INSULATION CONTRACTORS ASSOCIATION OF AMERICA

Technical Bulletin

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Technical Bulletin No. 30: Insulation in Floors over Unheated Spaces

In all cases, consult with the project architect, engineer, or building code official prior to installing insulation under floors. ICAA Technical Bulletins are provided as a convenience for informational purposes only. ICAA and/or its members are not responsible for loss or damage caused by errors or omissions or any other cause.

I. Scope:

This bulletin provides an overview of the installation of insulation products in floors over unheated spaces. It is intended to be a guideline only. Consult with the insulation manufacturer for proper installation of the product.

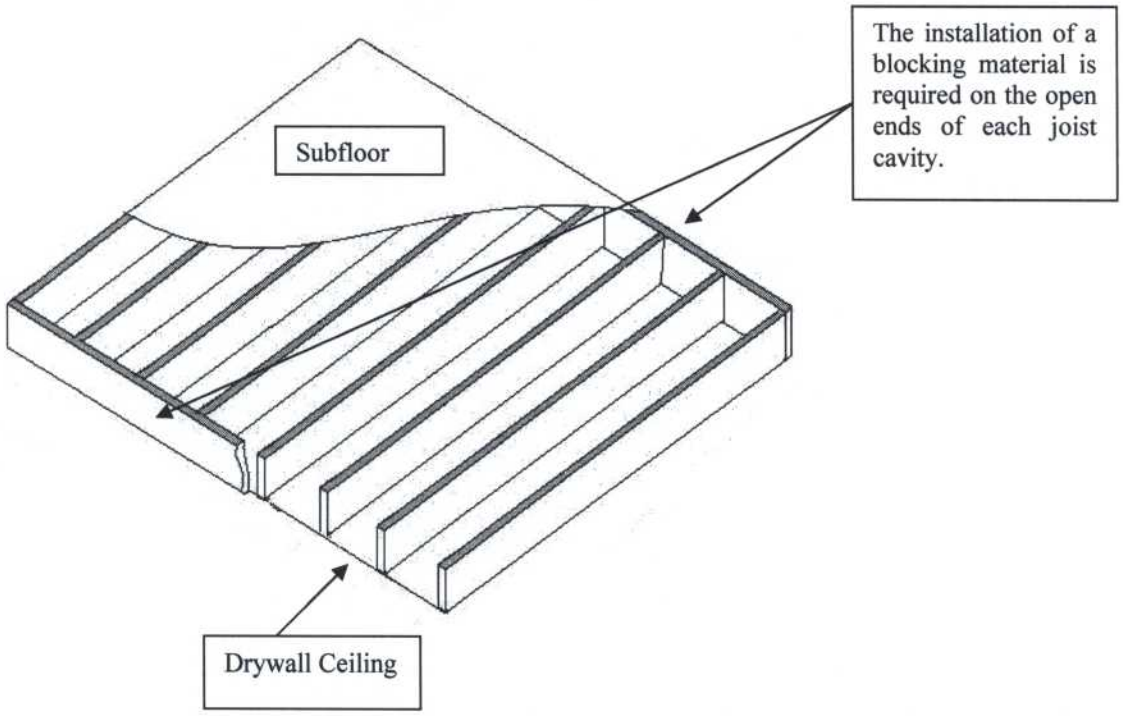
II. Definition: Floors over Unheated Spaces

Floors over unheated spaces include floors over garages, floors over ambient air, floors over unheated basements, and floors over open and vented crawl spaces.

III. Performance of Insulated Floor Assemblies

There are a number of potential performance problems with floor assemblies, particularly when constructed with open web floor trusses and engineered wooden "I" joists. The performance of the insulated floor assembly is dependent upon the placement of the insulation product, the amount of framing, and the elimination of air movement.

A. Floors constructed using dimensional lumber are less susceptible to performance issues than those constructed with engineered framing members. With dimensional lumber, only the two open ends of the joist cavities need to be blocked and air sealed. The subfloor and dry-wall ceilings below can be sealed to the framing members at the time of installation. Any issue with air leakage is typically confined within a single enclosed floor joist cavity and may have little effect on the performance of the assembly as a whole.

