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Standard Guide for Selecting Jacketing Materials for Thermal Insulation¹

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1. Scope

1.1 This guide covers criteria for selecting thermal insulation jacketing materials and is not intended for use as a performance or product specification.

1.2 This guide applies to jacketing materials applied over thermal insulation for piping, ducts, and equipment.

1.3 This guide includes jacketing materials used over thermal insulation whether the insulation is in the form of pipe, board, or blanket, or field applied materials that are self-supporting, including insulating cements.

1.4 This guide does not include covers or other retaining walls that contain loose fill, other nonsupporting insulation materials, or conduits or containers for buried insulation systems.

1.5 This guide does not include mastics and coatings and their reinforcements.

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

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:

A 240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels²

A 366/A 366M Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality²

B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate³

C 168 Definitions of Terms Relating to Thermal Insulating Materials⁴

C 488 Practice for Conducting Exterior Exposure Tests of Finishes for Thermal Insulation⁴

C 835 Test Method for Total Hemispherical Emittance of Surfaces from 20 to 1400° C⁴

C 921 Practice for Determining the Properties of Jacketing Materials for Thermal Insulation⁴

C 1057 Determination of Skin Contact Temperature from Heated Surfaces Using a Mathematical Model and Thermesthesiometer⁴

C 1136 Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation⁴

C 1258 Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation⁴

C 1263 Test Method for Thermal Integrity of Flexible Water Vapor Retarders⁴

C 1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings⁴

D 828 Test Methods for Tensile Breaking Strength of Paper and Paperboard⁵

D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting⁶

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature⁶

E 84 Test Methods for Surface Burning Characteristics of Building Materials⁷

E 96 Test Methods for Water Vapor Transmission of Materials⁴

E 119 Method for Fire Tests of Building Construction and Materials⁷

E 596 Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures⁴

F 1249 Test Method for Water Vapor Transmission Rate through Plastic Film and Sheeting Using a Modulated Infrared Sensor⁵

¹ This guide is under the jurisdiction of ASTM Committee C-16 on Thermal Insulation and is direct responsibility of Subcommittee C16.40 on Insulation Systems.

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² *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 02.02.

⁴ *Annual Book of ASTM Standards*, Vol 04.06.

⁵ *Annual Book of ASTM Standards*, Vol 15.09.

⁶ *Annual Book of ASTM Standards*, Vol 08.01.

⁷ *Annual Book of ASTM Standards*, Vol 04.07.

2.2 Tappi Standards:⁸

T461 Flame Resistance of Treated Paper and Paperboard
T803 Puncture Test of Containerboard

3. Terminology

3.1 *Definitions*—Definitions C 168 apply to the terms used in this practice. The following terms are also used in this standard.

3.1.1 *abuse resistance*—ability of a material to be exposed for prolonged periods of time to normal physical abuse without significant deformation or punctures.

3.1.2 *ambient temperature*—the dry bulb temperature of surrounding air when shielded from any sources of incident radiation.

3.1.3 *cleanability*—ability of a material to be washed or otherwise cleaned to maintain its appearance.

3.1.4 *corrosion resistance*—ability of a material to be exposed for prolonged periods of time to a corrosive environment without significant onset of corrosion and the consequential loss of mechanical properties.

3.1.5 *fire resistance*—ability of a material to be exposed for a defined period of time to a fire with only limited and measurable loss of mechanical properties.

3.1.6 *fungus growth resistance*—ability of a material to be exposed continuously to damp conditions without the growth of mildew or mold.

3.1.7 *temperature resistance*—ability of a material to perform its intended function after being subjected to high and low temperatures which the material might be expected to encounter during normal use.

3.1.8 *weather resistance*—ability of a material to be exposed for prolonged periods of time to the outdoors without significant loss of mechanical properties.

