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An American National Standard

Standard Specification for Selection and Application of Thermal Insulation Systems on Liquefied Natural Gas (LNG) Type C Tanks[1]

This standard is issued under the fixed designation F3562; 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 selection and application requirements for the design of a thermal insulation system used on cryogenic liquefied natural gas (LNG) Type C tanks that can store LNG at a higher pressure than Type A or Type B tanks.

1.2 Methods and materials for installation, including jacketing and vapor retarders, are also detailed.

1.3 This specification shall be applied to LNG fueled and cargo vessel applications as regulated by either the International Code of Safety for Ships Using Gases or Other Low Flashpoint Fuels (IGF Code) or International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).

1.4 This specification provides requirements for the properties of thermal insulation and other materials used in LNG Type C tanks as described in IGC Code Chapter 4.19.3 and IGF Code Section 6.4.13.3.

1.5 LNG Type C tanks are described in IGC Code and IGF Code.

1.6 This specification addresses suitable properties of resistance to fire and flame spread for LNG Type C tanks or portions of the tank are located on or above the exposed deck as well in hold spaces that are not maintained permanently inerted (that is, an atmosphere with less than 5 % oxygen).

1.7 The LNG tank operating temperature range addressed by this specification is from a temperature of –259 °F (–162 °C) +0/–9 °F (+0/–5 °C) to ambient temperatures no greater than 113 °F (45 °C).

1.8 This specification does not address the thermal insulation on vacuum jacketed (that is, insulation systems that operate at below ambient pressure) insulated LNG Type C tanks.

1.9 The design of removable/reusable insulation systems is not addressed in this specification.

1.10 Structural design and physical strength of insulation systems are not addressed in this specification. However, the securement of jacketing systems is addressed.

1.11 Insulation system density is not a design criterion considered in this specification.

1.12 Tank-mounted insulated pipe is outside the scope of this specification.

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

1.14 *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.*

1.15 *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 Documents

2.1 *ASTM Standards:*[2]

C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

C165 Test Method for Measuring Compressive Properties of Thermal Insulations

C167 Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations

C168 Terminology Relating to Thermal Insulation

C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C272 Test Method for Water Absorption of Core Materials

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

for Sandwich Constructions
C303 Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation
C591 Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate 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
C835 Test Method for Total Hemispherical Emittance of Surfaces up to 1400°C
C1136 Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
C1729 Specification for Aluminum Jacketing for Insulation
C1767 Specification for Stainless Steel Jacketing for Insulation
C1809 Practice for Preparation of Specimens and Reporting of Results for Permeance Testing of Pressure Sensitive Adhesive Sealed Joints in Insulation Vapor Retarders
D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and +30°C with a Vitreous Silica Dilatometer
D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
D1622 Test Method for Apparent Density of Rigid Cellular Plastics
D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
D6226 Test Method for Open Cell Content of Rigid Cellular Plastics
E84 Test Method for Surface Burning Characteristics of Building Materials
E96 Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
E136 Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C
E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer
E831 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
F3319 Specification for Selection and Application of Field-Installed Cryogenic Pipe and Equipment Insulation Systems on Liquefied Natural Gas (LNG)-Fueled Ships

2.2 *Other Standards:*
46 CFR Part 38 Subpart 38.05-2 Design and Construction of Cargo Tanks[3]
46 CFR Part 164 Subpart 164.109 Non-Combustible Materials (SOLAS)[3]
IMO FTP Code Fire Test Procedures Code IMO Resolution MSC 307 (88), Annex 1 Part 1 and Part 5 and Annex 2[4]
IMO SOLAS 1974 International Convention for the Safety of Life at Sea, as amended through 2014, Chapter II-2 Regulations 5 and 6[4]
IGC Code International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk[4]
IGF Code International Code of Safety for Ships using Gases or Other Low-Flashpoint Fuels[4]
ISO 8497 Determination of Steady-State Thermal Transmission Properties of Thermal Insulation for Circular Pipe[5]
MSC 1-Circ 1558 Unified Interpretations of The IGF Code[6]
DIN 4102-1 Fire Behavior of Building Materials and Elements for Classification of Building Materials Requirements and Testing[7]

3. Terminology

3.1 *Definitions*—For definitions of terms relating to insulating materials used in this specification, refer to Terminology C168.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *rubber membrane vapor retarder, n*—relatively thick, flexible material acting as a vapor retarder, the primary component of which is a rubber or rubberized material such as rubberized asphalt, nitrile rubber, or butyl rubber, combined with one or more secondary components such as aluminum foil, plastic film, and mesh or nonwoven reinforcement.

4. Insulation and Jacket Materials

4.1 Insulation and jacket/lagging manufacturers shall publish/describe material specifications that are intended for use on LNG Type C tanks at the temperature range requirements.

4.2 All materials and material properties shall be verified for applicability for use at cryogenic temperatures.

NOTE 1—The heat transmission studies for these tanks and issues related to stress corrosion cracking of austenitic stainless steel includes a maximum ambient still air temperature of 113 °F (45 °C) and this design condition is adopted in this specification for these tanks.

5. General Requirements

5.1 All safety requirements as applicable to ships such as those from the relevant flag administration, the IMO SOLAS 1974, the IGC Code, and the IGF Code are applicable to the insulation materials and systems described in this specification.

5.2 Insulation systems will comply with one of the following flammability requirements:

5.2.1 Be noncombustible by virtue of complying with the criteria of one of the following three: (*1*) Test Method E136, (*2*) Part 1 of the IMO FTP Code, or (*3*) 46 CFR 164.109 (see Table 1 I A).

NOTE 2—Thermal insulation that does not meet recognized standards for fire resistance may be used in hold spaces that are not kept permanently inerted provided its surfaces are covered with material with low-flame-spread characteristics and that forms an efficient approved vapor seal.

[3] Available from the U.S. Government Printing Office, Superintendent of Documents, 732 N. Capital St NW, Washington, DC 20402-0001, www.access.gpo.gov.

[4] Available from the International Maritime Organization, 4 Albert Embankment, London, United Kingdom, SE1 7SR, http://www.imo.org.

[5] Available from the American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

[6] Available from the Iranian Classification Society, NO.5, Shabnam. Alley, Qaem Maqam-e-Farahani St., Haft-e-Tir. Sqr,, Tehran, IR, ics.org.ir.

[7] Available from Deutsches Institut für Normung e.V.(DIN), Am DIN-Platz, Burggrafenstrasse 6, 10787 Berlin, Germany, http://www.din.de.