Designation: C1767 – 16a

Standard Specification for Stainless Steel Jacketing for Insulation[1]

This standard is issued under the fixed designation C1767; 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 inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 A version of this standard in SI units is available as Specification C1767M.

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A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)[4]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

C1729 Specification for Aluminum Jacketing for Insulation

C1767M 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

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

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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.

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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 3⁄16 in. 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 40 lb Kraft paper and one or more layers of plastic film, usually polyethylene at a minimum thickness of 1.5 mils.

3.2.10.1 *Discussion*—Kraft paper is commonly referred to by its basis weight which is the mass per area in units of lb/3000 ft^2. 40 lb Kraft has a basis weight of 40 lb/3000 ft^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, $\varepsilon \geq 0.3$,

5.1.1.2 Type II = Painted with pigmented paint, $\varepsilon \geq 0.8$,

5.1.1.3 Type IV = PVF film coated surface, $\varepsilon \geq 0.85$, and

5.1.1.4 Type V = Painted with a PVdF based paint system, $\varepsilon \geq 0.8$.

NOTE 1—Type III is omitted to maintain consistency with the similar standard for aluminum jacketing, Specification C1729.

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

NOTE 3—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, 3 mil thick
5.1.3.2 Class C = polykraft per section 3.2.10
5.1.3.3 Class E = no moisture retarder

NOTE 4—Classes B & D are omitted to maintain consistency with the similar standard for aluminum jacketing, Specification C1729.

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, 3⁄16 in. 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 3⁄8 to 1⁄2 in. 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 3⁄16 in. 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 0.2 mils and the PVdF topcoat must have a minimum dry thickness of 0.7 mils.

NOTE 5—It is important to be aware that the minimum 0.7 mil 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 1.5 mils 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 6—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 7—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.

6.13 Stainless steel jacketing shall be specified by the thickness which shall be in the range from 0.010 to 0.050 in. with the exception of 3⁄16 in. corrugated stainless steel which shall not be specified at greater than 0.024 in. thickness. Stainless steel jacketing of thickness greater than 0.032 in. is typically used only to provide the mass required in some acoustic jacketing.

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 50 ft^2)	≤ 5	≤ 5	n.a.	≤ 5	≤ 5	n.a.	≤ 5	≤ 5	n.a.	≤ 5	≤ 5	n.a.
Moisture retarder WVTR (g/100 $in.^2$/day)	≤ 0.1	≤ 1.1	n.a.	≤ 0.1	≤ 1.1	n.a.	≤ 0.1	≤ 1.1	n.a.	≤ 0.1	≤ 1.1	n.a.
Outer Paint or Film Thickness (mils) (minimum)	n.a.	n.a.	n.a.	0.7	0.7	0.7	1.5	1.5	1.5	0.7	0.7	0.7
Outer Paint or Film Pencil Hardness (minimum)	n.a.	n.a.	n.a.	H	H	H	H	H	H	H	H	H

NOTE 8—The thickness values mentioned in sections 6.13, 6.14, 6.15, and 6.16 are nominal thickness. The tolerances shown in Table 3 apply to these listed nominal values.

6.14 The measured thickness of metal jacketing will be affected by any forming or rolling such as that described in 10.5. All requirements for and discussion of jacketing thickness and thickness tolerance in this specification including Table 2 and Table 3 apply to the base metal before any forming or rolling and do not include any coatings or films that are applied to the surface such as the moisture barriers described in 5.1.3.

6.15 Box rib stainless steel jacketing pieces shall be 0.020, 0.024, or 0.032 in. thick, with a stucco embossed finish.

NOTE 9—Typical box rib widths available are 38.5 in. and 27.5 in.. Typical lengths available are 8, 10, and 12 ft. The pattern of grooves and ridges typically repeats on 4 in. centers and the height of each rib is typically 1 in.

6.16 Deep corrugated stainless steel jacketing pieces shall be 0.010, 0.016, 0.020, or 0.024 in. thick.

NOTE 10—Typical deep corrugated width is 33 in. and typical length is 6 to 12 ft. Two nominal repeating patterns are common: 1-¼ in. on centers with a ¼ in. height and a 2-½ in. on centers with a ⅝ in. height. For specific repeating pattern distances, the manufacturer shall be consulted.

7. Physical Properties

7.1 Required physical properties are shown in Tables 2 and 1.

7.2 All stainless steel jacketing shall demonstrate a flame spread index of 25 or less and smoke developed index of 50 or less when tested with the outer side (the side opposite that contacting the insulation) exposed to the flames in accordance with 11.2.

