



Standard Guide for Installation and Application of Type C Portable Tanks for Marine LNG Service¹

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1. Scope

1.1 This guide is intended to identify and define the minimum requirements for the best practices in the design, installation, and application of Type C portable tanks in marine liquefied natural gas (LNG) fuel tank service used on LNG-fueled vessels.

1.2 This guide comprises the necessary guidance for regulatory compliance in addition to the requirements of the IMO IGF Code, along with the risk assessment considerations to detail the criteria for design, location, configuration, associated safety systems, and periodic system inspections. Included in the safety systems criteria would be leakage/spill detection and containment, water spray protection, emergency shutdown, grounding requirements, pressure relief to a fixed venting system, associated alarms, and color code markings for system identification. The locating and securing of suitable tank types with associated systems for marine service that will ensure compliant vessel stability with appropriate access to critical systems and connections for emergency response and vessel egress will also be addressed in this guide.

1.3 *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.*

1.4 *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.*

¹ This guide is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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2. Referenced Documents

2.1 *EN Standard:*²

EN 1474-2 Installation and Equipment for Liquefied Natural Gas—Design and Testing of Marine Transfer Systems—Part 2: Design and Testing of Transfer Hoses

2.2 *IMO Standards:*³

IGF Code IMO MSC 95/22/Add. 1 Annex 1 International Code of Safety for Ships Using Gases or Other Low Flashpoint Fuels

IMDG Code International Maritime Dangerous Goods Code

2.3 *ISO Standards:*²

ISO 1496-3 Series 1 Freight Containers—Specification and Testing—Part 3: Tank Containers for Liquids, Gases and Pressurized Dry Bulk

ISO 14726 Ships and Marine Technology—Identification Colors for the Content of Piping Systems

2.4 *Federal Standard:*⁴

49 CFR 393.134 What Are the Rules for Securing Roll-On/Roll-Off or Hook Lift Containers?

3. Terminology

3.1 *Definitions:*

3.1.1 *green seas, n*—solid waves of water coming aboard a ship.

3.1.2 *holding time, n*—means the time that will elapse from the establishment of the initial filling condition until the pressure has risen due to heat influx to the lowest set pressure of the pressure-limiting device(s).

3.1.3 *Type C portable tanks, n*—pressure vessels meeting the requirements of 6.4.15.3 of the IGF Code, which are also designed to be safely disconnected and removed from the

² Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

³ Available from International Maritime Organization, 4, Albert Embankment, London, SE1 7SR, UK, <http://www.imo.org>.

⁴ Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

vessel for refilling ashore and capable of being brought back on board and reconnected.

3.2 Acronyms:

3.2.1 LNG—liquefied natural gas

4. Significance and Use

4.1 This guide is intended to define and identify best practices for minimum requirements for the design, installation, and application of Type C portable tanks for marine service on LNG fueled vessels for service as a LNG fuel tank. These best practices provide added detail to the requirements in 6.5 of the IGF Code to facilitate consistent and practical implementation of those requirements.

5. Procedure

NOTE 1—In addition to the regulations in 6.5 of the IGF Code, the following represent best practices for the safe design, installation, and operation of Type C portable tanks for use in shipboard LNG fuel systems. The following text in italics comes from the International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code).

5.1 *Tank Construction—The design of the tank shall comply with IGF Code 6.4.15.3. The tank support (container frame or truck chassis) shall be designed for the intended purpose* (IGF Code 6.5.1).

5.1.1 The design of the tank support shall include considerations to withstand green seas if applicable for the operating environment.

5.1.2 The deck strength calculation shall be included and be part of the design approval process.

5.1.3 The portable tank connections shall be clearly color marked and labelled to indicate its function in accordance with ISO 14726.

