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Ships and marine technology — Specification for bunkering of liquefied natural gas fuelled vessels (ISO 20519:2017)

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National foreword

This British Standard is the UK implementation of EN ISO 20519:2017.

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Schiff- und Meerestechnik - Spezifikation für das Bunkern flüssigerdgasbetriebener Schiffe (ISO 20519:2017)

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

This document (EN ISO 20519:2017) has been prepared by Technical Committee ISO/TC 8 "Ships and marine technology" in collaboration with Technical Committee CEN/TC 282 “Installation and equipment for LNG” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2017, and conflicting national standards shall be withdrawn at the latest by August 2017.

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Endorsement notice

The text of ISO 20519:2017 has been approved by CEN as EN ISO 20519:2017 without any modification.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*.

Introduction

This document has been produced to meet an industry need identified by the International Maritime Organization (IMO). This document has been designed to support the IMO International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code).

Due to numerous economic and environmental factors, the use of liquefied natural gas (LNG) as a vessel's fuel has increased. While LNG fuelled ships and vessels have been in service for over 10 years, most of these vessels have operated within small defined areas using LNG bunkering operations designed for that particular vessel service. The increase in LNG fuelled vessels corresponds with an increase in the number of the regions that these vessels will service. Therefore, there is a need to standardize LNG bunkering operations internationally to a reasonable degree so that vessel operators will have the tools to select vessel fuel providers that meet set safety and fuel quality standards and LNG bunkering operations will be conducted safely. This document can be used for both vessels involved in international and domestic service regardless of size.

This document does not replace existing laws or regulations. It is flexible so that it can be applied in many situations and under various regulatory regimes as long as the requirements of this document are met. If, however, local regulations preclude its use and do not provide the safety specified in this document, compliance with this document should not be claimed.

INTERNATIONAL STANDARD **ISO 20519:2017(E)**

Ships and marine technology — Specification for bunkering of liquefied natural gas fuelled vessels

1 Scope

This document sets requirements for LNG bunkering transfer systems and equipment used to bunker LNG fuelled vessels, which are not covered by the IGC Code. This document includes the following five elements:

a) hardware: liquid and vapour transfer systems;

b) operational procedures;

c) requirement for the LNG provider to provide an LNG bunker delivery note;

d) training and qualifications of personnel involved;

e) requirements for LNG facilities to meet applicable ISO standards and local codes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 16904, *Petroleum and natural gas industries — Design and testing of LNG marine transfer arms for conventional onshore terminals*

ASME B16.5, *Pipe flanges and flanged fittings: NPS 1/2 through NPS 24 metric/inch standard*

BS 4089, *Specification for metallic hose assemblies for liquid petroleum gases and liquefied natural gases*

EN 1474-2, *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Design and testing of transfer hose*

EN 1474-3, *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Offshore transfer systems*

EN 12434, *Cryogenic vessels — Cryogenic flexible hoses*

IEC 60079-10-1, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*

IMO International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code)

IMO International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)

Oil Companies International Marine Forum. *Design and Construction Specification for Marine Loading Arms*. Third edition, 1999. London, England: Oil Companies International Marine Forum

Society of International Gas Tanker and Terminal Operators (SIGTTO). *ESD Arrangements & Linked Ship/Shore Systems for Liquefied Gas Carriers* [online]. First edition, 2009. Scotland, UK: Witherby Seamanship International Ltd

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
bunkering
operation of transferring LNG fuel to a *vessel* (3.22)

Note 1 to entry: For the purposes of this document, it refers to the delivery of LNG only. This document does not address the transfer of CNG, propane or fuels other than LNG that may be covered by the IGF Code (see 3.2).

3.2
bunkering terminal
fixed operation on or near shore that is not regulated as a *vessel* (3.22) that can be used to provide LNG bunkers to a receiving vessel

3.3
classed
classification
process in which the design and condition of a *vessel* (3.22) is evaluated to determine its compliance with rules and standards developed by the *Classification Society* (3.5) issuing the classification

3.4
controlled zones
areas extending from the bunkering manifolds on the LNG receiving vessel and the LNG supply source during LNG bunkering operations that have restrictions in place

Note 1 to entry: These restrictions include limitation on personnel access, sources of ignition and unauthorized activities. The controlled zones are subdivided into hazardous zones, safety zones and the monitoring and security areas as defined in Annex B.

3.5
Classification Society
non-governmental organization that establishes and maintains technical standards for the construction and operation of ships and offshore structures

Note 1 to entry: They also validate that construction is according to these standards and carry out regular surveys in service to verify compliance with the standards.

3.6
dry-disconnect
method that reduces *LNG* (3.10) or natural gas releases into the atmosphere under normal operation to a negligible amount consistent with safety, either by equipment design or procedural practice

3.7
emergency release (break-away) coupling
ERC
coupling installed on *LNG* (3.10) and vapour lines, as a component of ERS, to ensure the quick physical disconnection of the transfer system from the unit to which it is connected, designed to prevent damage to loading/unloading equipment in the event that the transfer system's operational envelope and/or parameters are exceeded beyond a predetermined point

3.8
emergency release system
ERS
system that provides a safe shut down, transfer system isolation and quick release of hoses or *transfer arms* (3.19) between the facility or *vessel* (3.22) providing the *LNG* (3.10), and the vessel receiving the LNG, preventing product release at disconnection time

Note 1 to entry: The ERS consists of an emergency release coupling (ERC) and interlocked isolating valves which automatically close on both sides, thereby containing the LNG or vapour in the lines (dry disconnect), and, if applicable, associated control system.

3.9
emergency shutdown system
ESD
system that safely and effectively stops the transfer of *LNG* (3.10) and vapour between the facility or *vessel* (3.22) providing the LNG and the vessel receiving the LNG or vice versa

Note 1 to entry: The operation of this system can be referred to as an "ESD I". Vessel ESD systems should not be confused with other emergency shutdown systems within the terminal or on board vessels.

Note 2 to entry: An informative illustration of an ESD I and ESD II is provided in Figure C.2.

3.10
liquefied natural gas
LNG
natural gas that has been cooled and condensed into liquid form

Note 1 to entry: It is characterized as a cryogenic liquid having a temperature typically around –161 °C under normal atmospheric pressure.

3.11
lower flammable limit
LFL
concentration of flammable gas or vapour in air below which there is insufficient amount of substance to support and propagate combustion

3.12
management system
set of procedures an organization needs to follow in order to meet its objectives

3.13
member state authority
legal authority within a member state that has jurisdiction over maritime or port activities within that state

3.14
mobile facility
mobile facilities are trucks, rail car or other mobile device (including portable tanks) used to transfer *LNG* (3.10) to a *vessel* (3.22)

3.15
monitoring and security area
area around the bunkering facility and *vessel* (3.22) where vessel traffic and other activities are monitored to mitigate harmful effects

3.16
recognized organization
competent organization with delegated authority on behalf of an Administration to assist in the uniform and effective implementation of IMO Codes and Conventions

Note 1 to entry: Adapted from IMO A.739(18).