7.3 Unless otherwise agreed to by purchaser and seller of the metal jacketing, the emittance of the jacketing shall be:

7.3.1 Type I ≥ 0.3 which is typical for a 2B mill finish stainless steel jacket in service.

7.3.2 Type II ≥ 0.8 which is typical for a pigmented paint.

7.3.3 Type IV ≥ 0.85 which is typical of a PVF film coated surface.

7.3.4 Type V ≥ 0.8 which is typical for a PVdF based paint system.

NOTE 11—Values reported in the literature for the emittance of stainless steel range from 0.2 to 0.8 depending on degree of polishing and oxidation of the surface (**2-6**). Stainless steel jacketing is smooth but not highly polished and develops some oxidation in service. The insulation industry has had historical success using a fairly conservative emittance value of 0.3 for "in-service" stainless steel jacketing. Section 7.3 addresses the situation where a user of this standard wishes to consider a different emittance value.

TABLE 2 Minimum Thickness for Pipe Jacketing

Nominal Outer Insulation Diameter (in.)	Minimum Allowable Stainless Steel Nominal[A] Thickness inches
≤ 8	0.010
over 8 thru 11	0.010
over 11 thru 24	0.010
over 24 thru 36	0.016
over 36	0.020

[A] The minimum thickness values in this table are the minimum nominal thickness permitted. The tolerances shown in Table 3 still apply to the minimum nominal values in this table.

TABLE 3 Permissible Thickness Tolerances

Nominal thickness inches	Thickness tolerance in in. for	
	Up to 39.4 in. wide jacketing and deep corrugated sheet	48 in. wide jacketing and box rib sheet
≤ to 0.012	± 0.0010	± 0.0015
>0.012 and ≤ 0.016	± 0.0015	± 0.0015
>0.016 and ≤ 0.020	± 0.0015	± 0.0015
>0.020 and ≤ 0.024	± 0.0020	± 0.0020
>0.024 and ≤ 0.032	± 0.0020	± 0.0020
>0.032 and ≤ 0.040	± 0.0025	± 0.0025
>0.040 and ≤ 0.050	± 0.0030	± 0.0030

7.4 Permissible thickness tolerances vary with nominal thickness and are shown in Table 3. Thickness is measured per 11.3.

7.5 Requirements for permissible pinhole detections in the moisture retarder when tested per 11.4 are shown in Table 1.

7.6 The moisture retarder shall have no visual defect that will affect performance and shall be free of laminated separations, holes, rips, tears, scratches, dents, non-uniform edges, or creases.

7.7 Requirements for water vapor transmission rate (WVTR) of the moisture retarders tested per 11.5 are shown in Table 1. Testing the WVTR of moisture retarders is not possible after they are applied to the stainless steel jacketing so this testing shall be done on the moisture retarders prior to application.

8. Dimensions and Permissible Variations

8.1 Dimensions for stainless steel jacketing shall be as agreed to by purchaser and seller.

8.2 When cut into sheets for use as pipe insulation jacketing, the dimension of the stainless steel jacketing sheet designed to accommodate the pipe insulation circumference shall be called the length and the other major dimension shall be identified as the width.

8.2.1 The length shall be a minimum of the outer circumference target of the insulation plus 2 in. for insulation outer diameter ≤20 in. and a minimum of the outer circumference target of the insulation plus 2.5 in. for insulation outer diameter >20 in.

8.2.2 Typical width is 36 in., 48 in., or 1 meter.

8.2.3 Dimensions differing from these standards are possible but must be agreed to by purchaser and seller.

8.2.4 Tolerances for stainless steel jacketing sheets shall be ± ⅛ in. in width and ± ¼ in. in length.

8.3 When cut into sheets for use as equipment and vessel insulation jacketing, the longer dimension of the box rib or corrugated stainless steel jacketing sheet shall be called the length and the other (shorter) major dimension shall be identified as the width.

8.3.1 Typical width of deep corrugated stainless steel sheet is 33 in..

8.3.2 Typical lengths of deep corrugated stainless steel sheet are 6 to 12 ft.

8.3.3 Typical widths of box rib stainless steel sheet are 38.5 in. and 27.5 in..

8.3.4 Typical lengths of box rib stainless steel sheet are 8, 10, and 12 ft.

8.3.5 Dimensions differing from these standards are possible when agreed to by purchaser and seller.

8.3.6 Tolerances for stainless steel jacketing deep corrugated sheets and box rib shall be ± ½ in. in width and ± ¼ in. in length within a lot and ± ½ in. in width and length between lots.

8.4 When stainless steel jacketing is provided in rolls, the longer dimension is called the length and the shorter dimension is called the width.

8.4.1 Tolerances for roll materials shall be ± ⅛ in. on width and –0/+6 in. on length. This length tolerance does not apply to splice/split rolls where the total length shall be as required by 15.2.

