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Petroleum and natural gas industries — Installation and equipment for liquefied natural gas — Ship-to-shore interface and port operations

Industries du pétrole et du gaz naturel — Installations et équipements relatifs au gaz naturel liquéfié — Interface terre-navire et opérations portuaires

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 28460 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*.

Introduction

The original liquefied natural gas (LNG) business was based on long-term sale and purchase agreements with essentially dedicated fleets and terminals and each party having a thorough understanding of the particular ship/shore interface, which resulted in a safe and reliable operation.

The considerable growth of the LNG short-term and spot cargo markets has resulted in the requirement to ensure that the ship/shore interface issues are standardized and well understood to ensure the continuing safe transportation of LNG.

It is necessary that each LNG port facility and terminal have its own specific safety and operational systems and that LNG carriers using the facility comply with these systems. For all vessels, it is necessary to take particular care to ensure that the basic requirements laid down in this International Standard are understood and applied at each cargo transfer in order to ensure the safe, secure and efficient transfer of cargo between ship and shore or vice versa.

This International Standard relates to marine operations during the vessel's port transit and the transfer of cargo at the ship/shore interface taking into account the publications of the International Maritime Organization (IMO), the Society of International Gas Tankers and Terminal Operators (SIGTTO), the International Group of Liquefied Natural Gas Importers (GIIGNL) and the Oil Companies International Marine Forum (OCIMF). Relevant publications by these and other organizations are listed in the Bibliography.

It is not necessary that the provisions of this International Standard be applied retrospectively and it is recognized that national and/or local laws and regulations take precedence where they are in conflict with this International Standard.

Petroleum and natural gas industries — Installation and equipment for liquefied natural gas — Ship-to-shore interface and port operations

1 Scope

This International Standard specifies the requirements for ship, terminal and port service providers to ensure the safe transit of an liquefied natural gas carrier (LNGC) through the port area and the safe and efficient transfer of its cargo. It is applicable to

a) pilotage and vessel traffic services (VTS);

b) tug and mooring boat operators;

c) terminal operators;

d) ship operators;

e) suppliers of bunkers, lubricants and stores and other providers of services whilst the LNG carrier is moored alongside the terminal.

This International Standard includes provisions for

— a ship's safe transit, berthing, mooring and unberthing at the jetty;

— cargo transfer;

— access from jetty to ship;

— operational communications between ship and shore;

— all instrumentation, data and electrical connections used across the interface, including OPS (cold ironing), where applicable;

— the liquid nitrogen connection (where fitted);

— ballast water considerations.

This International Standard applies only to conventional onshore liquefied natural gas (LNG) terminals and to the handling of LNGC's in international trade. However, it can provide guidance for offshore and coastal operations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IMO[1)], *International ship and port facility security code (ISPS Code)*, 2003

IMO, *International code for the construction and equipment of ships carrying liquefied gases in bulk (IGC Code)*, 1993

SOLAS[2)] chapter II-2 and chapter V, regulation 12

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
communication
all methods of transmitting written or verbal information, including information covered by data links

3.1.2
control room
area situated in the terminal from which cargo operations are monitored and controlled

3.1.3
conventional onshore LNG terminal
LNG export or receiving terminal that is located on-shore and that has a marine transfer facility for the loading or unloading of LNG carriers in a harbour or other sheltered coastal location

NOTE The transfer facility consists of a wharf or fixed structure capable of withstanding the berthing loads of a fully laden LNG carrier of a given specification and mooring the vessel safely alongside. This includes any structure connected to the shore by a trestle, tunnel or other means, facilitating the LNG transfer and ancillary services and providing safe access and egress for personnel performing maintenance or operational duties.

3.1.4
emergency release system
ERS
system that provides a positive means of quick release of transfer arms and safe isolation between ship and shore, following a predefined procedure including an **emergency shut-down** (ESD)

NOTE The operation of the emergency release system can be referred to as an “ESD II”.

3.1.5
emergency shut-down
ESD
method that safely and effectively stops the transfer of LNG and vapour between ship and shore or vice versa

NOTE The operation of this system can be referred to as an “ESD I”. Ship/shore ESD systems should not be confused with other emergency shut-down systems within the terminal or on board ship.

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1) IMO International Maritime Organization

2) SOLAS: International Convention for Safety of Life at Sea.

3.1.6
fail-safe
property of a component or system that fails towards a safer or less hazardous condition

3.1.7
jetty
facility consisting of a trestle or similar structure, berthing facilities including fendering and topside equipment to enable the transfer of LNG between ship and shore

3.1.8
LNGC cargo control room
area situated on board the ship from which the control of the ship's transfer operation is directed

3.1.9
LNGC heel
quantity of cargo that remains on board (ROB) after discharge to maintain the cargo tank temperature and/or to provide fuel gas

3.1.10
marine exclusion zone
area around the **jetty** (3.1.7) in which no unauthorized traffic is allowed to enter

NOTE 1 This may vary according to jetty operations and security levels.

NOTE 2 There may also be a land-use planning exclusion zone, in which no public permanent human activity is allowed.

3.1.11
moving safety zone
area around the transiting LNG carrier, into which no unauthorized traffic is allowed to enter, so as to protect the vessel from marine hazards (collision, grounding) while in transit

3.1.12
onshore power supply
OPS
provision of electrical power to a vessel from shore to minimize local atmospheric pollution

NOTE This can be referred to as “cold ironing”.