3.17
LNG transfer system
consists of all equipment contained between the bunkering manifold flange on the facility or *vessel* (3.22) providing LNG fuel and the bunkering manifold flange on the receiving LNG fuelled vessel including but not limited to; vessel to vessel transfer arms, LNG transfer arms (articulated rigid piping) or hoses, *emergency release system (ERS)* (3.8), insulation flanges; quick connect/disconnect couplings (QC/DC), and in addition the ESD ship/shore or ship/ship link used to connect the supplying and receiving ESD systems

Note 1 to entry: An illustration of a typical LNG transfer system is provided in Figure C.1.

3.18
technical standards
standards that prescribe requirements for one or more of the following: operations, equipment design/fabrications or testing methodology

Note 1 to entry: Auditors cannot issue a certification or approval to a company that claims compliance with a Technical Standard unless that standard is incorporated into a recognized management system as a management objective.

3.19
transfer arm
articulated metal transfer system used for transferring *LNG* (3.10) to the *vessel* (3.22) being bunkered

Note 1 to entry: It can be referred to as a "loading arm" or "unloading arm".

3.20
safety zone
area around the bunkering station where only dedicated and essential personnel and activities are allowed during *bunkering* (3.1)

3.21
security zone
area established by the national or local authorities around a bunkering facility or area through which *vessel* (3.22) and personnel movement is subject to regulatory restrictions

3.22
vessel
includes ships, barges (self-propelled or no propulsion) or boats of any size in domestic or international service

Note 1 to entry: A bunkering vessel is a vessel used to transport LNG to a vessel using LNG as a fuel.

Note 2 to entry: A receiving vessel is a vessel that uses LNG as a fuel and does not transport LNG as a cargo.

4 Abbreviated terms

Term	Description	Explanation
IGC Code	International Maritime Organization's International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk	The IGC Code applies to ships involved in the carriage of bulk liquefied gases and prescribes the design and construction standards of ships involved in such carriage and the equipment they should carry.
IGF Code	International Maritime Organization's International Code of Safety for Ships using Gases or other Low-flashpoint Fuels, 2017	The IGF Code applies to ships fuelled by gases or other low-flashpoint fuels. The Code contains mandatory provisions for the arrangement, installation, control and monitoring of machinery, equipment and systems using low-flashpoint fuels.
IACS	International Association of Classification Societies	An organization that establishes, reviews, promotes and develops minimum technical requirements in relation to the design, construction, maintenance and survey of ships and other marine related facilities; and assists international regulatory bodies and standards organizations to develop, implement and interpret statutory regulations and industry standards in ship design, construction and maintenance, with a view to improving safety at sea and the prevention of marine pollution.
IMO	International Maritime Organization	A specialized agency of the United Nations whose purpose is "to provide machinery for cooperation among governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning efficiency of navigation, and prevention and control of marine pollution from ships."
ISM	International Safety Management Code	An IMO code that provides an international standard for the safe management and operation of ships and for pollution prevention.
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers	This convention promotes the safety of life and property at sea and the protection of the marine environment by establishing in common agreement international standards of training, certification and watchkeeping for seafarer.
SGMF	Society for Gas as a Marine Fuel	A non-governmental organization established to promote safety and industry best practice in the use of gas as a marine fuel.

5 Transfer system design requirements

5.1 Vessel requirements

5.1.1 In order to be compliant with this document, vessels involved shall meet the following requirements (this applies to vessels of all sizes, in domestic or international service):

5.1.2 Bunkering vessels shall conform with this document and be approved by its Flag State, Recognized Organization or Classification Society that complies with the applicable uniform interpretations and requirements posted by IACS, indicating that it meets, at a minimum, the applicable requirements of the IGC Code, this document and applicable Flag State requirements.

5.1.3 Receiving vessels shall conform with this document and be approved by its Flag State, Recognized Organization or Classification Society that complies with the applicable uniform interpretations and requirements posted by IACS, indicating that it meets, at a minimum, the applicable requirements of the IGF Code, this document and applicable Flag State requirements.

5.2 Facility requirements

5.2.1 Mobile facilities (e.g. tank trucks, rail cars and portable tanks) including their tanks, piping, hoses, pumps and valves shall be fabricated and conform to meet ISO or other standards recognized by national standards bodies that are ISO members for handling cryogenic liquids.

5.2.2 The bunkering terminal shall conform to local codes. If local codes do not address LNG bunkering terminals, the terminal operator shall obtain a document issued by a competent organization or individual such as a qualified engineer confirming the terminal conforms to the applicable sections of standards published by ISO and ISO member organizations as well as guidance published by SGMF.

5.3 Transfer equipment requirements

5.3.1 All equipment used in the transfer system shall meet the requirements defined for that specific piece of equipment as prescribed in 5.3 to 5.5. The use of liquid nitrogen as a substitute for LNG during testing of the equipment by the equipment manufacturers is acceptable.

5.3.2 All the components of the transfer system through which LNG or natural gas flow shall be rated for the maximum transfer system design pressure but shall have a pressure rating of no less than 1 034 MPa. All flanges shall be at least Class 150 in accordance with ASME B16.5 and of the weld-neck type.

5.3.3 All the components of the transfer system shall be fabricated to meet or exceed the applicable sections of the standards indicated in Table 1, the IGC/IGF Codes, in addition to other requirements listed in this document.

Table 1 — Standards containing requirements applicable to transfer system components

Component	Function	Standard(s)
Hoses	Transfer of LNG and natural gas	EN 1474-2 or EN 12434 or BS 4089
Swivel joints	Product line articulation	ISO 16904
Flanges	Product line connections	ASME B16.5
Bearings	Articulation of support structure	ISO 16904
ERS	Emergency disconnect	ISO 16904
Breakaway coupling	Emergency disconnect	ISO 16904
Transfer arms	LNG bunkering loading solution	ISO 16904
Other transfer system	LNG bunkering loading solution	ISO 16904

5.3.4 Flow rate of LNG through the transfer system shall not exceed 12 m/s, however, higher speeds can be locally acceptable in reduced passages, for example in the ERS, provided cavitation and vibration is acceptable.

5.4 Emergency shutdown and release systems

5.4.1 The LNG transfer system shall be fitted with an emergency release system (ERS) and connected to an emergency shutdown system (ESD). The delivery facility and receiving vessel ESD systems shall be interconnected with a ship/shore or ship/ship ESD link to ensure the coordinated operation of both the delivery and receiving ESD systems and ERS.