8.4.2 For 3⁄16 in. corrugated stainless steel jacketing, the length that is sold shall be that after corrugation.

9. Workmanship, Finish, and Appearance

9.1 There shall be no defects in materials or workmanship that will affect the required performance of the stainless steel jacketing.

9.2 There shall be no defects that adversely affect the appearance of the stainless steel jacketing.

9.3 There shall be no defects that would affect the ability of the user to process the stainless steel jacketing material.

10. Requirements of Stainless Steel Jacketing

10.1 The main purposes of stainless steel jacketing are to provide physical damage resistance, corrosion resistance, fire resistance, UV protection, and to shed liquid water minimizing the amount entering the insulation system.

10.2 If greater levels of corrosion resistance are desired than that achieved with bare outer surface stainless steel, a painted (Type II or V) or film coated (Type IV) stainless steel shall be considered.

10.3 The applications for stainless steel jacketing are categorized into three areas; straight pipe, pipe elbows/fittings, and vessels/equipment. The requirements for each of these applications differ.

10.4 *Stainless Steel Jacketing on Straight Pipe:*

10.4.1 At the point of application, stainless steel jacketing used on straight pipe will consist of a multitude of pre-curved pieces with dimensions per 8.2.

10.4.2 The thickness (gauge) used for the stainless steel jacketing on straight pipe varies with jacket diameter as shown in this section and in Table 2.

10.4.2.1 For straight pipe up to a jacket diameter of 24 in., the minimum allowable thickness is 0.010 in. and Grade 1 or Grade 2 stainless steel shall be used.

10.4.2.2 For straight pipe with jacket diameter greater than 24 in. up to 36 in., the minimum allowable thickness is 0.016 in. and Grade 1 or Grade 2 stainless steel shall be used.

10.4.2.3 For straight pipe with a jacket diameter greater than 36 in., the minimum allowable thickness is 0.020 in. and Grade 1 or Grade 2 stainless steel shall be used.

10.4.3 When expected physical abuse is severe, consideration shall be given to using thickness of 0.024 in. or greater. Grade 1 or Grade 2 stainless steel shall be used.

10.4.4 Stainless steel jacketing on straight pipe requires the use of a moisture retarder so only Classes A or C shall be used.

10.5 *Stainless Steel Jacketing on Pipe Elbow/Fittings:*

10.5.1 Stainless steel jacketing applied to insulation on pipe elbows/fittings shall take the form of 2-piece (pressed), 4-piece, or gores all of which shall be pre-formed or pre-rolled to fit around the insulation. For outer insulation diameters of 20 in. or larger, the use of 8-piece sections on pipe elbows/fittings is acceptable.

10.5.1.1 For 2-piece (pressed) elbows, the overlaps at the heel and throat shall comply with the minimum values in Table 4 when the insulation outer diameter conforms to the target values in Practices C585 or C450.

NOTE 12—When the insulation outer diameter is smaller or larger than that specified in Practices C585 or C450, the heel and throat overlaps will be larger or smaller than ⅝ in. With 2-piece (pressed) elbows, deviations in insulation outer diameter from that specified in Practices C585 or C450 causes, in some cases, undesirable gaps in the joint at the heel or throat.

10.5.2 Stainless steel jacketing used shall be Grade 2 (T-316/T316L annealed), 0.016 in. thick.

10.6 *Stainless Steel Jacketing on Equipment and Vessels:*

10.6.1 Except for the thickness, finish, and Grade requirements in 10.6.2 to 10.6.4, stainless steel jacketing applied to equipment and vessels shall be of any size and shape agreed upon by purchaser and seller.

10.6.2 The minimum allowable stainless steel jacketing thickness shall be as listed in Table 2.

10.6.3 For horizontal vessels, only smooth or stucco embossed finish shall be used (no deep corrugated sheet or 3⁄16 in. corrugated finish).

NOTE 13—When deep corrugated or 3⁄16 in. corrugated sheet is used on horizontal vessels, there is a tendency for water to pond in the corrugations on the top of the vessel resulting in an increase in jacket corrosion, more dirt collection, poorer aesthetics, and an increased likelihood of water penetrating the jacket and entering the insulation system.

10.6.4 For vertical vessels and equipment less than 8 ft diameter, any finish of stainless steel jacketing or stainless steel deep corrugated sheet is acceptable. For vertical vessels and equipment 8 ft diameter and greater, deep corrugated stainless steel sheet jacketing shall be used.

TABLE 4 Minimum Overlap at Heel and Throat of Two-piece Elbows

Insulation O.D. inches	Minimum Elbow Heel and Throat Overlap,[A] inches
Up to 2.375	0.4375
2.875 and up	0.625

[A] Also called the “tangent”.

