



Designation: C 667 – 92 (Reapproved 1996)^{ε1}

Standard Specification for Prefabricated Reflective Insulation Systems for Equipment and Pipe Operating at Temperatures above Ambient Air¹

This standard is issued under the fixed designation C 667; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

^{ε1} NOTE—A referenced document was added and caveat updated editorially in September 1996.

1. Scope

1.1 This specification covers the requirements for all metal prefabricated, reflective insulation systems for equipment and piping operating at temperatures above ambient in air. Typical applications are in nuclear power-generating plants and industrial plants.

1.2 Reflective insulation is thermal insulation that reduces radiant heat transfer across spaces by the use of surfaces of high reflectance and low emittance.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.4 *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.*

2. Referenced Documents

2.1 ASTM Standards:

- C 168 Terminology Relating to Thermal Insulating Materials²
- C 335 Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation²
- C 411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation²
- C 835 Test Method for Total Hemispherical Emittance of Surfaces from 20 to 1400°C²
- C 854 Test for Resistance to External Loads on Metal Reflective Pipe Insulation²
- C 1033 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation Installed Vertically²
- C 1061 Test Method for Thermal Transmission Properties of Non-Homogeneous Insulation Panels Installed Vertically³

¹ This specification is under the jurisdiction of ASTM Committee C-16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.21 on Reflective Insulation.

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² *Annual Book of ASTM Standards*, Vol 04.06.

³ Discontinued. See 1994 *Annual Book of ASTM Standard*, Vol 04.06.

3. Terminology

3.1 Definitions:

3.1.1 Terms relating to thermal insulation materials and testing are in accordance with Terminology C 168.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *convection stops*—seals used to reduce convection losses.

3.2.2 *end supports*—structural members placed at the end of a unit of insulation and fastened to both the inner and outer case. Their primary purpose is to increase the structural integrity of the unit.

3.2.3 *inner case*—the innermost sheet of the unit of insulation (closest to the hot surface). It may perform structural functions in addition to its thermal functions.

3.2.4 *insulation assembly*—an assembly of insulation units arranged and secured together in a prescribed order that comprises the complete insulation for a vessel, pump, pipeline, or other component for a single design objective.

3.2.5 *insulation system*—a collection of insulation assemblies, that when secured together in a prescribed order, comprises the complete insulation for a vessel, pump, pipeline, or other component for a single design objective.

3.2.6 *lap straps*—strips that overlap a longitudinal or circumferential joint in the insulation which aligns adjacent insulation units and may also serve to restrict air infiltration and convection losses and to shed external falling water. They may be integral with one piece of the outer case or separate strips secured to it.

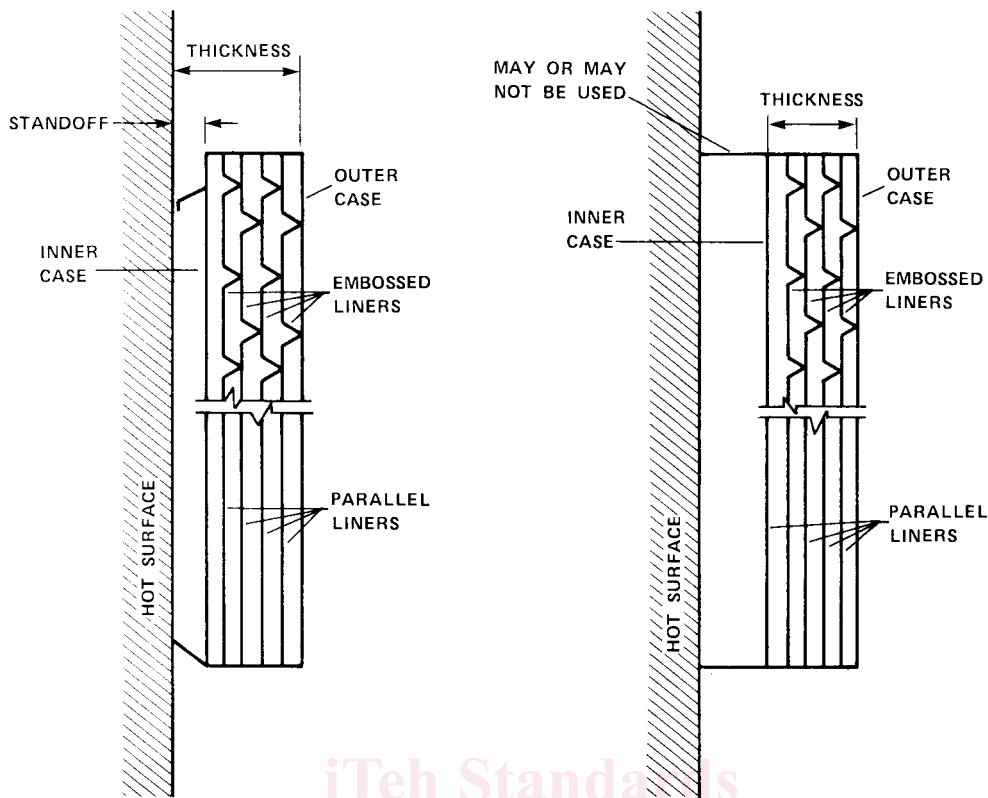
3.2.7 *outer case*—the outermost sheet or the unit of insulation (farthest from the hot surface). It usually performs structural functions in addition to its thermal functions.

