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Standard Specification for Stainless Steel Jacketing for Insulation[1]

This standard is issued under the fixed designation C1767M; 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.

1. Scope

1.1 This specification covers stainless steel jacketing for thermal, acoustical, and fire protective insulation operating at either above or below ambient temperatures and in both indoor and outdoor locations. It does not cover insulation jacketing made from other materials such as mastics, fiber reinforced plastic, PVC, aluminum, or coated carbon steel (for example, aluminum-zinc, galvanized steel, or aluminized steel) nor does it cover the details of thermal, acoustical, or fire protective insulation systems.

1.2 While not intended to cover use inside the containment buildings of nuclear power plants, this standard does not preclude use of Class E material which does not have a moisture barrier in this containment building application.

1.3 This specification provides physical requirements for stainless steel jacketing for thermal and acoustical insulation. Guide C1423 provides guidance in selecting jacketing materials and their safe use.

1.4 This is a material specification and does not imply any performance of the installed system using the materials specified herein. For information about installation of stainless steel jacketing, see **(1)**.[2]

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

NOTE 1—A version of this specification in IP units is available as Specification C1767.

1.6 *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:*[3]

A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)[4]

A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A480/A480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

B487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section

C168 Terminology Relating to Thermal Insulation

C450 Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

C585 Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing

C835 Test Method for Total Hemispherical Emittance of Surfaces up to 1400°C

C1371 Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers

C1423 Guide for Selecting Jacketing Materials for Thermal Insulation

C1729M Specification for Aluminum Jacketing for Insulation

C1767 Specification for Stainless Steel Jacketing for Insulation

C1785 Test Method for Concentration of Pinhole Detections in Moisture Barriers on Metal Jacketing

D3363 Test Method for Film Hardness by Pencil Test

E84 Test Method for Surface Burning Characteristics of Building Materials

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[1] This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.40 on Insulation Systems.

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[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] The last approved version of this historical standard is referenced on www.astm.org.

F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

3. Terminology

3.1 *Definitions*—Definitions in Terminology C168 apply to terms used in this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *box rib*—stainless steel sheet formed to have alternating parallel grooves and ridges with a cross section approximating a square wave.

3.2.2 *cladding (as related to insulation jacketing)*—synonymous with jacketing.

3.2.2.1 *Discussion*—

The three terms "jacketing," "lagging," and "cladding" are considered synonymous in most applications and geographies. However, in some cases in the power industry in North America the term "lagging" has a different meaning than "jacketing" or "cladding" and refers specifically to a heavier gauge of jacketing.

3.2.3 *crevice corrosion, n—in metal jacketing* localized corrosion of metal jacketing surface at, or immediately adjacent to an area that is shielded from full exposure to the environment because of close proximity between the metal and the surface of another material.

3.2.4 *cross crimped*—synonymous with 4.8 mm corrugated.

3.2.5 *deep corrugated*—stainless steel sheet formed to have alternating parallel grooves and ridges with a cross section approximating a sine wave.

3.2.6 *gore*—jacketing for elbows, fittings, or other non-straight portions of the piping system made from a multitude of similar overlapping pieces.

3.2.7 *lagging (as related to insulation jacketing)*—synonymous with jacketing.

3.2.7.1 *Discussion*—

The three terms "jacketing," "lagging," and "cladding" are considered synonymous in most applications and geographies. However, in some cases in the power industry in North America the term "lagging" has a different meaning than "jacketing" or "cladding" and refers specifically to a heavier gauge of jacketing.

3.2.8 *mill finish*—the appearance of the stainless steel surface as supplied from the metal mill.

3.2.9 *moisture retarder (moister barrier)*—a layer of plastic film or other material applied to the inner side of metal jacketing to inhibit jacket corrosion by interfering with the formation of a galvanic cell between the dissimilar metals of the pipe and jacket or by preventing crevice corrosion.

3.2.9.1 *Discussion*—

A moisture retarder is not an insulation system water vapor retarder and does not perform the same function.

3.2.10 *polykraft*—a multilayer composite film used as a moisture retarder on metal jacketing consisting of at least one layer of minimum 65 g/m^2 Kraft paper and one or more layers of plastic film, usually polyethylene at a minimum thickness of 38 microns.

3.2.10.1 *Discussion*—

Kraft paper is commonly referred to by its basis weight which is the mass per area in units of lbs/3000 ft^2. In Metric units, this mass per area is called the grammage and is in units of g/m^2. 40 lb Kraft has a basis weight of 40 lbs/3000 ft^2 and a grammage of 65 g/m^2.