5.4.1.1 The ERS shall be designed to protect the transfer system and the connections by disconnecting the transfer system, primarily should the vessel drift out of their operating envelope. The ERS shall consist of an emergency release coupling (ERC) including interlocked isolating valves to minimize loss of LNG or NG when the ERC is activated.

5.4.1.2 The ESD shall be designed to be activated by operator-initiated signals as well as sensor input and when activated, initiate shutting down the LNG transfer pumps and closing of the ESD valves. At a minimum, they will include sensors that will provide input in the event of

— fire or gas detection,

— power failure,

— LNG tanks being overfilled,

— abnormal pressure in the transfer system,

— vessel drifting out of position,

— low temperature in the drip tray, and

— loading arm being overstressed.

NOTE An illustration of the ESD initiators is provided in Figures C.3 and C.4.

5.4.2 The ESD link shall be designed to conform to the requirements specified in Appendix D or H of *ESD Arrangements & Linked Ship/Shore Systems for Liquefied Gas Carriers*.

5.4.3 The emergency release system (ERS) shall be designed to operate as a dry break system and conform to the following requirements.

— Designed to separate before the hose or loading arm is overstressed. This calculated force or bending moment is to be recorded. The system shall be capable of actuation both automatically on vessel drift or manually from a remote location.

— Designed to operate with ESD I and ESD II stage systems.

— Designed to maintain integrity without leakage following ESD II while LNG is being transferred at maximum flow (for example, ESD II, “may” and “should” were replaced with “shall” throughout the document when they were part of a requirement without ESD I).

— The consequences of an emergency breakaway in terms of resultant surge pressures are to be determined and demonstrated to be within the capability of the supply system to not exceed the design pressure.

— Designed so that ice that forms during or after transfer will not impede the function of the coupling or its emergency release collar when used in accordance with the manufacturer’s directions.

5.4.4 The design for the ERS shall take into account drifting scenarios commensurate with the surrounding environment and location. A study shall be undertaken to simulate and determine the acceleration and velocity of drift likely to occur due to a possible failure of the mooring system, taking into consideration the range of vessels that are likely to use the terminal. The study shall take into account, as a minimum, the following:

— wind speeds and direction;

— current and bank effect;

— tidal range;

— waves and swell height, period and direction;

— surge from passing vessels;

— inadvertent operation of vessel’s propulsion or of mooring system;

— ice flows.

5.4.5 Low volume transfer systems in which the LNG transfer rate will not exceed 150 m^3/h (for example tank trucks) may, subject to performance of a transfer system design analysis, eliminate the requirements for:

— manual activation of the ERS (5.4.3, list item 1);

— ERS to be designed to activate the emergency shutdown (5.4.3, list item 2);

— ESD link system complying with Appendix H of ESD *Arrangements & Linked Ship/Shore Systems for Liquefied Gas Carriers*. Note that a system complying with Appendix D of *ESD Arrangements & Linked Ship/Shore Systems for Liquefied Gas Carriers* is still required.

5.4.6 Prevention of over pressurization: Design of transfer system shall consider over pressurization due to surge pressure in the event the ERS or the ESD is activated. If procedures are developed, they shall be documented in the bunkering operations procedures manual required in 6.5.

5.5 Specific requirements

5.5.1 System support

All transfer equipment shall be adequately supported during transfer operations to perform safely under the operating parameters also listed in 5.6. Determination of the support required can be obtained from two sources.

a) Documentation from the equipment manufacturers that lists the additional support (if any) needed for the system to operate under the parameters listed in 5.6.

b) Documentation of an analysis conducted by a competent organization or individual such as a qualified engineer, of the forces involved under the operating parameters listed in 5.6 that identifies what additional support (if any) is needed for the system to operate without exceeding the load (tension, compressive, axial) or bending limits established by the equipment manufacturers.

5.5.2 Hoses, corrugated metallic or composite

Hoses used as part of the transfer system shall be designed for LNG use and meet one of the hose standards listed in Table 1. The maximum load (stress), calculated by the manufacturer, that the hose can be placed under prior to its failure (parting) shall be documented.

5.5.2.1 Hose support loading arm and hose supports (saddles)

If used, shall conform to ISO 16904 or EN 1474-3 and be designed to safely support the loads (static and dynamic) imposed by the LNG transfer operations during hose connection, transfer operations and when the hose is disconnected under emergency conditions. They shall provide the necessary support so that the hose bending radius is not below recommended minimum bending radius specified by the hose manufacturer.

The minimum and maximum hose lengths and diameters the hose support loading arm and/or hose saddles can support shall be documented in the LNG bunkering procedures manual.

5.5.3 Transfer arms

Transfer arms shall at a minimum conform to the requirements of ISO 16904 or EN 1474-3 or the *Design and Construction Specification for Marine Loading Arms*.

5.5.4 Bunkering connections

Bunkering connections shall all be arranged in order to allow dry-disconnect operation and shall be

— dry-disconnect/connect coupling compliant with 5.5.5;

— flange bolting assembly (on provider side only), unless an assessment of operating procedures concludes that dry-disconnection can be achieved by procedural means;

— manual connect coupler (without check valves) on standardized flange;

— hydraulic coupler on standardized flange (without check valves);

— except in the case of an emergency release, drained and inerted before being disconnected.

5.5.5 Dry-disconnect/connect coupling

The coupling consists of a nozzle and a receptacle. The nozzle allows quick connection and disconnection of the fuel supply hose to the receptacle mounted on the LNG hose or transfer arm of the transfer system. Connectors used shall be designed to operate as quick connect/disconnect couplings and shall conform to the following requirements.

— Both the nozzle and the receptacle shall have an internal valve which are operated by each other. The volume between the two valves shall be as small as possible to prevent the loss of LNG during the disconnection process.

— Connection and disconnection shall be made with positive indication that connection is fully made. An interlock shall be included to ensure coupling cannot be disconnected with the valve in the open position.

— The maximum force to (dis)connect the nozzle from the receptacle shall be 350 N applied to the locking device (release mechanism).

— The coupling shall be supplied designed to prevent dust, moisture and other foreign debris from entering the receptacle when not in use or it shall be provided with protective caps and venting holes (if applicable) to provide such protection.

— End connections shall be flanges in accordance with ASME B16.5, Class 150.

— They shall be clearly and indelibly marked in English “Liquid Natural Gas use only” or “Natural Gas use only” as applicable. Additional markings in other languages are permissible. Liquid Natural Gas and Natural Gas may be abbreviated as LNG or NG.

— Designed so that ice that forms during or after transfer will not impede the function of the coupling or its dry disconnect valves when used in accordance with the manufacturer’s directions. This is to include internal ice formation.

