



Standard Practice for Selection and Application of Thermal Insulation for Piping and Machinery¹

This standard is issued under the fixed designation F683; 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.

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

1. Scope

1.1 This practice covers the selection of types and thicknesses of thermal insulation materials for piping, machinery, and equipment for nonnuclear shipboard applications within the temperature ranges specified in [Tables 1-16](#). Methods and materials for installation, including lagging, are also detailed.

1.2 This practice addresses operating temperatures from a low of –20 °F (–29 °C) up to 1200 °F (649 °C).

1.3 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.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents²

2.1 ASTM Standards:³

[A240](#) Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

[B209/B209M](#) Specification for Aluminum and Aluminum-Alloy Sheet and Plate

[C168](#) Terminology Relating to Thermal Insulation

[C195](#) Specification for Mineral Fiber Thermal Insulating Cement

[C449/C449M](#) Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

[C533](#) Specification for Calcium Silicate Block and Pipe Thermal Insulation

[C534](#) Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

[C547](#) Specification for Mineral Fiber Pipe Insulation

[C552](#) Specification for Cellular Glass Thermal Insulation

[C553](#) Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

[C610](#) Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation

[C612](#) Specification for Mineral Fiber Block and Board Thermal Insulation

[C680](#) Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

[C892](#) Specification for High-Temperature Fiber Blanket Thermal Insulation

[C1086](#) Specification for Glass Fiber Mechanically Bonded Felt Thermal Insulation

[C1729](#) Specification for Aluminum Jacketing for Insulation

[C1767](#) Specification for Stainless Steel Jacketing for Insulation

[D962](#) Specification for Aluminum Powder and Paste Pigments for Paints

2.2 Federal Specifications:⁴

[HH-P-31](#) Packing and Lagging Material, Fibrous Glass Metallic and Plain Cloth and Tape

2.3 Military Specifications:⁴

[MIL-C-20079](#) Cloth, Glass, Tape, Textile Glass and Thread, Glass

¹ This practice is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.02 on Insulation/Processes.

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² The latest revision of all referenced documents shall apply.

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 Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

TABLE 1 Insulation and Lagging Materials for Pipe, Tubing, and Fittings Used for Interior Piping Systems^{A,B}

Temperature Range °F (°C)	Insulation	Specification	Lagging ^{C,D}	Specification
–20 to +40 (–29 to +4)	cellular glass	ASTM C552, Type II	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	elastomeric cellular ^A	MIL-PRF-32514, Type I, (ASTM C534, Grade 3), ASTM C534, Grades 1, 2, and 3	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
41 to 125 (5 to 51)	cellular glass	ASTM C552, Type II	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	elastomeric cellular ^A	MIL-PRF-32514, Type I, (ASTM C534, Grade 3), ASTM C534, Grades 1, 2, and 3	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	mineral fibers	ASTM C547, Types I through IV	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
126 to 450 (52 to 232)	cellular glass	ASTM C552, Type II	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	elastomeric cellular 220 °F (104 °C) max	MIL-PRF-32514, Type I (ASTM C534, Grade 3), ASTM C534 Grades 1, 2, and 3	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	calcium silicate	ASTM C533, Type I	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	expanded perlite	ASTM C610	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	mineral fiber	ASTM C547, Types I through IV	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
451 to 1200 (233 to 649)	cellular glass, 800 °F (427 °C) max	ASTM C552, Type II	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	mineral fiber	ASTM C547, Types I to IV for up to 1000 °F (538 °C)	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Table 12 materials	
	mineral fiber	ASTM C547, Types II and III for up to 1200 °F (649 °C)	Knitted glass fiber tape	MIL-C-20079, Type II, Class 3
			Table 12 materials	
	calcium silicate	ASTM C533, Type I	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3
	expanded perlite	ASTM C610	Woven glass fiber cloth	MIL-C-20079, Type I, Classes 3 through 9
			Knitted glass fiber tape Table 12 materials	MIL-C-20079, Type II, Class 3

^A See 5.4.

^B Insulation and insulation covering materials are acceptable for the temperature ranges indicated; other materials are capable of being used provided the requirements of this practice are satisfied. Thermal insulating tape is capable of being used as allowed by Section 8 of this practice.

^C Lagging shall be used over insulation only.

^D Factory applied aluminum foil lagging may be used in areas not requiring a paintable surface, such as behind drop ceilings and joiner panels and the lagging meets all regulatory requirements.