10.7 The purchaser shall be aware that Grade 1 (T-304/T-304L alloy) is normally used in most applications except the most corrosive areas, where Grade 2 (T-316/T-316L) or Grade 1, Type II, IV, or V is recommended.

10.8 For all applications of stainless steel jacketing, the purchaser shall select the Type (outer surface treatment) to meet the required emittance and corrosion resistance.

11. Test Methods

11.1 *Outer Jacket Surface Emittance*—Test in accordance with Test Method C835 or C1371.

11.2 *Surface Burning Characteristics*—Test in accordance with Test Method E84 with outer surface of jacketing exposed to the flames.

11.3 *Metal Sheet Thickness*—Test in accordance with Specification A480/A480M.

11.4 *Pinhole Detections in Moisture Retarder*—Test in accordance with Test Method C1785.

11.4.1 *Pass Criteria*—The moisture retarder is considered acceptable when no more than 5 pinhole detections, collectively, are detected in the 10 wetted test areas.

11.5 *Water Vapor Transmission Rate of the Moisture Retarder*—Test in accordance with Test Method F1249 at 73°F and 100 % relative humidity with results normalized to 1 atmosphere of pressure.

11.6 *Paint or Film Thickness*—Test in accordance with Test Method B487.

11.7 *Pencil Hardness*—Test in accordance with Test Method D3363.

12. Sampling, Inspection, and Rejection of Defective Material

12.1 A lot of material shall be considered to be the largest quantity of a specific stainless steel jacketing received by the purchaser under one order, or, when so designated by the manufacturer, that quantity of products identified as the particular lot.

12.2 A unit of material shall be considered to be the smallest packaged quantity of stainless steel jacketing within a lot, that is, one roll in a lot of rolls or one bundle of sheets in a lot of sheeted material.

12.3 Inspection shall consist of any tests for specification conformance the user deems necessary. Due to the impracticality of performing some tests on an inspection basis, when deemed necessary, the user shall request certification to specific test requirements.

12.4 Incoming lots shall be sampled at a minimum rate of 5 % of units received for inspection.

12.5 When any nonconformance to specification is detected within the 5 % sample, increase sampling to 10 % of the lot.

12.6 When 50 % or more of the 10 % sampled units is determined to be defective, the lot shall be considered unacceptable.

12.7 It shall be left to the discretion of the user whether to continue sampling for acceptable material. In any case, units found defective shall be considered unacceptable and rejected.

12.8 The purchaser shall be aware that in some cases there is natural and unavoidable variation in color, reflectivity, and other aspects of surface appearance in stainless steel mill finish from lot to lot. Provided the stainless steel meets the mill finish requirements in section 6.2, variation in the appearance of this mill finish from lot to lot shall not be a cause for rejection.

13. Certification

13.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a report of the results shall be furnished.

13.2 *Qualification Requirements*—The following requirements are generally designated for initial product qualification:

13.2.1 Outer surface emittance,

13.2.2 Surface burning characteristics, and

13.2.3 Pinhole detections in moisture retarder.

13.3 *Inspection Requirements*—The following requirements are generally designated for acceptance sampling of lots of qualified products. Any performance requirements not listed in 13.3 are considered qualification requirements.

13.3.1 Thickness,

13.3.2 Dimensions, and

13.3.3 Workmanship and appearance.

13.4 When required by the purchaser or user, the manufacturer shall provide evidence from an independent testing laboratory of the surface burning characteristics in accordance with Test Method E84 and the emittance of the outer jacket surface in accordance with Test Method C835 or C1371.

14. Product Marking

14.1 The packaged stainless steel jacketing material shall bear identification including the following information:

14.1.1 Manufacturer,

14.1.2 Product designation,

14.1.3 Roll or sheet dimensions, presence of a splice/split roll per 15.2 if applicable, and

14.1.4 Lot number.

14.2 When required by the user, the packaged material shall bear a marking of conformance to this specification and classification by Type, Grade, and Class, such as: Complies with Specification C1767, Type I, Grade 1, Class A.

15. Packaging

15.1 Unless otherwise specified, the material shall be supplied in the manufacturer's standard commercial package.

15.2 The presence of a splice roll or split roll shall be marked on the packaging, an extra 5 ft minimum of length shall be provided in that package, and a maximum of one splice/split roll shall be allowed per pallet.

NOTE 14—There are typically 20 packages of roll jacketing per pallet so

this assures a maximum of 5 % of roll jacketing packages on a full pallet can contain a splice/split roll.

16. Keywords

16.1 cladding; jacket; jacketing; lagging; moisture barrier; moisture retarder; stainless steel; thermal insulation

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