5.5.6 Insulation flange

A single insulation (isolation) flange (built to meet applicable requirements of the International Oil Tanker and Terminal (ISGOTT) Safety Guide, 5th Edition) shall be provided (as recommended by the SGMF) in each transfer arm or hose of the transfer system between the receiving vessel manifold and the bunker pipeline. The installation shall not permit shorting out of this insulation; when bunkering from a mobile facility, the vehicle shall be grounded to an earthing point at the quay to prevent static build-up. The earthing point shall conform to local electrical codes.

Vessel-shore bonding cables/straps should not be used. If national or local regulations require a bonding cable/strap to be used, the circuit continuity shall be made via a “certified-safe” switch (such as one housed inside an inherently-safe enclosure) and the connection on board the vessel shall be in a location remote from the hazardous area. The switch shall not be closed until the bonding cable/strap has been connected and it shall be opened prior to disconnection of the bonding strap.

5.5.7 Fall arrest

If the distance that a transfer hose, connections, vapour return line could fall during a normal or emergency decoupling (release) operations could generate forces sufficient to damage any part of the

transfer system or result in the bending radius lower than recommended by the hose manufacturer, a fall arresting system (cable, sling or other) of a design adequate to support the transfer system shall be installed.

5.6 Identification of transfer equipment

The LNG bunker provider shall list the equipment and applicable operating parameters for the equipment that will be used during a bunkering operation including, if applicable, the return of natural gas (vapour return). This list shall at a minimum provide the following information:

a) connection types to which connection is possible;

b) diameter of hoses or pipes to be used;

c) ESD system or systems to be used;

d) maximum and minimum flow rates created by pumps or pressure differentials;

e) maximum pressure the transfer system could experience during transfer or in the event the breakaway emergency release system is triggered (the valve instantly closes, i.e. surge);

f) number of bunkering operations which can be conducted simultaneously;

g) equipment used, if any, for returning natural gas (i.e. vapour return);

h) horizontal and vertical distances that their system can transfer LNG;

i) weather conditions under which operation can take place including temperature, wind, precipitation, lighting;

j) limitations on sea state conditions under which operations can take place;

k) operating envelope of the transfer system taking into account the degrees of freedom, relative motion required in regard to h), i) and j);

l) lines for inerting the system

If the LNG provider has more than one type or size of transfer system or more than one pumping system, the information required by this subclause shall be listed separately for each system.

5.7 Transfer system design analysis

5.7.1 General

The LNG bunker provider shall conduct or have a transfer system design analysis conducted by a competent organization or individual such as a qualified engineer to confirm and document, at a minimum, the following:

— the functionality of the system (will the system function properly within its stated parameters);

— if all the components when assembled will function properly;

— the operating parameters for which the transfer system is designed to operate;

— all generated loads in the transfer system and stresses induced on the manifold piping systems do not exceed the maximum allowable stress stated in ISO 16904.

  If loads or stresses exceed the allowable limits, the system shall be redesigned until compliance is achieved.

— a listing of transfer system components and information as specified in 5.6.

5.7.2 Additional items to be considered to meet the requirements of 5.4.5:

If the option to use reduced equipment allowed in 5.4.5 is selected by the LNG bunker provider, the transfer system design analysis shall also confirm and document

— the LNG transfer rate will not exceed 150 m^3/h;

— the transfer system will maintain dry break integrity without leakage when transfer system is disconnected at extreme operation condition or incidental activation at maximum flow;

— the resultant surge pressures are determined and demonstrated to be within the capability of the supply system so as to not exceed the design pressure.

5.8 Maintenance

Equipment manufactured/fabricated to meet the specific standards identified in 5.3 to 5.6 shall be maintained and inspected according to the recommendations of the manufacturer of that equipment. Equipment whose design is not linked to a specific standard shall be maintained and inspected according to requirements set by the Flag State, Recognized Organization or Classification Society that complies with the applicable uniform interpretations and requirements posted by IACS.

5.9 Maintenance manual

The LNG provider shall maintain a maintenance manual for their transfer system. The manual shall contain a listing of each piece of equipment contained in the transfer system by serial number. The manual shall contain a list of the maintenance procedures and inspections recommended by the manufacturer and/or required by the competent authority for each piece of equipment. In addition, the user shall maintain a record of all maintenance and inspections conducted over the last 36 months.

6 LNG bunkering processes and procedures

6.1 Mooring

It is the responsibility of the Master(s) to ensure that the vessel(s) is/are securely moored in accordance with agreed/approved mooring plans. Mooring arrangements should take into account

— wind,

— current/tides,

— waves/swell,

— surges from passing vessels,

— ice, and

— changes in draught, trim or list.

Lines, fenders, winches and other mooring equipment shall be visually checked for wear or damage before bunkering commences.

6.2 Communication in preparation for a transfer

6.2.1 Prior to any connections being made in preparation of an LNG bunkering operation, the information described in 6.2.2 and 6.2.3 shall be provided (in written or electronic form).

6.2.2 Information that the LNG provider shall provide to the operator of the vessel being bunkered:

a) Information that shall be provided for each transfer:

— the information required in the IGF Code, Annex 1;

NOTE This information can be revised during the transfer if conditions or quantities involved change.

— saturation pressure of the LNG being bunkered;

— how net quantity delivered will be metered and calculated;

— any restrictions on bunkering operations that were identified in the risk assessment.

b) Information that shall be provided for the first transfer between the LNG provider to the operator of the receiving vessel and whenever the information has changed:

— location, if any, of LNG bunkering areas designated by the port or competent authority;

— if no location has been designated by a port or competent authority, the LNG provider shall provide evidence that the port or competent authority has approved the proposed location of the bunkering operation, unless the bunkering operations will take place outside of national waters;

— any restrictions imposed by the port or competent authority applicable to LNG bunkering operations;

— the transfer equipment that will be used including connection type, diameter of hoses or pipes, ESD system and any transfer system limitations in regard to sea states, distance, height or flow rates.

6.2.3 Information that the operator of the vessel to be bunkered shall provide to the LNG provider:

a) Information that shall be provided for each transfer:

— a description of other operations that will be taking place (including LNG and fuel oil bunkering, delivery of stores/lubes, cargo and passenger operation) and that existing procedures permit these operations simultaneously;

— any restrictions on bunkering operations that were identified in the risk assessment;

— available capacity of the LNG bunker tanks and amount of LNG being requested;

— temperature and pressure of the LNG bunker tanks;

— a statement that current conditions are within acceptable parameters of the risk assessment (see 6.3).

b) Information that shall be provided for the first transfer, between the operator of the receiving vessel and the LNG provider, and whenever the information has changed:

— the parameters under which their transfer system/equipment is capable of operating safely;

— connection types to which they can connect;

— diameter of hoses or pipes they can accept;

— ESD systems to which they can connect;

— maximum and minimum pump/flow rates they can accept;

— horizontal and vertical distances involved in transferring LNG to the vessel;

— weather conditions under which they can conduct a transfer including temperature, wind, precipitation, lighting;

— sea states limitations and conditions under which they can conduct a transfer;

— any restrictions imposed by the their competent authority applicable to LNG bunkering operations.

