and the exterior wall sheathing. Sidewalls where plumbing fixtures are to be placed shall be insulated before the fixtures are installed.
11. Insulation shall not be installed on a suspended ceiling with removable ceiling panels.

Wood-framed wall:

1. For glass fiber insulation with facing, flanges shall be stapled either to the faces or sides of the studs. Flanges shall be pulled taut and stapled such that there are no gaps between the stapling surface and the flanges through the entire length of the insulation. The flange of the faced insulation placed in the next cavity shall overlap the previously stapled flange.
2. Unfaced rigid fit insulation shall be pressure fitted between studs.
3. Additional strips of insulation shall be cut and installed to fill all gaps around window and doorframes, without compressing the insulation. This does not replace sealing with a sealant.
4. Pieces of insulation shall be installed (without compressing the insulation) in small spaces between studs at the corners of buildings and at intersections of partitions and sidewalls before sheathing is applied.
5. Non-standard-width framed spaces shall be insulated by cutting the insulation and facing about an inch wider than the space to be filled. The uncut flange shall be stapled as usual. The facing on the cut side shall be pulled to the other stud and stapled through the vapor retarder to the stud.

Wood-framed ceiling:

1. Faced insulation shall be placed between joists with the vapor retarder facing down. If insulation is installed before ceiling finish flanges shall be stapled to bottom faces or sides of joists.
2. Non-standard-width framed spaces shall be insulated by cutting the insulation and facing about an inch wider than the space to be filled. The uncut flange shall be stapled as usual. The facing on the cut side shall be pulled to the other stud and stapled through the vapor retarder to the stud.
3. If existing insulation is near or above the top of the joists, the new batts shall be placed perpendicular to the old ones.
4. All deep drops and interior wall cavities shall be covered by an air impervious layer to keep insulation in place and stop air movement.

Floor Joists:

1. Faced insulation shall be used with the vapor retarder facing up.
2. The insulation must be in contact with the subfloor.
3. The headers or band joists at outside walls shall also be insulated.

Cathedral Ceilings:

1. A ventilation space of at least one inch shall be left between the insulation and the roof.
2. Prior to installation, ventilation baffles shall be installed along the entire run of each rafter cavity.
3. Faced insulation shall be installed with vapor retarder facing down, and stapled between the rafters. Staples shall not be secured to the inside face of the rafter. The flange of the faced insulation placed in the next cavity shall overlap the previously stapled flange.
4. Non-standard-width framed spaces shall be insulated by cutting the insulation and facing about an inch wider than

the space to be filled. The uncut flange shall be stapled as usual. The facing on the cut side shall be pulled to the other stud and stapled through the vapor retarder to the stud.

During a Home Energy Rating, a mandatory insulation inspection occurs. The insulation installation must be graded using Grade 1 for an excellent installation, Grade 2 for a good installation and Grade 3 for a poor installation. Grade 1 is defined as having less than 2% of the area compressed to no more than 30% of the depth of the insulation and is in contact on all 6 sides (front, back, and top, bottom, left & right) with an air barrier. This last requirement is waived for a Grade 1 installation in the attic (ceiling insulation or roofline) or floor: either the top or bottom may be open. Fiberglass batts must be split around pipes and wires. Grade 2 is defined as less than 2% voids or gaps and less than 10% of the area compressed to no more than 30% of the insulation depth, and is enclosed on all 6 sides with an air barrier. Grade 3 has between 2% and 5% of the area missing and is open on one side. If more than 5% of the area is missing insulation, that portion must be modeled in the home energy rating software as uninsulated.

References

Recommendations for Installation in Residential and Other Light-Frame Construction: Fiber Glass Building Insulation, published by North American Insulation Manufacturers Association 3/06, Publication #BI402

Recommendations for Installation in Residential and Other Light-Frame Construction: Fiber Glass Loose Fill Insulation, published by North American Insulation Manufacturers Association 3/00, Publication #BI403

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Nominal Lumber Size	Depth of cavity	R-6 1 ¾"	R-8 2 ½"	R-11 3 ½"	R-13 3 ½"	R-15 3 ½"	R-19 6 ¼"	R-21 5 ½"	R-22 6 ½"	R-25 8"	R-30HD 8 ¼"	R-30 10"	R-38HD 10"	R-38 12"
1 x 2	¾"	3.5												
2 x 2	1 ½"	5.5	5.6	6.0										
2 x 3	2 ½"	6.0	8.0	9.0	10.0	12.0								
2 x 4	3 ½"	6.0	8.0	11.0	13.0	15.0	14.0	15.0	15.0					
2 x 4 (Full)	4"	6.0	8.0	11.0	13.0	15.0	15.0	17.0	16.0	16.0	17.0			
2 x 6	5 ½"	6.0	8.0	11.0	13.0	15.0	18.0	21.0	20.0	20.0	22.0	21.0		
2 x 8	7 ¼"	6.0	8.0	11.0	13.0	15.0	19.0	21.0	22.0	24.0	27.0	26.0	30.0	28.0
2 x 10	9 ¼"	6.0	8.0	11.0	13.0	15.0	19.0	21.0	22.0	25.0	30.0	29.0	36.0	33.0
2 x 12	11 ¼"	6.0	8.0	11.0	13.0	15.0	19.0	21.0	22.0	25.0	30.0	30.0	38.0	37.0

Chart showing compressed fiberglass/mineral wool batt insulation R-values, courtesy CertainTeed Corporation