Technical Q & A

Installing Insulation in Truss Fire Endurance Assemblies

by SBCA Staff

Rules of thumb for if and when insulation can be added in a fire-rated assembly.

Some tested fire endurance assemblies include insulation in the assembly; others do not. The question of whether insulation can be added to a particular assembly can be tricky. Follow these tips to figure it out.

Question

I have been asked to add insulation in a floor-ceiling or roof-ceiling fire-rated assembly that has otherwise been tested without it. Can I do this? And why would someone want it?

Answer

Reasons to add insulation could be for temperature control or sound dampening. To make a rational assessment of this modification, you must look at the properties of the insulation and the impact that its placement inside the assembly will have on the fire endurance performance of the assembly.

The effect of insulation is to reduce the flow of cold air to heated spaces and vice versa. Since insulation restricts the flow of heat, its addition to a fire endurance assembly can create heat build-up problems. The insulation will retard heat movement and may also reduce the open space (i.e., plenum) that was available for heat dissipation during the original test. Because of this, it is likely that the protective gypsum layer will heat up more quickly resulting in an increased rate of hydration. This can lead to an earlier failure of the gypsum and consequent failure of the fire endurance assembly.[1]

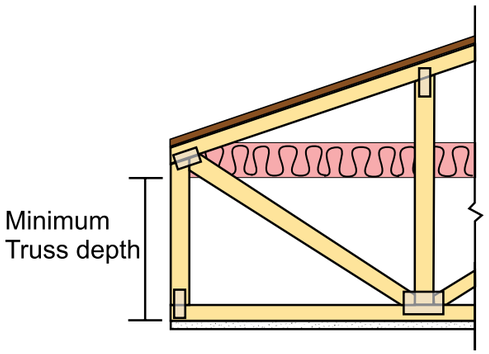

Figure 1. Example of Insulation Installation while Maintaining the Minimum Tested Truss Depth above the Gypsum Board.

The single most critical element in the fire endurance performance of cold-formed steel and wood truss assemblies is the gypsum board, but there are ways insulation may be added to assemblies without affecting the gypsum board.

Following are some observations about the problem:

- Since insulation will retard the flow of heat through it, incorporation of insulation in a rated assembly must be kept as far away from the gypsum surface as possible. This will minimize the heat build-up that causes premature hydration.
- Since the plenum cavity helps to dissipate the heat as it passes through the gypsum membrane, maintaining a plenum space that is greater than or equal to that of the tested assembly is critical to the field assembly's performance in a fire.

Therefore, to incorporate insulation into a tested assembly, an equivalent or greater plenum space should be maintained and the insulation must be placed as far away from the gypsum surface as possible (see Figure 1).

As a general rule of thumb, it is allowable to add insulation to an assembly provided that the depth of the truss is increased by the depth of the insulation and that the insulation is maintained at the maximum distance possible from the gypsum surface. SBC

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at a glance

- Gypsum board is the most critical element in the fire endurance performance of cold-formed steel and wood truss assemblies.
- When adding insulation to a tested assembly, plan for an equivalent or greater plenum space.

Here's an example.

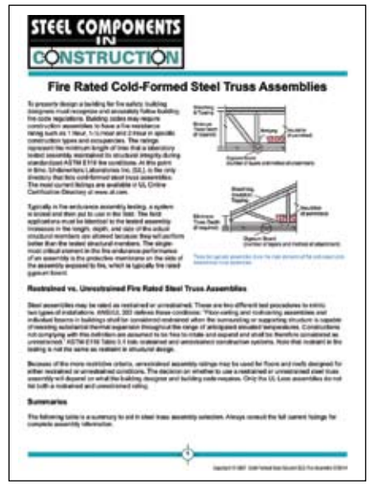
A specific truss application calls for an 18" deep truss. A 12" deep truss assembly was tested and passes the 1-hr. fire endurance requirement, with 5/8" Type X gypsum directly attached to the bottom chord and 5/8" plywood directly attached to the top chord. The resulting plenum space for this assembly is 12".We plan to apply the rating from the 12" tested assembly to the truss with a depth of 18".

If insulation is to be added to this hypothetical 18" assembly without diminishing its fire endurance, consideration must be given to the following points:

- Pursuant to Underwriters Laboratories' Fire Resistance Directory,[2] increasing the depth of an assembly does not adversely affect its fire endurance rating. In fact, increasing the depth may actually enhance performance through better heat dissipation properties, and through reduced chord stresses resulting from a larger moment of inertia for the truss section.
- The addition of insulation must be kept as far away as possible from the surface of the gypsum, so that it does not speed up the hydration process unduly, and so that the additional weight of the insulation will not cause a premature collapse.

Therefore, it is logical to assume that insulation can be added to this truss fire endurance assembly since the depth of the assembly has increased to 18"; the extra 6" of space can be filled with insulation. This insulation would be attached 12" above the gypsum membrane. This maintains the original test plenum depth and is a conservative approach.

A argument could be made for the allowance of insulation within the 12" free plenum space, but this should be dealt with on a case by case basis, since the final performance of the assembly is dependant on the insulation density, the type of gypsum used, the stresses developed in the chords of the trusses, etc. It is wise to obtain professional engineering assistance in situations like this.



SBCA offers two documents that list all the fire-rated cold-formed steel and wood truss assemblies that are currently available. It should be noted that certain assemblies from Underwriters Laboratories and Gypsum Association allow the addition of any depth of insulation at any location in the tested truss assembly as long as another layer of gypsum (of the same type as specified in the tested assembly) is installed at the ceiling.

[1] *Metal Plate Connected Wood Truss Handbook,* 3rd Edition, Section 17: Fire Performance of Trusses. www.sbcindustry.com/fire.php

[2] 2009 UL Fire Resistance Directory: General information on fire resistance ratings (BXRH)

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