6.3 Risk assessments

6.3.1 General

The decision to establish or not to establish designated LNG bunkering areas remains within the discretion of the port or maritime authorities and is outside the scope of this document. However, there is a need to determine if the proposed bunkering location is acceptable for bunkering operations to be conducted. This determination shall be made after a risk assessment is conducted. While the vessel receiving the LNG is not required under this document to conduct a bunkering site assessment, the Captain or his delegate shall assess if the conditions at the proposed bunkering site are within the limits prescribed in their bunkering operations procedures and the bunkering operations can be conducted safely. In most cases, personnel involved in bunkering operations will not have the legal authority to require other ships, vessels or personnel to remain outside of any safety zone, or monitoring and security areas, that are determined necessary in the risk assessment. As a result, personnel involved in the transfer shall devise procedures to minimize the risks when a safety zone, or a monitoring and security area, in their provisions are violated. If safety or security zones are enacted by local authorities for the bunkering operation, a means of communication shall be established so that enforcement personnel will be notified in the event the safety or security zone restrictions are violated.

6.3.2 Risk assessment

A risk assessment shall be conducted and documented before a bunkering operation is conducted at a specific location. The risk assessment shall be conducted by or on behalf of the organization providing the LNG, or the national or local authorities that have jurisdiction over the safety and security where the bunkering operation takes place. The assessment will remain valid as long as the conditions documented in the assessment remain unchanged. If the conditions change, the assessment shall be revised or performed again.

6.3.3 Conditions considered

As a minimum, the risk assessment shall consider the following conditions:

— proximity of the bunkering location to areas where personnel, other workers, individuals and/or the public can be expected;

— proximity of the bunkering location to port infrastructure;

— marine traffic that could impact bunkering operations;

— expected sea states, tide changes, currents and weather conditions at the bunkering location;

— any hot work within the monitoring zone;

— acceptability and/or limitations on conducting other simultaneous operations (SIMOPS), e.g. cargo operations, bunkering of other fuels, or passenger loading, while LNG bunkering is taking place. Each pair or group of SIMOPS shall be considered separately (e.g. cargo operations and bunkering).

6.3.4 Assessment methodology

a) If the risk assessment is being performed to meet a requirement set by national or local authorities that have jurisdiction over the safety and security where the bunkering operation will take place, the assessment methodology used should conform to requirements set by the authorities.

b) All other assessments should be conducted using methodology that is either a deterministic approach or a risk-based approach and conforms to the guidelines listed for those approaches that are described in Annex B.

6.3.5 Acceptable bunkering parameters

Based on the results of the risk assessment, the LNG provider shall define:

— the controlled areas/zone (safety, hazard, etc.) that are required,

— the acceptable range of sea states, tidal changes, currents and weather conditions under which bunkering can take place safely, and

— any requirements applicable to the proposed bunkering location imposed by a competent authority that has jurisdiction over where the bunkering operation takes place.

6.4 Vessel safety assessments

Vessels involved with the bunkering operations are required by this document to meet the applicable requirements of the IGF or IGC Code as appropriate. The IGF Code requires specific risk/safety assessments to be conducted during vessel's design or modification. The vessel Captain or his delegate shall assess the conditions of the proposed transfer location to determine if they are within the parameters considered acceptable for the vessel to bunker.

6.5 Transfer procedures

6.5.1 LNG bunker operation shall be conducted in accordance with the detailed fuel handling manual and the emergency producers specified in 18.2.3 of the IGF Code that have been approved for the involved vessel or vessels by their Flag State, Recognized Organization or Classification Society that complies with the applicable uniform interpretations and requirements posted by IACS and has classed the vessel. Transfers from terminals or mobile facility shall be conducted in accordance with approved terminal or mobile facility transfer procedures.

6.5.2 This document requires a level of staffing during bunkering operations; however, it does not relieve the vessel captains or facility operators from their responsibilities.

6.5.2.1 For each bunkering operation, a qualified person in charge (PIC) for the receiving vessel and a person in charge for the LNG provider shall be assigned. These people shall have no other duties during the bunkering operations that can interfere with them performing their duties as a person in charge including being able to activate the ESD immediately if an unsafe condition occurs.

6.5.2.2 On the vessel being bunkered, there shall be a dedicated manifold watch that is able to communicate with the PIC and will monitor the transfer system for unsafe conditions. The manifold watch shall monitor the transfer operation via CCTV or shall be located close to the receiving manifold but not in harm's way. The manifold watch shall not be assigned any other duties that could interfere with monitoring of the transfer system or immediately communicating with the PIC and activating the ESD if an unsafe situation is observed.

6.5.2.3 The LNG provider shall allocate a dedicated hose watch that is able to communicate with the PIC and will monitor the transfer system for unsafe conditions. The hose watch shall monitor the transfer operation via CCTV or shall be located close to the discharge manifold but not in harm's way. The hose watch shall not be assigned any other duties that could interfere with monitoring of the transfer system or immediately communicating with the PIC and activating the ESD if an unsafe situation is observed.

6.5.3 Planned operations checklist "Part A" (see Annex A) shall be completed within 48 h of the planned bunkering operation and may be conducted in person or electronically as long as copies of the completed

signed (electronic signature is acceptable) checklists are available at the transfer location and retained in accordance with Clause 9.

6.5.4 The bunker provider is responsible for advising the receiving vessel of local regulatory requirements, notifications and competent authority approvals required for LNG bunkering operations.

6.5.5 The two PICs shall decide and agree who will make the manifold connections for receiving and delivering LNG and ensure the connections are secured and leak tested.

6.5.6 Unless other arrangements are made, the bunker transfer equipment shall be supplied and maintained by the LNG provider.

6.5.7 Communications for the transfer to be conducted shall meet the following requirements.

— The means of communication shall allow immediate communications between the two PICs.

— Communication shall be conducted in English or a language agreed upon during the pre-transfer conference. The language that will be used shall be recorded in Part B of the check sheet listed in Annex A.

— Electronic devices used for communications shall be of a type approved by the competent authority; both parties shall agree on the channel they will use exclusively during the transfer and will conduct no other operations on that channel. A dedicated hardwired telephone may be used; however, cell phones are not authorized.

— The above is in addition to the ESD LNG provider to vessel being bunkered link; however, the hardwired telephone could be incorporated into this link.