5.1.4 Plan review and approval of portable tanks shall be vessel-specific with documentation clearly indicating the vessel or vessels for which the tanks have been designed. Each portable tank approved for use with a vessel's LNG fuel system shall be listed in the vessel's fuel handling manual (IGF Code 18.2.3) by serial number or other suitable identifying marking. Due consideration shall be given to applicable international and domestic multi-modal portable tank regulations such as those contained in the IMO IMDG Code.

5.2 *Tank Location—Portable fuel tanks shall be located in dedicated areas fitted with* (IGF Code 6.5.2) the following:

5.2.1 *Mechanical protection of the tanks depending on location and cargo operations* (IGF Code 6.5.2.1). Mechanical protection shall be in the form of a structural frame around the tank in accordance with ISO 1496-3 or equivalent. The risk assessment required by 4.2 and 6.4.1.1 of the IGF Code should address any mechanical protection required for portable fuel tanks taking into account the tanks location, the overall vessel design, and the cargo/vessel operations. This includes protection against the following:

5.2.1.1 Lateral impact, which may consist of longitudinal bars protecting the shell on both sides;

5.2.1.2 Overturning, which may consist of reinforcement rings or bars fixed across frames;

5.2.1.3 Front and rear impact, which may consist of a bumper or frame; and

5.2.1.4 Shell damage, which may consist of a structural frame constructed in accordance with a recognized standard.

5.2.2 *If located on open deck: spill protection and water spray systems for cooling* (IGF Code 6.5.2.2).

5.2.2.1 Spill protection can either be part of the tank frame support or the ship. If it is part of the portable tank, it shall be connected by flexible hose to the ship's system in accordance to EN 1474-2: or equivalent.

5.2.2.2 Similarly, the water spray system can be part of the portable tank or the ship.

5.3 *Tank-Securing Systems—Portable fuel tanks shall be secured to the deck while connected to the ship systems. The arrangement for supporting and fixing the tanks shall be designed for the maximum expected static and dynamic inclinations, as well as the maximum expected values of acceleration, taking into account the ship characteristics and the position of the tanks* (IGF Code 6.5.3).

5.3.1 The design of the supporting and fixing arrangement shall include external forces such as green seas, as applicable to the operating environment.

5.3.2 If the fuel tank is mounted on a truck chassis, the securing system shall be such that the weight of the tank shall not be carried by the truck wheels and tires, which may be subject to punctures or completely damaged in a fire scenario.

5.3.3 Securing arrangements are to be included in the fuel handling manual (IGF Code 18.2.3).

5.3.4 Recognized standard is 49 CFR 393.134 or equivalent.

5.4 *Tank Consideration on Vessel Strength and Stability—Consideration shall be given to the strength and the effect of the portable fuel tanks on the ship's stability* (IGF Code 6.5.4).

5.5 *Connections to Ship's Fuel Piping Systems—Connections to the ship's fuel piping systems shall be made by means of approved flexible hoses or other suitable means designed to provide sufficient flexibility* (IGF Code 6.5.5).

5.5.1 Connections and piping shall be so positioned and arranged that any damage to the fuel piping does not cause damage to the ship's fuel containment system resulting in an uncontrolled gas discharge.

5.5.2 Hoses subject to tank pressure, shall be designed for a bursting pressure not less than five times the maximum pressure the hose can be subjected to.

5.5.3 The surrounding hull or deck structures shall not be exposed to unacceptable cooling, in case of leakage of fuel. The flexible hose and connections shall have spill protection or shielding around it.

5.5.4 An arrangement for purging fuel lines with inert gas shall be provided for the exchange of portable fuel tanks.

5.5.5 Each ship's fuel piping system connection shall be color marked and labelled to indicate its function in accordance with ISO 14726.

5.5.6 Procedure for connecting shall be included in the vessel's fuel handling manual (IGF Code 18.2.3).

5.6 *Spill Limitation—Arrangements shall be provided to limit the quantity of fuel spilled in case of inadvertent disconnection or rupture of the non-permanent connections* (IGF Code 6.5.6).