3.1.13
ship's cargo manifold
flanged pipe assembly, mounted on board ship to which the outboard flanges of the transfer arms are connected

NOTE See also OCIMF[4].

3.1.14
ship/shore compatibility study
study undertaken by the ship owner or technical manager and terminal operators to ensure the vessel can safely berth and transfer cargo at a particular terminal

3.1.15
ship/shore interface
matching of ship to shore and all operations relating to LNG cargo transfer, ship's access and ship's supplies

3.1.16
ship/shore safety check-list
list of items that are checked by ship and shore prior to commencing cargo operations using the current ISGOTT edition as applicable to the transfer of LNG

NOTE See Reference [2].

3.1.17
vessel traffic services
VTS
shore-side systems which range from the provision of simple information messages to ships, such as position of other traffic or meteorological hazard warnings, to extensive management of traffic within a port or waterway

NOTE SOLAS Chapter V (Safety of Navigation) states that governments may establish VTS when, in their opinion, the volume of traffic or the degree of risk justifies such services.

3.1.18
vetting
process of marine quality assurance by assessing ship quality against a known standard to determine acceptance for use

NOTE 1 The process of assessing the ship quality should include the assessment of operational standards of the vessel, including crew competency and training, adherence to class and international rules and the ship's physical condition.

NOTE 2 Recognized industry inspection reports of the ship, ship manager, port state control databases and class reports provide some of the information that assist in determining the vetting decision.

3.2 Abbreviated terms

ERC emergency release coupling

LNG liquefied natural gas

LNGC liquefied natural gas carrier

QC/DC quick connection/disconnection coupling

ROB remaining on board

SSL ship/shore link

4 Description and hazards of LNG

The characteristics of LNG are described in EN 1160[28].

The main hazards are also defined in EN 1160 and those most important in the transfer of LNG are:

— the cryogenic temperatures, which can cause injury to people (frostbite), and also cause damage to non-cryogenic materials such as carbon steel, which lose their mechanical properties, become brittle and fracture;

— fire, explosion or asphyxiation from possible leaks or spillage of LNG;

— the overpressure resulting in shock waves, caused by rapid phase transition (RPT) of LNG due to the interaction between LNG and water;

— overpressure due to thermal expansion of trapped LNG.

Release to the atmosphere should be avoided as methane is considered a greenhouse gas.

NOTE It is necessary that standards for security, fire protection equipment and explosion-proof equipment be in accordance with local rules and regulations as appropriate to the application.

5 Potential hazardous situations associated with LNG transfer

The following hazardous situations should be considered for operational and contingency planning by all relevant parties:

— failure of ship's mooring;

— incorrect adherence to cool-down or warm-up procedures, including purging and draining of transfer arms and piping;

— flange and valve leaks including QC/DC;

— overfilling of tanks (ship and shore);

NOTE Experience shows that overfilling of ship's tanks, due to human error, also occurs during discharge operations.

— failure of ERC, including activation of coupler whilst ball valves are still open;

— overpressure/underpressure of tanks (ship and shore);

— excessive surge pressure in transfer lines.

6 Possible factors affecting ship/shore interface and port operations

The following factors should be considered for operational and contingency planning by all relevant parties:

a) environmental factors;

b) atmospheric conditions (wind, lightning, etc.);

c) sea conditions;

d) current effects to determine the berthing strategy;

e) seismic conditions (potential for earthquake and/or tsunami);

f) rise and fall of the tide;

g) silt (turbidity) in harbour water that can be deposited in ballast tanks;

h) ice conditions affecting navigation, port and jetty operations;

i) tropical revolving storms;

j) high latitude factors;

Other factors that should be considered are

— heavy jetty contact during berthing or unberthing;

— impact from another ship;

— LNG ship movement along the jetty, e.g. due to engine control malfunction, tidal forces, wind and wind gusts, failure or slackening of mooring lines, or by the interaction effect from ships passing nearby;

— grounding and other navigational errors during port transit;

— loss of LNG ship power or tug line or engine failure during ship manoeuvring;

— bunkering and storing;

— noxious or flammable gas release at the terminal or its surroundings;

— emergencies including fire on vessel or shore.

NOTE See Annex A for information on ship's equipment.

7 Jetty

7.1 Siting of jetty

The location and configuration of the LNG jetty and marine exclusion zone should be the result of a risk assessment taking into consideration, as a minimum, the following:

— physical location of the berthing facility with regard to marine topography;

— local oceanographic and meteorological conditions;

— frequency, displacement and types of passing ships;

— closest point of approach and course of passing ships, including the requirements of a moving safety zone;

— distance to populated areas and population density;

— potential for future increase in port traffic;

— total inventory of flammable products on the jetty;

— emergency departure considerations;

— potential for uncontrolled sources of ignition nearby, over which the terminal operator might not have control;

— distance from other berths;

— type of products and operations on adjacent berths, including the different safety philosophies and requirements between LNG and other cargo types;

— proximity, displacement and type of vessels manoeuvring at adjacent berths.

Mitigation measures may include stopping cargo transfer whilst a vessel is manoeuvring at an adjacent berth, increasing the number and power of tugs, and more restrictive environmental windows.

All applicable national statutory and regulatory requirements shall be complied with.

Risk assessments required or recommended by Clauses 7 and 8 should be undertaken by a team including personnel with marine expertise, LNG carrier operational experience and local knowledge.

Sources of additional information and guidance are listed in the Bibliography.

