



# Standard Practice for Installation and Use of Radiant Barrier Systems (RBS) in Building Construction<sup>1</sup>

This standard is issued under the fixed designation C 1158; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This standard has been prepared for use by the designer, specifier, and installer of RBS (radiant barrier systems) for use in building construction. The scope is limited to recommendations relative to the use and installation of RBS including a surface(s) normally having a far-infrared emittance of 0.1<sup>2</sup> or less, such as metallic foil or metallic deposits unmounted or mounted on substrates. Some examples that this standard is intended to address include: (1) low emittance surfaces in vented building envelope cavities intended to retard radiant transfer across the vented airspace; (2) low emittance surfaces at interior building surfaces intended to retard radiant transfer to or from building inhabitants; and (3) low emittance surfaces at interior building surfaces intended to reduce radiant transfer to or from radiant heating or cooling systems. See Figs. 1-4 for typical examples of use.

1.2 This standard covers the installation process from pre-installation inspection through post-installation procedure. It does not cover the production of the radiant barrier materials.

1.3 This standard is not intended to replace the manufacturer's installation instructions, but shall be used in conjunction with such instructions. This practice is not intended to supersede local, state, or federal codes.

1.4 This standard assumes that the installer possesses a good working knowledge of the application codes and regulations, safety practices, tools, equipment, and methods necessary for the installation of radiant barrier materials. It also assumes that the installer understands the fundamentals of building construction that affect the installation of RBS.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see Sections 5 and 7.

1.6 When the installation or use of radiant barrier materials, accessories and systems, may pose safety or health problems,

the manufacturer shall provide the user appropriate current information regarding any known problems associated with the recommended use of the company's products and shall also recommend protective measures to be employed in their safe utilization. The user shall establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.

## 2. Referenced Documents

### 2.1 ASTM Standards:

C 168 Terminology Relating to Thermal Insulating Materials<sup>3</sup>

E 84 Test Method for Surface Burning Characteristics of Building Materials<sup>4</sup>

E 96 Test Methods for Water Vapor Transmission of Materials<sup>3</sup>

### 2.2 NFPA Standards:<sup>5</sup>

NFPA 54 National Fuel Gas Code

NFPA 211 Standard for Chimneys, Fireplaces and Vents

### 2.3 Other Documents:

CPSC Product Safety Fact Sheet No. 18 "The Home Electrical System"<sup>6</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definitions of terms used in this standard practice refer to Terminology C 168.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *applicator*—the person or persons who apply radiant barrier materials in buildings.

3.2.2 *conditioned space*—any space in a building that is served by a heating or cooling system.

3.2.3 *open air space*—a vented building cavity (for example, a vented attic) or a large conditioned or unconditioned building space.

NOTE 1—A large building space is defined as a one whose minimum dimension exceeds two feet.

3.2.4 *owner*—the person, partnership, corporation, agency,

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<sup>2</sup> The as manufactured emittance of a radiant barrier product should be stated on the label.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.06.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>5</sup> Available from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

<sup>6</sup> Available from U.S. Consumer Product Safety Commission, Washington, DC 20207.

