

3.3.3 Radiant Barriers

Radiant Barrier Requirements

§151(f)2

The prescriptive requirements call for a radiant barrier in climate zones with significant cooling loads (2, 4, and 8 through 15). The radiant barrier is a reflective material that reduces radiant heat transfer caused by solar heat gain in the roof. Radiant barriers reduce the radiant gain to air distribution ducts and insulation located below the radiant barrier. In the performance approach, radiant barriers are modeled as separate adjustments to the heating U-factor and the cooling U-factor. The duct efficiency is also affected by the presence of a radiant barrier, with the performance approach.

Radiant Barrier Construction Practice

To qualify, a radiant barrier must have an emittance of 0.05 or less. The product must be tested according to ASTM C-1371-98 or ASTM E408-71(2002) and must be certified by the Department of Consumer Affairs². Radiant barriers must also meet installation criteria as specified in Section 4.2.1 of the *Residential ACM Manual* (Section 4.2.1 is also reproduced in Appendix D of this document).

The most common way of meeting the radiant barrier requirement is to use roof sheathing that has a radiant barrier bonded to it in the factory. Oriented strand board (OSB) is the most common material available with a factory-applied radiant barrier. The sheathing is installed with the radiant barrier (shiny side) facing down toward the attic space. Alternatively, a radiant barrier material that meets the same ASTM test and moisture perforation requirements that apply to factory-laminated foil can be field-laminated. Field lamination must use a secure mechanical means of holding the foil to the bottom of the roof decking such as staples or nails that do not penetrate all the way through the roof deck material.

Other acceptable methods are to drape a foil type radiant barrier over the top of the top chords before the sheathing is installed, stapling the radiant barrier between the top chords after the sheathing is installed, and stapling the radiant barrier to the underside of the truss/rafters (top chord). For these installation methods, the foil must be installed with spacing requirements as described in Section 4.2.1 of the *Residential ACM Manual*. The minimum spacing requirements do not apply to this installation since it is considered a “laminated” system.

Installation of radiant barriers is somewhat more challenging in the case of closed rafter spaces when sheathing is installed that does not include a laminated foil. Foil may be field-laminated after the sheathing has been installed by “laminating” the foil as described above to the roof sheathing between framing members. This construction type is described in the Residential ACM Manual, Section 4.2.1.

See Figure 3-12 for drawings of radiant barrier installation methods.

² Certification of radiant barriers is required by CCR, Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.