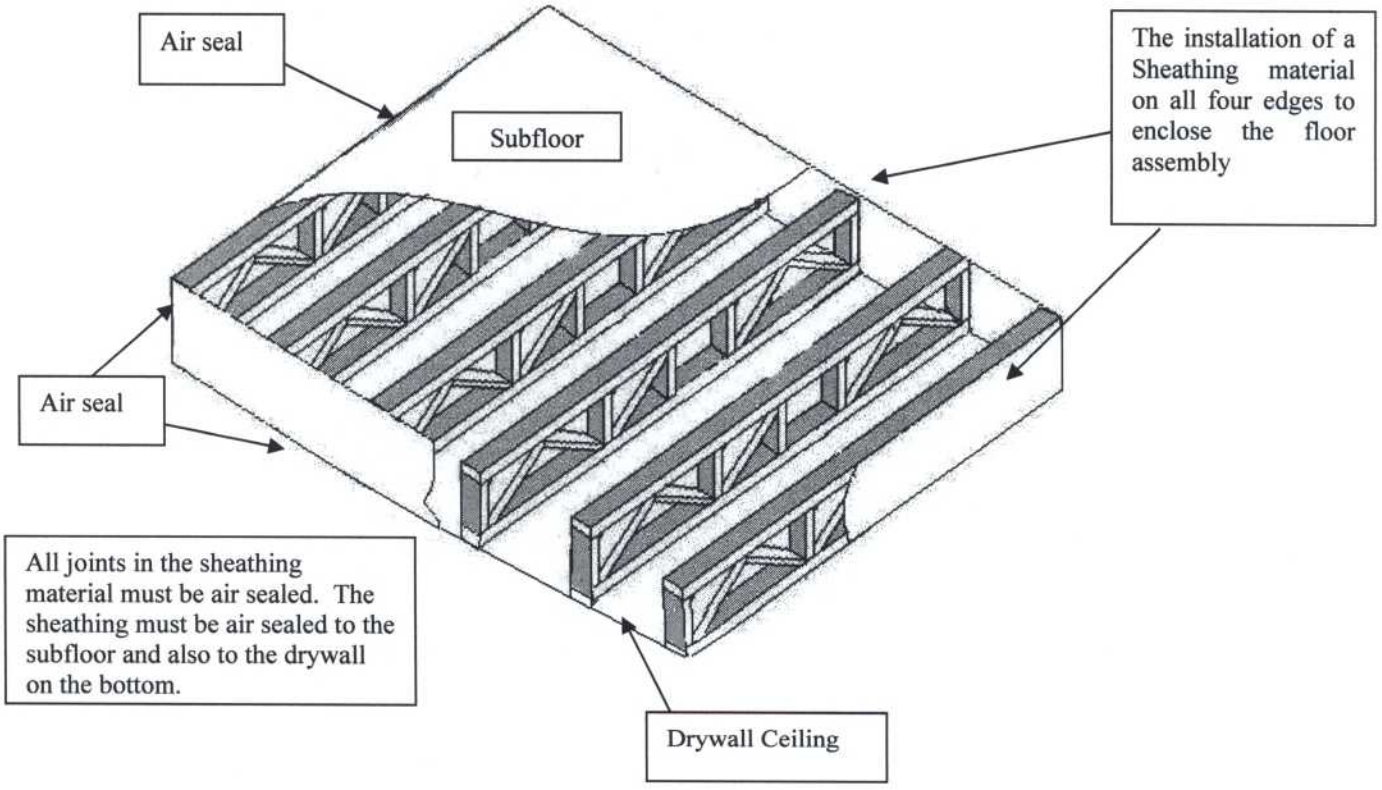


B. Floor assemblies constructed with open web trusses, are difficult to effectively air seal. Air leaks in the assembly in conjunction with air gaps between the insulation product and the sub-floor can allow convective air currents to bypass the insulation, resulting in significantly reduced thermal performance. In the heating season, conductive heat loss through the subfloor is carried out of the floor assembly by these air leaks. In the cooling season, the heated air in the air gap can have the affect of the floor acting as a large radiant heater.