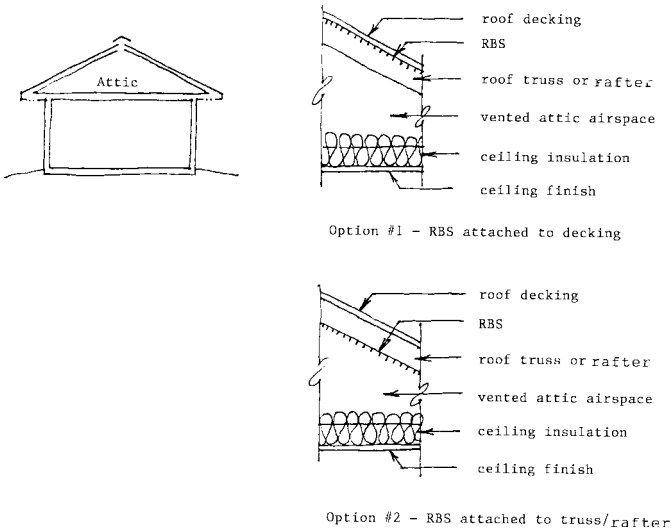


FIG. 1 Typical Residential Use—Southern Climates

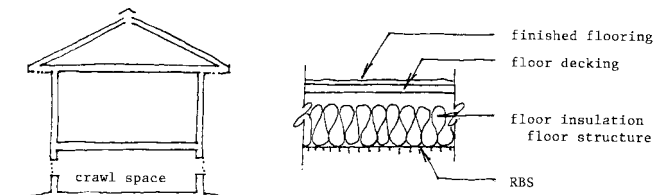
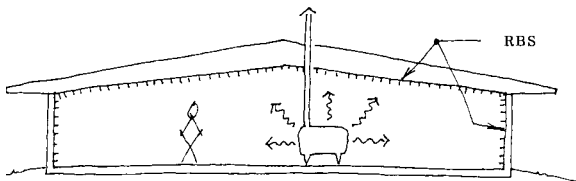


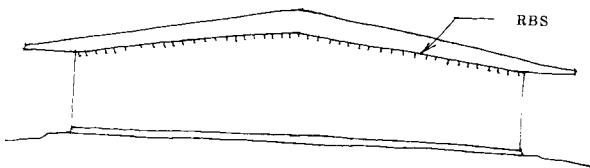
FIG. 2 Typical Residential Use—Northern Climates



NOTE 1—Intended to protect inhabitants, materials and radiant heating or cooling sources from interior building surface temperature extremes.

NOTE 2—For this typical application, the radiant barrier will be installed so as to substantially cover the entire building surface. A low-emittance surface of the radiant barrier will face the interior.

FIG. 3 Typical Industrial/Commercial Use



NOTE 1—Intended to protect inhabitants and livestock from interior building surface temperature extremes.

NOTE 2—For this typical applications, the radiant barrier will be installed so as to substantially cover the entire building surface. A low-emittance surface of the radiant barrier will face the interior.

FIG. 4 Typical Agricultural Use

or other entity who owns the building in which the RBS is to be installed whether such ownership is by virtue of deed, contract, or any other instrument for acquiring legal title under the laws of the state in which the building is located.

3.2.5 *radiant barrier system (RBS)*—a building construction

consisting of a low emittance (normally 0.1 or less) surface (usually aluminum foil) bounded by an open air space. A RBS is used for the sole purpose of limiting heat transfer by radiation and is not specifically intended to reduce heat transfer by convection or conduction.

#### 4. Significance and Use

4.1 A standard recognizes that effectiveness, safety, and durability of a RBS depends not only on the quality of the materials, but also on their proper installation.

4.2 Improper installation of a RBS can reduce their thermal effectiveness, cause fire risks and other unsafe conditions, and promote deterioration of the structure in which they are installed. Specific hazards that can result from improper installation include fires caused by (1) heat buildup in recessed lighting fixtures, (2) deterioration or failure of electrical wiring components, and (3) deterioration in wood structures and paint failure due to moisture accumulation.

4.3 This standard provides recommendations for the installation of radiant barrier materials in a safe and effective manner. Actual conditions in existing buildings may vary greatly and in some cases additional care should be taken to ensure safe and effective installation.

4.4 This standard presents requirements that are general in nature and considered practical. They are not intended as specific recommendations. The user should consult the manufacturer for recommended application methods.

#### 5. Safety Precautions

5.1 The applicator shall wear proper clothing and equipment as recommended by the manufacturer and shall follow local codes and safety regulations for building construction sites. (For example, hard hats, safety goggles, respiratory protection, may be required, depending on site conditions.)

#### 6. Pre-Installation Inspection and Preparation

##### 6.1 Inspections:

6.1.1 Inspect the roof, walls, ceilings, and floors to identify areas where previous or existing moisture problems have caused paint peeling, warpage, stain, visible fungus growth, rotting, or other structural damage. Do not install RBS in such areas until the owner has been informed and has certified that these conditions have been corrected and their source(s) eliminated.

6.1.2 In areas where a RBS is to be installed, components of the electrical system shall be in good condition. If there is reason to believe the electrical system is faulty, do not install RBS in such areas until the owner has been informed and qualified inspection and repair has been accomplished.