4. Significance and Use

4.1 This standard is intended to be used by engineers and designers as a guide to assist them in selecting appropriate thermal insulation jacketing materials. As a guide, it can be used to identify performance characteristics that might be necessary for a particular insulation jacketing system. This guide is not a specification and therefore should not be used as such. It might, however, be useful in writing a specification. C 921 can also be used to determine properties of jacketing materials for thermal insulation.

5. Materials and Manufacture

5.1 Jacketing materials may be composed of a single material or a lamination of several components. The material may be in the form of rolls or sheets or preformed to fit the surface to which they are to be applied. The materials may be applied in the field or may be a factory-applied composite with the insulation.

5.2 *Metallic:*

5.2.1 Metallic jacketing materials are those whose primary material (usually the component of greatest thickness) is metal, such as, aluminum, steel, and stainless steel. The metal may be

smooth, corrugated, or embossed. The dimensions of corrugations (pitch and depth) may be specified by the purchaser for interchangeability, constant rigidity, and control of sizes. The inner surface of metallic jacketing materials may be coated or covered with a moisture resistant film to retard possible galvanic and/or chemical corrosion of the jacketing.

5.2.1.1 Aluminum jacketing materials can be manufactured from Specification B 209, Type 3003, 3004, 3105, 5005, 5010, 5020, or 1100 aluminum, temper ranges from H14 (half hard) through H19 (full hard). Where ambient conditions are severe, the outer surface of the aluminum may be coated when specified. Thicknesses generally available are from 0.006 to 0.040 in. (0.15 to 1.02 mm).

5.2.1.2 Steel jacketing materials can be manufactured from Specification A 366/A 366M, Type 1010, 1015, or 1020 steel. The outer surface is typically protected by aluminizing, galvanizing, or coating with plastic film or enamel to retard exterior corrosion, or a combination thereof. Metal thicknesses generally available are from 0.010 to 0.019 in. (0.25 to 0.46 mm).

5.2.1.3 Stainless steel jacketing materials can be manufactured from Specification A 240, Type 301, 302, 303, 304, or 316 stainless steel, hardness B85 (soft annealed). Thicknesses generally available are from 0.010 to 0.019 in. (0.25 to 0.46 mm).

5.3 *Nonmetallic and Laminated Jacketing:*

5.3.1 Laminated jacketing materials are typically manufactured from combinations of plastic films, plastic composites, metallic foils, reinforcing fabrics, papers, or felts selected to obtain the required performance characteristics. For flexible low permeance vapor retarders, see Specification C 1136.

5.3.2 Textile or cloth jacketing materials are woven or knitted of textile yarns. Commonly available forms are 4, 6, or 8 oz/yd² (0.14, 0.20, or 0.27 kg/m²) cotton canvas, various weaves of glass fiber yarns, presized glass cloth, knit or woven plastic fibers.

5.3.3 Plastic jacketing materials are manufactured in various forms and types. Thicknesses generally available are from 0.003 to 0.035 in. (0.08 to 0.89 mm). Various materials can be used such as poly-vinyl chloride (PVC), CPVS, fiberglass reinforced plastic (FRP), and others.

5.3.4 Saturated felt or cloth jacketing materials are manufactured from various base felts or cloths that have been impregnated with bitumen or resinous materials. Examples: Glass fiber, polyester fiber, polyolefin fiber. This definition does not include tar paper, asphalt paper, or other paperboard materials or other products, such as rag felt, that are made out of waste and they do not represent a continuous and resistant base for a jacketing.

6. Physical and Chemical Performance Considerations

6.1 This section includes a number of performance issues that should be considered when using this guide to select a jacketing material for thermal insulation. Some may not be applicable to the particular application. However, to be certain none are overlooked, the user should consider all initially and then eliminate those that are not applicable.

6.2 *Abuse Resistance*—Consideration should be given to the ability of a jacketing material to withstand a variety of physical conditions in excess of required functional design criteria.

⁸ Tappi Standards, Atlanta, GA.