3.2.11 *polyfilm—in relation to metal jacketing*, a three-layer film used as a moisture retarder on metal jacketing consisting of one layer of ethylene/methacrylic acid copolymer and two layers of other polymers, usually polyethylene.

3.2.12 *PVdF based paint system*—a pigmented paint used on the outer surface of metal jacketing to provide corrosion resistance and higher emittance than bare metal consisting of a fairly thin primer paint layer covered by a thicker topcoat paint layer where the latter is a polyvinylidene fluoride (PVdF) type paint.

3.2.13 *PVF film*—a polymer film consisting of polyvinyl fluoride used on the outer surface of metal jacketing to provide corrosion resistance and higher emittance than bare metal.

3.2.14 *safety edge*—an edge of metal jacketing that has been de-burred or rounded by a rolling operation.

3.2.15 *safety hem*—a rounded edge of metal jacketing created by folding the edge of sheet jacketing completely back upon itself using a roll former or a brake.

3.2.15.1 *Discussion*—

the fold is typically made toward the underside of the jacketing so that the original edge is hidden and the external appearance of the jacketing is preserved

3.2.16 *splice roll*—metal jacketing sold in roll form where the package contains two separate pieces of metal jacketing rolled approximately end to end.

3.2.16.1 *Discussion*—

A splice roll occurs when the metal coil being used to form the roll jacketing reaches its end before the required roll length is obtained.

3.2.17 *split roll*—synonymous with splice roll.

3.2.18 *surface finish (as related to insulation jacketing)*—the final texture of the stainless steel jacketing surface.

4. Significance and Use

4.1 This specification is used to specify material by physical property requirements that address the prerequisites in Sections 6 to 10. The designer of an insulation system, after determining the system requirements, shall use this specification to specify the appropriate stainless steel jacketing.

5. Classification

5.1 Classification of stainless steel jacketing is based on three factors:

5.1.1 *Outer Surface Treatment and Emittance (ε):*

5.1.1.1 Type I = Bare surface, ε ~~= 0.3~~≥ 0.3,

5.1.1.2 Type II = Painted with pigmented paint, ε ≥ 0.8,

5.1.1.3 Type IV = PVF film coated surface, ε ≥ 0.85, and

5.1.1.4 Type V = Painted with a PVdF based paint system, ε ≥ 0.8.

NOTE 2—Type III is omitted to maintain consistency with the similar standard for aluminum jacketing, Specification C1729M.

5.1.2 *Alloy and Temper per Specification A240/A240M:*

5.1.2.1 Grade 1 = Alloy T-304/T-304L, annealed temper

5.1.2.2 Grade 2 = Alloy T-316/T-316L, annealed temper

NOTE 3—The four allowable alloys shown in 5.1.2 are of the austenitic type of stainless steel.

NOTE 4—The "L" in the alloy is an indication of low carbon content. Since the low carbon alloy will avoid corrosion problems caused by welding, a low carbon alloy is required on those rare occasions when the stainless steel jacketing will be subjected to direct welding or the heat from welding nearby metal. The low carbon and standard alloys are considered interchangeable for use as insulation jacketing.

5.1.3 *Moisture Retarder:*

5.1.3.1 Class A = polyfilm, 76 microns thick

5.1.3.2 Class C = polykraft per section 3.2.10

5.1.3.3 Class E = no moisture retarder

NOTE 5—Classes B & D are omitted to maintain consistency with the similar standard for aluminum jacketing, Specification C1729M.

6. Materials and Manufacture

6.1 Stainless steel jacketing materials are composed of a single material or a lamination of several components. The materials are supplied in the form of rolls or sheets or preformed to fit the surface to which they are to be applied. The materials are applied in the field or as a factory-applied composite with the insulation.

6.2 Material shall be stainless steel with a mill finish of either 2B or 2D per Specification A240/A240M unless an alternative finish is agreed to by both buyer and seller.

6.3 Material shall be stainless steel and shall have a surface finish that is smooth, 4.8 mm corrugated, or stucco embossed. The dimensions of corrugations (pitch and depth) must be agreed to by manufacturer and purchaser to achieve interchangeability, constant rigidity, and appearance.