NOTE 2—The CPSC Product Safety Fact Sheet No. 18 has identified the following signs of potential electrical deficiencies: lights dimming, fuses blowing, circuit breakers tripping frequently, electrical sparks and glowing from receptacle, light flickering, and cover plates on switches and outlets that are warm or hot to the touch.

6.1.3 In areas where a RBS is to be installed the applicator shall locate and plan for installation around ventilation openings. The applicator shall not install RBS that will obstruct or block existing ventilation openings.

##### 6.2 Preparation:

6.2.1 All electrical wiring at or near radiant barrier material attachment surfaces shall be either moved or protected to ensure that fasteners used to install the radiant barrier material cannot contact the electrical wiring system.

6.2.2 Where attic ventilation may be compromised by the installation of a RBS or the subsequent application of fibrous ceiling insulation, vent baffles shall be installed at the soffits of the attic such that attic ventilation airflows are maintained in accordance with applicable building codes.

## 7. Installation Guidelines

### 7.1 Material Handling:

7.1.1 The radiant barrier material shall be handled in accordance with manufacturer's instructions, should be kept dry, and should not be in contact with the ground or sources of water.

7.1.2 The radiant barrier material shall not be placed in contact with corrosive building materials.

### 7.2 Performance Considerations:

7.2.1 The performance of a RBS depends on adherence to manufacturer's recommendations. Manufacturer's installation instructions and local building codes shall be followed. The manufacturer shall provide product information sheet(s) that specify the product's intended use(s), application method(s), health and safety considerations, and material properties to include: (1) the emittance of the surface of the radiant barrier material shall be determined using a portable emissometer, (2) the product water vapor transmission rate in accordance with Test Method E 96, and (3) the product surface burning characteristics in accordance with Test Method E 84.

7.2.2 The performance of a RBS is dependent on the maintenance of an open airspace adjacent to the low emittance surface.

7.2.3 The performance of a RBS may be adversely affected by foreign materials on the low emittance surface. Prior to installation, foreign materials shall be removed using manufacturer's instructions, taking care not to damage the radiant barrier material.

7.2.4 The performance of a radiant barrier may be reduced by a corrosive environment. Severe air pollutants may react with the low emittance surface causing a significant increase in the emittance of the material. If such conditions exist, the owner shall be informed that they may result in material degradation and significant decrease in RBS performance.

7.2.5 The performance of a radiant barrier will be reduced by the presence of moisture on the low emittance surface. Such

conditions may be temporary or long term and the manufacturer should be consulted to determine the applicability of RBS where these conditions are expected to occur.

7.2.6 The performance of a RBS will be adversely affected by the accumulation of dust over time on the low emittance surface. RBS should be installed to avoid the settlement of dust on the radiant barrier surface.

7.2.7 Damaged areas will result in loss of performance and shall be repaired in accordance with manufacturer's instructions.

### 7.3 Installation Precautions:

7.3.1 In areas where radiant barrier materials are to be installed, the applicator shall provide clearance around lighting fixtures, motors, fans, blowers, heaters, flues, chimneys and other heat producing electrical and mechanical devices.

7.3.1.1 The applicator shall provide 3-in. (75-mm) minimum clearance around all sides of recessed lighting fixtures, unless such fixtures are approved for installation in direct contact with radiant barrier materials. Such fixtures include fixture wiring compartments, ballasts, and other heat-producing devices. These devices shall not be covered unless they are specifically approved for operation when covered.

7.3.1.2 The applicator shall provide the minimum clearances specified in NFPA-54. Provide a 2-in. (50-mm) minimum clearance from the outside face of the masonry around masonry chimneys or masonry enclosing a flue. For vents, vent connectors and chimneys other than masonry provide minimum clearances as specified in NFPS-211.

7.3.1.3 The operative material of most RBS is a metallic foil or a vapor deposition of a metal on a substrate. Therefore, radiant barrier materials can provide an extremely high resistance to water vapor transmission. Radiant barrier materials shall not be installed so as to lead to moisture accumulation and deterioration in the structure. Radiant barriers can be produced to provide low resistance to water vapor transmission.

7.4 *Post-installation*—The applicator shall provide a signed and dated statement describing the RBS installation, the radiant barrier material installed in accordance with Practice C 1158, and the area covered.

## 8. Keywords

8.1 aluminum foil; low emittance; radiant barrier; radiant barrier system; vapor retarder

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