6.5.8 Pre-transfer conference shall be conducted before the transfer begins and the bunker checklists shall be signed and retained by both parties. The pre-transfer conference shall cover the information stated in Parts B to D of the check sheets listed in Annex A.

6.5.9 The transfer system between the last shut-off valves of the LNG provider and those of the vessel being bunkered shall be drained and purged without releasing the LNG or natural gas to the atmosphere when the bunkering operation ends. Mobile facility operations may substitute alternate procedures for this requirement if the alternate procedures are approved by the authorities with jurisdiction over mobile facility operations conducted at that location and do not result in the releasing the LNG or natural gas to the atmosphere.

6.5.10 Personnel protective equipment required. Personnel with assigned duties that will place them within close proximity of the LNG transfer system could be exposed to cryogenic liquid and cold gas in an emergency and shall wear as a minimum:

— a hard hat with face shield,

— safety shoes,

— protective cryogenic gloves with protective sleeves for arms and with elastic ends, and

— non-static electricity accumulating, flame retardant or cotton long sleeve shirt and pants.

6.5.11 Post-transfer conference shall be conducted upon completion of transfer operations and the bunker checklists shall be signed and retained by both parties. The post-transfer conference shall cover the information stated in Part E of the check sheets listed in Annex A.

7 Management system/quality assurance

7.1 Management systems

Organizations desiring to be compliant with this document shall list conformance with this document as a management objective in their management system. Management systems that can be used are ISO 9001, ISO 14001, ISM, ISO/TS 29001 and API Spec Q1.

7.2 Management systems for transfer equipment manufacturers

Equipment used in the transfer system shall conform to the standards listed for that equipment in the applicable clauses of this document and the manufacturer/fabricator of such equipment shall be compliant to one or more of the management systems listed in 7.1 or be listed on the API Composite List (for that piece of equipment).

8 Personnel training

8.1 Vessel personnel training requirements

Personnel on bunkering and receiving vessels shall meet the applicable training requirements outlined in the Seafarers' Training, Certification and Watchkeeping (STCW) Code for IGC Code vessels (vessels delivering the LNG) or the IGF Code (vessels receiving the LNG) regardless of whether the vessel is involved in international service or is under IMO size limits.

8.2 Additional training requirements for personnel involved in bunkering operations on vessels

8.2.1 General

In addition to meeting the training requirements specified in 8.1, personnel with assigned duties related to bunkering operations onboard a vessel shall also be trained on the following:

— all applicable requirements of this document and the procedures and documents developed by the vessel operators to conform with the requirements of this document;

— appropriate equipment specific familiarization with arrangements, procedures and operational characteristics that are relevant to their routine and emergency duties;

— actions to be taken and notifications to be made in the event that the LNG transfer procedures are not being followed or a dangerous situation has been observed.

8.2.2 Personnel providing LNG from port or mobile facilities training

This document requires personnel that will be conducting LNG bunkering operations from LNG bunkering terminals or mobile LNGN facilities to be trained in accordance with local regulations and industry standards and all applicable requirements of this document and the procedures and documents developed by the vessel operators to conform with the requirements of this document.

8.3 Documentation of training

Organizations desiring to comply with this document shall maintain records that document that their personnel are current with the training requirements listed in this clause as applicable. This document shall list the personnel and the dates they received this training. Refresher training on the requirements of this document shall be repeated every 5 years.

9 Records and documentation

The following records and documents shall be maintained by parties that comply with this document:

— The transfer system analysis required by 5.7. This information shall be readily accessible to an auditor during a management system audit if compliance is being assessed.

— Documentation from a Flag State, Recognized Organization or Class Society indicating the vessels involved and equipment or procedures subject to their approval comply with applicable rules. This information shall be readily accessible to an auditor during a management system audit if compliance is being assessed.

— Documentation indicating port facilities, vehicles or portable tanks (if any) are in compliance with the requirements of this document. This information shall be readily accessible by personnel involved in LNG bunkering operations and to an auditor if compliance is being assessed.

— A listing of maintenance and inspections for equipment recommended or required by the equipment manufacturers' of the equipment listed in 5.6 and a record for at least the last 36 months of inspections or maintenance performed on this equipment. These records shall be adequately detailed to identify the specific equipment involved, what was done, the date it was performed, personnel involved and the findings. This information shall be readily accessible by personnel involved in LNG bunkering operations and to an auditor if compliance is being assessed.

— Copies (electronic or hard copy) of all completed checklists for at least the past 12 months. This information shall be readily accessible to an auditor if compliance is being assessed.

— Training records (electronic or hard copy) as required in 8.2 shall be maintained for at least 5 years. These records shall identify the contents of the training received, names of people receiving the training, date of training, method of training (e.g. classroom, online or supervised on-the-job training), date of training and how satisfactory performance was evaluated. This information shall be readily accessible to an auditor during a management system audit if compliance is being assessed.

— Copies of the risk assessment required in 6.3 or 6.4.

— LNG bunkering procedures manual that provides:

  — all personnel involved with LNG bunkering operations with a description of their duties (including meeting the requirements of this document) related to LNG bunkering before, during and after LNG bunkering operations are conducted including actions to be taken in an emergency;

  — a description of the bunkering parameters for which the bunkering transfer system or vessels/facilities involved have been designed;

  — listing of any limitations on bunkering operations that were identified in the risk assessment or imposed by competent authorities;

  — listing of personnel currently qualified to conduct LNG bunkering operations;

  — a listing of maintenance and inspections for equipment of the equipment involved in the LNG transfer;

  — listing of emergency contact information.

The manual may be incorporated into existing procedure manuals as long as the manual is readily accessible to involved personnel at each transfer site and to auditors. The LNG bunkering procedures manual should be readily accessible to personnel involved in LNG bunkering operations and to an auditor during a management system audit if compliance is being assessed.

Annex A
(normative)

LNG bunker checklists

The following checklists (Part A to E) were developed for use with this document, alternative check lists may be used as long as they contain at least the same information that is listed in the attached check sheets. 6.2.1 and 6.2.2 may be considered and checklist items that apply to those items that need to only be conveyed once (and after any changes) need not be checked off after the first transfer if both parties involved in the transfer agree and local or national authorities allow the omission.

As an option, the LNG bunker checklists (version 3.6, 2015) developed by SGMF and the International Association of Ports and Harbors (IAPH) published by IAPH (http://lngbunkering.org/lng/bunker-checklists) may be used in place of the attached checklists under the following conditions:

a) both parties involved agree to use the alternative checklists;

b) the competent authorities permit their use;

c) the same checklists are used from pre-operations through completion of the transfer (no mixing of lists).