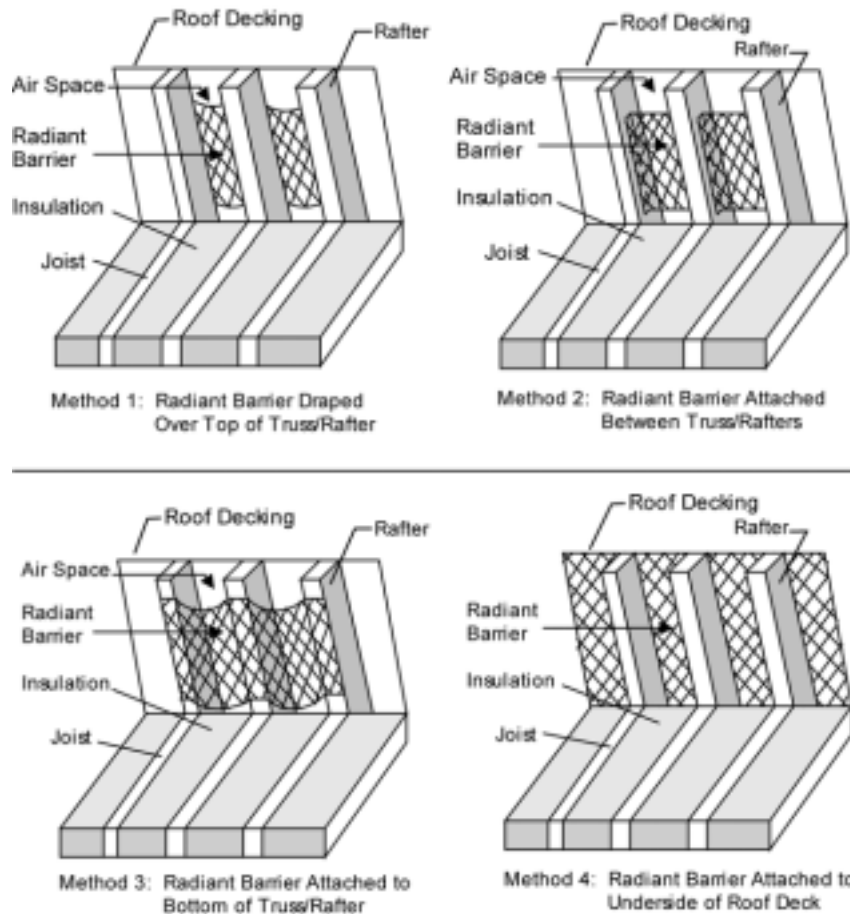


Figure 3-12 – Methods of Installation for Radiant Barriers

3.3.4 Wall Insulation

Mandatory Measures

§150(c)

The mandatory measures require that wood-framed walls above grade have at least R-13 insulation installed in the cavities between the framing members. However, the prescriptive measures for Alternative Component Package C requires more insulation than the minimum requirements in all climate zones. Likewise, Alternative Component Package D requires more insulation than the minimum requirements in climate zones 1 and 11 through 16.

Wall constructions with insulation that is not penetrated by framing members, or with metal framing, comply with this mandatory measure if they have a U-factor lower than 0.102, which is the U-factor of a wood-framed wall with R-13 insulation. Entry A3 in Table IV.9 in Joint Appendix IV is the basis for the U-factor criterion.

Appendix D

Eligibility Criteria for Radiant Barriers

Radiant barriers shall meet specific eligibility and installation criteria to be modeled by any ACM and receive energy credit for compliance with the energy efficiency standards for low-rise residential buildings.

- The emittance of the radiant barrier shall be less than or equal to 0.05 as tested in accordance with ASTM C-1371 or ASTM E-408.
- Installation shall conform to ASTM C-1158 [Standard Practice For Use and Installation Of Radiant Barrier Systems (RBS) In Building Construction.], ASTM C-727 (Standard Practice For Installation and Use Of Reflective Insulation In Building Constructions.), ASTM C-1313 (Standard Specification for Sheet Radiant Barriers for Building Construction Applications), and ASTM C-1224 (Standard Specification for Reflective Insulation for Building Applications). The radiant barrier shall be securely installed in a permanent manner with the shiny side facing down toward the interior of the building (ceiling or attic floor). Moreover, radiant barriers shall be installed at the top chords of the roof truss/rafters in **any** of the following methods:
 1. Draped over the truss/rafter (the top chords) before the upper roof decking is installed.
 2. Spanning between the truss/rafters (top chords) and secured (stapled) to each side.
 3. Secured (stapled) to the bottom surface of the truss/rafter (top chord). A minimum air space shall be maintained between the top surface of the radiant barrier and roof decking of not less than 1.5 inches at the center of the truss/rafter span.
 4. Attached [laminated] directly to the underside of the roof decking. The radiant barrier shall be laminated and perforated by the manufacturer to allow moisture/vapor transfer through the roof deck.

In addition, the radiant barrier shall be installed to cover all gable end walls and other vertical surfaces in the attic.
- The attic shall be ventilated to:
 1. Conform to the radiant barrier manufacturer's instructions.
 2. Provide a minimum free ventilation area of not less than one square foot of vent area for each 150 square feet of attic floor area.

3. Provide no less than 30 percent upper vents.

Ridge vents or gable end vents are recommended to achieve the best performance. The material should be cut to allow for full airflow to the venting.

- The radiant barrier (except for radiant barriers laminated directly to the roof deck) shall be installed to have a minimum gap of 3.5 inches between the bottom of the radiant barrier and the top of the ceiling insulation to allow ventilation air to flow between the roof decking and the top surface of the radiant barrier, and have a minimum of six (6) inches (measured horizontally) left at the roof peak to allow hot air to escape from the air space between the roof decking and the top surface of the radiant barrier.
- When installed in enclosed rafter spaces where ceilings are applied directly to the underside of roof rafters, a minimum air space of 1 inch shall be provided between the radiant barrier and the top of the ceiling insulation, and ventilation shall be provided for every rafter space. Vents shall be provided at both the upper and lower ends of the enclosed rafter space.
- The product shall meet all requirements for California certified insulation materials (radiant barriers) of the Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, as specified by CCR, Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.
- The use of a radiant barrier shall be listed in the *Special Features and Modeling Assumptions* listings of the CF-1R and described in detail in the ACM Compliance Supplement.