6.4 When agreed upon by purchaser and seller, stainless steel sheets used as pipe insulation jacketing (see 8.2) shall have a safety edge or a 10 to 13 mm safety hem along one entire width edge of the sheet. Stainless steel jacketing with a safety edge or safety hem must still meet the length dimensions specified in 8.2.1. A safety hem shall not be specified when the finish is 4.8 mm corrugated.

6.5 In most cases, the inner surface of stainless steel jacketing material is coated or covered with a moisture resistant film to retard possible galvanic or chemical corrosion, or both, of the jacketing and underlying pipe or equipment.

6.6 For highly corrosive ambient conditions or to increase emittance, the purchaser shall consider specifying that the outer surface of the stainless steel be coated with a pigmented paint (Type II), PVF film (Type IV), or with a PVdF based paint system (Type V).

6.7 Pigmented paint (Type II) and PVdF based paint systems (Type V) must be factory applied and baked on to the outer surface.

6.8 Unless agreed to otherwise by purchaser and seller of the metal jacketing, the primer layer for Type V outer surface treatment must have a minimum dry thickness of 5 µm and the PVdF topcoat must have a minimum dry thickness of 18 µm.

NOTE 6—It is important to be aware that the minimum 18 µm thickness requirement in Table 1 applies to the topcoat of the Type V PVdF based paint system and not to the total outer surface paint thickness.

6.9 PVF film for Type IV must be factory applied to the metal jacketing outer surface using heat lamination with a thermally activated adhesive.

6.10 PVF film for Type IV must be a minimum of 38 µm thick.

6.11 Polyfilm (Class A) and polykraft (Class C) must be factory applied and heat laminated to the interior surface of the metal jacketing.

6.12 The stainless steel used in this jacketing shall comply with the general, chemical composition, and mechanical property requirements of Specification A240/A240M—alloys T-304, T-304L, T-316, or T316L with annealed temper—Grades 1 or 2 per 5.1.2.

NOTE 7—In some cases, compliance to Specification A480/A480M is requested for stainless steel jacketing. Specification A240/A240M requires compliance to a number of general requirements contained within A480/A480M and additionally has requirements for chemical composition and mechanical properties so it is preferred and more thorough to require compliance with Specification A240/A240M.

NOTE 8—In some cases, compliance to Specification A167 is requested for stainless steel jacketing. Specification A167-99(2009) contains the following: "*Grades that were previously covered in both Specifications A167 and A240/A240M have been removed from this specification and may now be supplied and purchased in compliance with Specification A240/A240M. The chemical and mechanical property requirements of these grades were identical in Specifications A167 and A240/A240M at the time of removal from Specification A167.*" Since the grades used for stainless steel jacketing have effectively been transferred to and are now contained in A240/A240M, it is correct and preferred to require compliance with A240/A240M.

TABLE 2 Physical Properties

Type		I	
Grade		All	
Class	A	C	E
Emittance	0.3	0.3	0.3
~~Surface burning characteristics (flame spread index/ smoke developed index)~~	~~≤ 25/50~~	~~≤ 25/50~~	~~≤ 25/50~~
~~Moisture retarder pinhole detections (per 4.6 m^2)~~	~~≤ 5~~	~~≤ 5~~	~~n.a.~~
~~Moisture retarder WVTR (g/m^2/day)~~	~~≤ 1.55~~	~~≤ 17~~	~~n.a.~~

TABLE 1 Physical Properties

Type	I			II			IV			V		
Grade	All			All			All			All		
Class	A	C	E	A	C	E	A	C	E	A	C	E
Emittance (minimum)	0.3	0.3	0.3	0.8	0.8	0.8	0.85	0.85	0.85	0.8	0.8	0.8
Surface burning (flame/smoke)	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50	≤ 25/50
Moisture retarder pinhole detections (per 4.6 m^2)	≤ 5	≤ 5	n.a.	≤ 5	≤ 5	n.a.	≤ 5	≤ 5	n.a.	≤ 5	≤ 5	n.a.
Moisture retarder WVTR (g/m^2/day)	≤ 0.1	≤ 1.1	n.a.	≤ 1.55	≤ 17	n.a.	≤ 1.55	≤ 17	n.a.	≤ 1.55	≤ 17	n.a.
Outer Paint or Film Thickness (microns) (minimum)	n.a.	n.a.	n.a.	18	18	18	38	38	38	18	18	18
Outer Paint or Film Pencil Hardness (minimum)	n.a.	n.a.	n.a.	H	H	H	H	H	H	H	H	H