LNG BUNKER CHECKLIST

Part A: Planned Operations Checks

This part of the checklist should be completed by the LNG bunker provider and receiver independently within 48 h in advance of a planned LNG bunker operation.

Planned date and time **LNG receiving vessel**

_____ _____

Port and Berth or location **LNG bunker vessel**

_____ _____

	Check	Receiving vessel	Bunker vessel	Bunker terminal	Remarks
1	Emergency fire plans are located externally				Location:
2	International shore connection available				Location:
3	Firefighting equipment available for use				
4	Gas detection equipment tested, calibrated and available for use				
5	Personnel protective equipment available for use				
6	Water spray system available for use				
7	Spill containment and hull protection system in place				
8	LNG transfer pumps and/or equipment in working order				
9	Remote control valves tested and in working order				
10	LNG tank pressure control equipment in working order				
11	Instrumentation, control, shutdown and safety devices in working order				
12	Bunker plans, operations manual and emergency procedures are available				

	Check	Receiving vessel	Bunker vessel	Bunker terminal	Remarks
13	Personnel have required training and are instructed in the use of the equipment and procedures				
14	Bunker provider list of local Port State Control (PSC) restrictions or notifications required as a condition of the planned bunkering operation (i.e. wind speed less than 25 knots):				
	a. _____ b. _____ c. _____ d. _____				

DECLARATION

The undersigned as applicable have checked the above items in Part A and are satisfied that the entries made are correct.

Receiving vessel	Bunker vessel	Bunker terminal
Name:	Name:	Name:
Position:	Position:	Position:
Signature:	Signature:	Signature:
Date:	Date:	Date:
Time:	Time:	Time:

Instructions for completing this checklist

This independent declaration should be signed only by the applicable party. Once signed, copies of this document shall be kept onboard the LNG receiving vessel and the bunker vessel or terminal (as appropriate) for at least 1 year.

LNG BUNKER CHECKLIST

Part B: Pre-Operational Checks

This part of the checklist should be completed jointly by all appropriate parties, including any terminal where vessel to vessel bunkering occurs, immediately before the start of transfer operations.

Planned date and time **LNG receiving vessel**

_____ _____

Port and Berth or location **LNG bunker vessel**

_____ _____

	Check	Receiving vessel	Bunker vessel	Terminal	Code	Remarks
1	Part A has been completed and conditions noted have not changed				A	
2	Permission (if applicable) for LNG bunkering received and notifications made				P	
3	Present weather and wave conditions are within agreed limits				A, R	
4	Vessels are securely moored with sufficient fendering				R	
5	There is a safe means of access between the vessels				R	
6	The LNG bunker manifold is sufficiently illuminated				A, R	
7	The vessels are able to move under their own power in a safe and unobstructed direction				R	
8	Adequate supervision by responsible individuals is in place				R	
9	The method of electrical insulation has been agreed upon				A	
10	The controlled area designated, marked and free of unauthorized personnel				A, R	Location:
11	Control of ignition sources in controlled area implemented				A, R	
12	Material safety data sheets (MSDS) for LNG available				A	
13	External doors, portholes and accommodation ventilation inlets closed				A	

	Check	Receiving vessel	Bunker vessel	Terminal	Code	Remarks
14	An effective means of communication has been tested and language for communication agreed upon				A	Language that will be used: Primary system: Backup system: VHF/UHF Channel:
15	Emergency procedures reviewed and emergency shutdown systems (ESD) tested. Closing times for ESD's exchanged				A	Emergency stop signal: Provider ESD: _____ s Receiver ESD: _____ s
16	Procedures for prevention of falling object in place				A	
17	An effective deck watch has been established to monitor mooring				R	
18	An effective LNG bunker oversight has been established to monitor piping and controls				R	
19	Personnel working in the vicinity of the LNG bunker manifold are using appropriate personnel protective equipment				R	
20	Dry-break couplings installed on LNG bunker connections are in working order				A	
21	Bunker connections are adequately supported, properly connected and leak tested. Unused connections are closed, blanked and fully bolted				A	
22	Procedures for purging, cool down and LNG transfer operations have been agreed by the receiving vessel and provider				A	
23	Part C has been completed				A	
24	The receiving vessel confirms that LNG bunker operations can commence				P	Time notified: _____ h

DECLARATION

The undersigned as applicable have checked the above items in Part B and are satisfied that the entries made are correct.

Receiving vessel	Bunker vessel	Bunker terminal
Name:	Name:	Name:
Position:	Position:	Position:
Signature:	Signature:	Signature:
Date:	Date:	Date:
Time:	Time:	Time:

Instructions for completing this checklist

The "codes" indicate the following:

a) A (Agreement): indicating an agreement or procedure that may be detailed in the "Remarks" column;

b) R (Re-check): indicating that the item will be periodically reconfirmed at intervals agreeable to the parties;

c) P (Permission): indicating that permission has been granted by the appropriate authorities.

This joint declaration should be signed only when both parties have checked and accepted their assigned responsibilities. Once signed, copies of this document shall be kept onboard the LNG receiving vessel and the bunker vessel or terminal (as appropriate) for at least 1 year.

LNG BUNKER CHECKLIST

Part C: LNG Transfer

This part of the checklist should be completed immediately before the start of transfer operations by the LNG bunker provider and receiver.

Planned date and time

_____

LNG receiving vessel

_____

Port and Berth or location

_____

LNG bunker vessel

_____

AGREED STARTING TEMPERATURES AND PRESSURES

Note the agreed physical quantity unit (PQU): m^3 Tonnes _____

	Receiving vessel		Provider		Units[a]
	Tank 1	Tank 2	Tank 1	Tank 2	
LNG tank start temperature					°C/°F
LNG tank start pressure					bar/psi/MPa (absolute)
Available LNG tank capacity					PQU

[a] Delete as appropriate.

AGREED BUNKER OPERATIONS

	Receiving vessel		Units[a]
	Tank 1	Tank 2	
Agreed quantity to be transferred			PQU
LNG tanks start pressure			bar/psi/MPa (absolute)
Start pressure at manifold			bar/psi/MPa (gauge)
Starting flow rate			PQU per hour
Maximum transfer flow rate			PQU per hour
Topping off flow rate			PQU per hour
Maximum pressure at manifold			bar/psi/MPa (gauge)

[a] Delete as appropriate.

AGREED MAXIMUM AND MINIMUM BUNKERING PARAMETERS

Receiving vessel	Maximum	Minimum	Units[a]
LNG bunker tank pressure			bar/psi/MPa (absolute)
LNG temperature			°C/°F
Filling limit of LNG bunker tanks			%

[a] Delete as appropriate.