3.2.8 *penetrations*—openings in a unit of insulation from the cold surface through to the hot surface.

3.2.9 *reflective liners*—those reflective sheets or foil interposed between the inner and outer case to reflect radiant energy, to minimize emission of radiant energy, and to restrict internal convection.

3.2.10 *thickness*—(see Fig. 1).

3.2.11 *unit of insulation*—a single structurally independent assembly of inner case, outer case, reflective liners, and end supports (if required).



(a) Reflective Insulation Applied to Piping

(b) Reflective Insulation Applied to Equipment

FIG. 1 Illustration of Terms Relating to Prefabricated Reflective Insulation Systems

4. Ordering Information

4.1 Ordering information should include the following:

- 4.1.1 Service requirements including operating hot surface temperature, expected ambient temperatures, and ambient air velocities,
- 4.1.2 Expected service life and any special environmental exposures,
- 4.1.3 Permitted average heat loss per unit of cold surface or as otherwise specified,
- 4.1.4 Personnel exposure surface temperature limitations,
- 4.1.5 Expected seismic, loading, and vibration exposures,
- 4.1.6 Purchaser's systems and equipment drawings,
- 4.1.7 Limits, if any, on size, maximum thickness, weight, or number of insulation units requiring removal for inspection,
- 4.1.8 Location of components or maintenance, or both, and systems requiring removal of units for inspections,
- 4.1.9 Any unusual operating or test conditions, and
- 4.1.10 Cleanliness level required.

5. Materials and Manufacture

5.1 Each insulation unit is a rigid, self-contained, prefabricated metal construction comprised of an inner casing and an outer casing, and if needed, one or more reflective liners supported and spaced so as to minimize internal convection and conduction. These parts are arranged to form a durable rigid assembly with separated air spaces between the inner and outer casing and the individual reflective liners.

5.2 The reflective insulation described herein is limited to systems of insulating units, designed by the manufacturer to fit

the equipment or piping to be insulated, and engineered for the purchaser's service requirements.

5.3 All parts of reflective insulation units should be made of metals that meet the thermal, physical, and chemical requirements not only of the insulation as a unit, but also as an assembly of units forming the insulation system. The materials shall perform their functions for the service life specified and be compatible with the environment in which they will be used.

6. Temperature Limitations

6.1 Each insulation unit must effectively limit the flow of heat through the insulation by radiation, convection, and conduction. The reflective liners (also referred to as radiation shields) are made of metals having low surface emittance and high surface reflectance. The emittance should be tested according to Test Method C 835. The number and spacing of the liners are determined by the required limitation of heat flow.

6.2 The temperature limits of various materials should be based on the potential increase in radiant heat transfer across spaces due to a reduction in reflectance and a corresponding increase in emittance resulting from surface oxidation. Individual components of the insulation system which will be elevated to a temperature of 750°F (400°C) or higher should not be made of aluminum or aluminum alloys. If components will be elevated to 1200°F (649°C) or higher, Type 300 series austenitic stainless steel should be used. Other materials and alloys are available for use over 1200°F (649°C).

6.3 A representative unit or assembly shall be tested in