



Designation: C921 – 10 (Reapproved 2015)

# Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation<sup>1</sup>

This standard is issued under the fixed designation C921; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 This practice covers jackets applied over thermal insulation on piping and equipment, including materials applied solely for physical protection, and materials applied as vapor retarders.

1.2 This practice provides material and physical requirements, or both, for jackets. Guidance in selecting the proper jacket for a given application can be found in Guide C1423.

1.3 This practice does not cover field applied mastics or barrier coatings and their attendant reinforcements, nor does it cover jackets for buried insulation systems.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- A336/A336M Specification for Alloy Steel Forgings for Pressure and High-Temperature Parts
- A653/A653M Specification for Steel Sheet, Zinc-Coated

(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

A792/A792M Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C168 Terminology Relating to Thermal Insulation

C390 Practice for Sampling and Acceptance of Thermal Insulation Lots

C921 Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

C1258 Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation

C1263 Test Method for Thermal Integrity of Flexible Water Vapor Retarders

C1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings

C1423 Guide for Selecting Jacketing Materials for Thermal Insulation

D774/D774M Test Method for Bursting Strength of Paper (Withdrawn 2010)<sup>3</sup>

D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus (Withdrawn 2009)<sup>3</sup>

D882 Test Method for Tensile Properties of Thin Plastic Sheeting

D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

E84 Test Method for Surface Burning Characteristics of Building Materials

E96/E96M Test Methods for Water Vapor Transmission of Materials

### 2.2 TAPPI Standards:

T461 Flame Resistance of Treated Paper and Paperboard<sup>4</sup>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.33 on Insulation Finishes and Moisture.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from Technical Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Suite 115, Peachtree Corners, GA 30092, <http://www.tappi.org>.

### 3. Terminology

3.1 *Definitions*—Definitions in Terminology C168 apply to terms used in this practice, including the word jacket, which is defined as "a form of facing applied over insulation." In common use, the terms jacket and jacketing shall be considered interchangeable.

### 4. Classification

4.1 *Type I*—Semi-rigid, for physical abuse resistance, physical support, and finish.

4.1.1 Grade 1: Aluminum sheet metal,

4.1.2 Grade 2: Stainless steel sheet metal,

4.1.3 Grade 3: Coated steel sheet metal, and,

4.1.4 Grade 4: Plastic sheet.

4.2 *Type II*: Flexible for vapor retardance, or physical support or finish combination thereof.

4.2.1 Grade 1: Laminated multi-layer,

4.2.1.1 Class A: Below ambient application; extremely low permeance,

4.2.1.2 Class B: Below ambient application; very low permeance,

4.2.1.3 Class C: Below ambient application; low permeance, and

4.2.1.4 Class D: Above ambient application; no vapor retarder needed,

4.3 Grade 3: Fabric

4.3.1 No grades; support only, vapor retarder properties not applicable.

4.4 Grade 4: Plastic film

4.4.1 Class A: Below ambient application; extremely low permeance,

4.4.2 Class B: Below ambient application; very low permeance,

4.4.3 Class C: Below ambient application; low permeance, and

4.4.4 Class D: Above ambient application; no vapor retarder needed.

### 5. Significance and Use

5.1 Jackets provide one or more of three basic functions when applied over thermal insulation:

5.1.1 Physical protection, in the form of abuse resistance and added structural integrity or support for the insulating medium.

5.1.2 Resistance to moisture vapor intrusion into the insulating medium in those applications where ambient and operating temperatures create a vapor driving force toward the cold (insulated) surface.

5.1.3 Exposed finish for the insulation

5.2 Type I semi-rigid jackets, in the form of metallic or heavy gauge plastic sheet, are used over insulation on piping or equipment to provide high abuse resistance. In this case, the material is also referred to as a protective jacket.

5.3 The vapor retarding Type II flexible jacket (Grades 1 and 2, Classes A, B, and C) is used by itself in below ambient service applications not requiring high abuse resistance. In

those cases where high abuse resistance is required, it is applied to the insulation prior to installation of a protective jacket.

5.4 The non vapor-retarding Type II flexible jacket (Grades 1 and 2, class D) is used by itself in above ambient service applications not requiring high abuse resistance. It may also be used for support of the insulation prior to installation of a protective jacket in above ambient applications requiring high abuse resistance.

5.5 Since semi-rigid protective jackets do not perform a vapor retarder function, and flexible jackets do not provide high abuse resistance, the various materials categorized herein are commonly used in combination, but not interchangeably.

5.6 Vapor-retarding properties are not necessary for systems operating above ambient.

5.7 In applications where there is a need to reduce surface emittance, non-metallic jacket, or painted, or film covered metal jacket may be specified.

5.8 For direct outdoor exposure, certain Type I jackets may be used. UV resistance is an important consideration with the Grade 4 materials. Consult with the manufacturer for recommendations on suitability for these applications.

### 6. Materials and Manufacture

6.1 Jackets shall be composed of a single material or a lamination of several components. The material shall be in the form of rolls or sheets or performed 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.

6.2 *Type I - Semi-rigid Protective:*

6.2.1 Semi-rigid jackets consist of metal jackets (Grades 1, 2, and 3) and heavy gauge plastic jackets (Grade 4).

6.2.2 Metal jackets are those whose primary material (usually the component of greatest thickness) is metal, such as aluminum alloy, stainless steel, or aluminum - zinc alloy coated steel sheet. Depending upon the metal, it may be available in a smooth mill finish, corrugated, embossed, painted or covered with a laminated, protective film. The inner surface (that side in contact with the insulation) is usually coated or covered with corrosion inhibiting film.

6.2.3 Aluminum Alloy jackets are commonly manufactured to Specification B209, Type 3003, 3004, 3104, 3105, 5005, 5052, or 1100. Aluminum temper ranges from half hard through full hard. Thicknesses generally available are 0.010 to 0.063 in. (0.25 to 1.60 mm) nominal.

6.2.4 Stainless steel jackets are manufactured to Specification A240/A240M, Type 301, 302, 304, or 316 stainless. Thicknesses generally available are from 0.010 to 0.032 in. (0.25 to 0.81 mm) nominal.

6.2.5 Coated steel jackets are manufactured to requirements in Specifications A336/A336M, A653/A653M, or A792/A792M as appropriate. Thickness generally available is 0.016 in. (0.41 mm) nominal. Other thicknesses shall be available as agreed upon between purchaser and seller.

6.2.6 Heavy gauge plastic Type I, Grade 4 jackets are manufactured in plastic films or sheet with materials such as