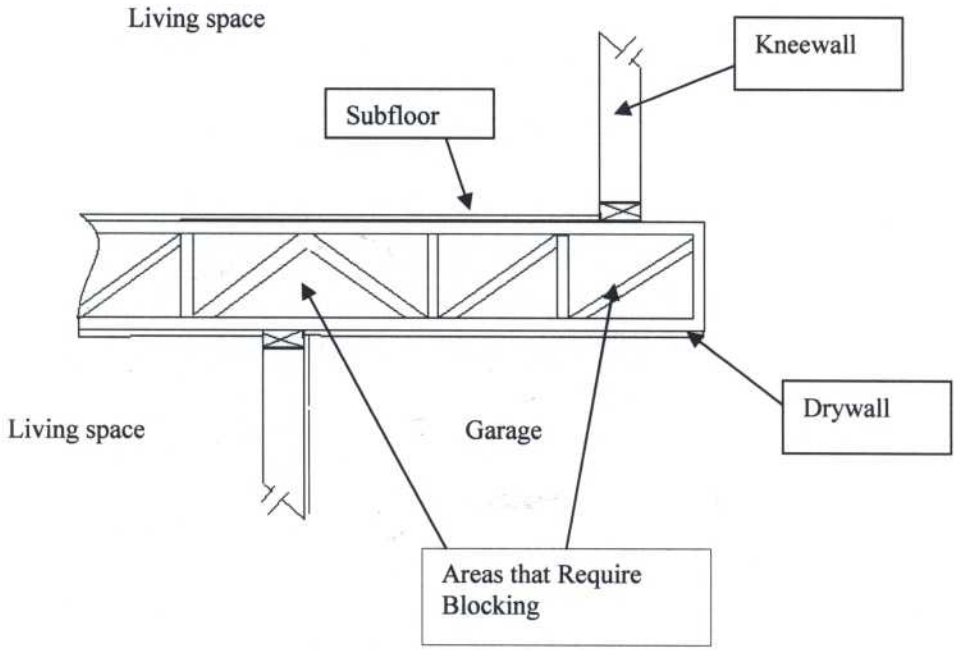
The thermal performance of the floor assembly is also a function of the ratio between insulated area and the area taken up by framing. The overall thermal performance can be significantly reduced due to the increased framing factor in open web truss systems or engineered floor joists, particularly if double joists are utilized. At an on-center spacing of 16", solid framing members represent 9.4% of the area with trusses representing 22%; even at 24" on-center spacing trusses represent 14.5% of the area. With the increased percentage of framing the web openings of floor truss systems is a significant factor in the overall thermal

performance of the floor assembly. The web openings are extremely labor intensive to fill with batt or rigid insulation but can be easily filled with blown or spray insulation. Similar problems exist with some engineered floor joists because of the irregular joist profiles.

C. The elimination of air leakage and air movement within the floor assembly can be a critical element in the overall thermal performance. The current trend toward increased use of truss floor assemblies leads to additional labor and air sealing materials required to eliminate air movement. All four edges of an open-web truss floor assembly require the installation of a sheathing material to enclose the entire floor cavity and then all joints and penetrations need to be air sealed. Any air leakage in an open-web floor cavity allows air movement across the entire floor assembly.

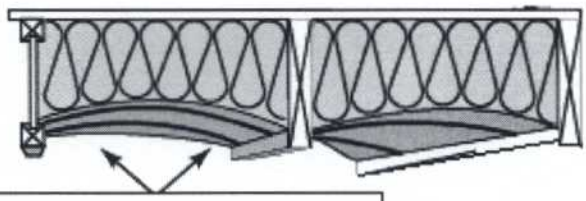


The location of the sheathing or blocking material is dictated by the footprint of the conditioned space above. In cases where the footprint does not match that of the floor assembly, the blocking and air sealing must be installed below the kneewalls (a.k.a. attic walls). This can be extremely difficult in an open-web truss floor assembly.



IV. Installation of Insulation Products

A. Batt insulations are to be installed with the insulation in permanent contact with the underside of the sub-floor of the conditioned space above. This is required to deliver the insulation performance and to eliminate the need for a flame-spread rating for the kraft facing. In cases where the depth of the insulation is less than the depth of the floor joists, the insulation must be permanently suspended in order to maintain contact with the sub-floor above. Methods of suspending the batts include using rigid metal staves (a.k.a. tiger teeth or lighting rods), mesh/screens (a.k.a. chicken wire), and wire lacing. Fasteners that are friction fitted in place tend to spring out allowing the insulation to fall during the loading of sheetrock or other phases of construction that may shake the framing of the floor assembly. Alternatively, floor cavities can be completely filled with insulation to ensure contact with the subfloor. However, fibrous insulation that is stacked too high to fill a cavity may settle over time, opening a gap between the insulation and the sub-floor.

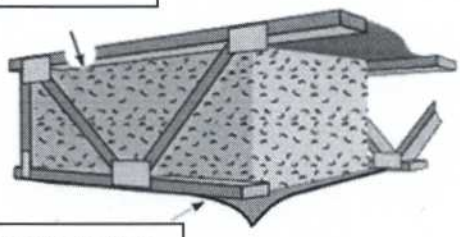


Metal Staves support insulation-engineered I-joists require a longer stave and trusses require shorter staves.

DOE Technology Fact Sheet

B. Spray fibrous insulation is installed with the use of a netting system. The netting is stapled to the bottom face of the framing member, and then a hole is cut for the blowing tube to enter. The insulation is then blown to a density of 2 pounds per cubic foot, surrounding mechanical, structural, plumbing and electric obstructions and maintaining contact with the subfloor.

Spray Fibrous Insulation fills in the spaces between the webs of the truss



Netting is stapled to the bottom chord of the truss to support insulation

DOE Technology Fact Sheet

C. Rigid Foam board insulation is adhered directly to the underside of the sub-floor of the conditioned space above. It must be cut to fit snug between floor joists. Gaps in open web truss or engineered floor joist systems may be difficult to address with this type of insulation.

D. Spray foam insulation expands upon exiting the foam gun. It is sprayed directly to the underside of the sub-floor, and adheres upon impact. Spray foam insulation can be applied to serve as an air barrier as well as insulation.

V. Codes and Standards

The installation of insulation in floors over unheated spaces is addressed in a number of model codes, construction industry standards, and manufacturer literature. The references listed below indicate installation methods consistent with the intent of this document.

A. **DOE Technology Fact Sheet, Titled: Crawlspace Insulation, page 3**

Steps for Installing Under floor Insulation

- Bullet #4, fourth sentence. The batts should be installed flush against the sub-floor to eliminate any gaps that may serve as passageways for cold air to flow between the insulation and the sub-floor

B. **2000 International Residential Code (2000 IRC), Section R320, Insulation**

R320.1 Insulation. Insulation materials, including facings, such as vapor barriers or breather papers installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame-spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84.

Exceptions:

1. When such materials are installed in concealed spaces, the flame-spread and smoke developed limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.

Note: Section R316 of the 2003 IRC, Section 718.2.1 of the 2000 International Building Code (2000 IBC) and Section 719.2.1 of the 2003 IBC contain similar language.

C. **NAIMA, Recommendations for Installation in Residential and Other Light-Frame Construction, page #8**

- If insulating over an unheated area, the vapor retarder should be in substantial contact with the sub-floor.

D. **International Energy Conservation Code, DOE approved changes to IECC 2003, Section 402, Building Thermal Envelope**

- 402.2.5 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the sub-floor decking.

E. **RESNET, Home Energy Rating Standards**

Proposed Amendment TECH: 2004-01 – Insulation Inspection Procedures

- Building Element: Floors
    1. Note: "good" installation for floor insulation also requires that the insulation be installed in complete contact with the sub-floor surfaces it is intended to insulate.

F. **Northeast Home Energy Rating Alliance, Rating Training Manual, Chapter Four, Insulation Assessment Guidelines**

- Basement Ceiling Insulation

  If an airspace exists between the heated floor and the insulation, the effective R-value is greatly reduced and should be discounted according to the size of the airspace. This procedure is the same for garage ceilings, cantilevered floors and overhangs.

G. **CertainTeed, Insulation Installations**

- Page 24: Never leave faced insulation exposed. The facing on kraft and foil-faced insulation will burn and must be installed in substantial contact with an approved ceiling, wall or floor construction material.
- Page 31: If insulating over an unheated area, the vapor retarder should be in substantial contact with the sub-floor.

H. **EPA Energy Star Qualified Homes, Proposed 2006 Requirements**

Thermal Bypass Inspection Checklist

- Insulated Floor above Garage; Insulation is installed to maintain permanent contact with the underside of the sub-floor decking
- Cantilevered Floor; Floor framing is completely filled with insulation or insulation is installed to maintain permanent contact with the sub-floor decking