AGREED SIMOPS LNG BUNKER/OIL BUNKER/CARGO OPERATIONS[1)]

Activity	Receiving vessel	Bunker vessel	Bunker terminal

RESTRICTION ON AGREED DEVIATION IN LNG BUNKER OPERATIONS[2)]

Activity	Receiving vessel	Bunker vessel	Bunker terminal	Mitigation measures

DECLARATION

The undersigned as applicable have checked the above items in Part C and are satisfied that the entries made are correct. We have arranged for the repetitive checks, noted as code "R" in Part B, to be re-checked at intervals not exceeding ___ min. If, to our knowledge, the status of any item changes, we will immediately inform the other party.

Receiving vessel	Bunker vessel	Bunker terminal
Name:	Name:	Name:
Position:	Position:	Position:
Signature:	Signature:	Signature:
Date:	Date:	Date:
Time:	Time:	Time:

Instructions for completing this checklist

This joint declaration should be signed only when both parties have agreed on the information. Once signed, copies of this document shall be kept onboard the LNG receiving vessel and the bunker vessel or terminal (as appropriate) for at least 1 year.

1) Complete Part D for simultaneous activities (SIMOPS). Note that for oil bunkering operations, a separate checklist should be completed.

2) Record additional restrictions resulting from checks in Parts A and B.

LNG BUNKER CHECKLIST

PART D: SIMOPS

This part of the checklist should be completed by all appropriate parties, including terminals where vessel to vessel bunkering takes place, immediately before starting the transfer.

Planned date and time

_____

LNG receiving vessel

_____

Port and Berth or location

_____

LNG bunker vessel

_____

	Check	Receiving vessel	Bunker vessel	Terminal	Code	Remarks
1	LNG bunkering simultaneously with other fuels is in accordance with the vessel's fuel handing manual				A	
2	LNG bunkering simultaneously with cargo operations is in accordance with terminal procedures				A	
3	Competent authorities have granted permission (if applicable) for simultaneous operations				P	
4	Safety measures are agreed upon and observed				A, R	

DECLARATION

The undersigned as applicable have checked the above items in Part D and are satisfied that the entries made are correct.

Receiving vessel	Bunker vessel	Bunker terminal
Name:	Name:	Name:
Position:	Position:	Position:
Signature:	Signature:	Signature:
Date:	Date:	Date:
Time:	Time:	Time:

Instructions for completing this checklist

The "codes" indicate the following:

a) A (Agreement): indicating an agreement or procedure that may be detailed in the "Remarks" column;

b) R (Re-check): indicating that the item will be periodically reconfirmed at intervals agreeable to the parties;

c) P (Permission): indicating that permission has been granted by the appropriate authorities.

This joint declaration should be signed only when both parties have checked and accepted their assigned responsibilities. Once signed, copies of this document shall be kept onboard the LNG receiving vessel and the bunker vessel or terminal (as appropriate) for at least 1 year.

LNG BUNKER CHECKLIST

Part E: Post-Transfer Checklist

This part of the checklist should be completed jointly by the bunker provider and receiver at the completion of transfer operations.

Planned date and time **LNG receiving vessel**

_____ _____

Port and Berth or location **LNG bunker vessel**

_____ _____

	Check	Receiving vessel	Bunker vessel	Bunker terminal	Remarks
1	Manifold valves are closed and ready for disconnection				
2	LNG bunkering lines have been warmed-up, purged and ready for disconnection				
3	Controlled area has been deactivated and vessels in the vicinity notified				
4	The receiving vessel has been notified that LNG bunkering is complete				Time notified: _____ h.
5	Near missies and incidents reported to competent authorities				Report number:

RECORD OF PERIODIC CHECKS

A record of periodic re-check of conditions as agreed in Parts B and D. Observations should be noted under “Remarks”.

Date	Time	Receiving vessel	Bunker vessel	Bunker terminal	Remarks

DECLARATION

The undersigned as applicable have checked the above items in Part E and are satisfied that the entries made are correct.

Receiving vessel	Bunker vessel	Bunker terminal
Name:	Name:	Name:
Position:	Position:	Position:
Signature:	Signature:	Signature:
Date:	Date:	Date:
Time:	Time:	Time:

Instructions for completing this checklist

This joint declaration should be signed only when both parties have agreed on the information. Once signed, copies of this document shall be kept onboard the LNG receiving vessel and the bunker vessel or terminal (as appropriate) for at least 1 year.

Annex B
(normative)

Risk assessment and controlled zones

B.1 General

A risk assessment needs to be conducted to determine if a location is acceptable for LNG bunkering operations. The assessment needs to consider

a) if the location is subject to any influences that could hinder a safe LNG bunkering operation, and

b) if there is an accident and LNG/gas is released will the damage be minimized.

Examples of influences that could hinder a safe LNG bunkering operation include the following:

— marine traffic;

— sea states, currents, tidal actions;

— winds;

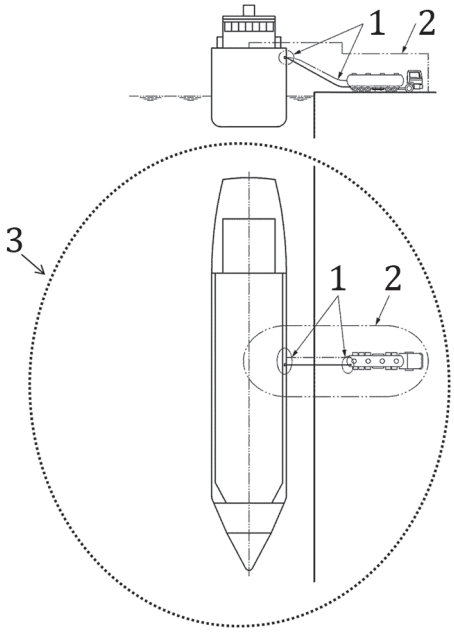
— severe weather;

— trespassing personnel.

If LNG or natural gas is accidently released, it will spread out, warm and rise slowly. Once it achieves an air fuel mixture that will support combustion, it will burn when an ignition source is found. A safety zone designed to ensure that only essential personnel and activities are allowed in the area that could be exposed to a flammable gas in case of an accidental release of LNG or natural gas during bunkering shall be created. This annex provides guidance on the determination of that safety zone.

The safety zone will normally be inside the monitoring/security area and shall encompass hazardous zones defined by IEC 60079-10-1 or other relevant regulations. Figure B.1 illustrates the relative location of the safety zone, the hazardous zone and monitoring and security area related to the bunkering facility. The combined hazardous zones (including relief valve vent outlets) and safety zones for the LNG receiver and LNG provider shall be considered in this risk assessment, particularly if they are in the proximity of unsecured ventilation inlets.

The monitoring and security area is a larger area that extends beyond the safety zone and is established to monitor vessel traffic and other activities that could be a threat during the bunkering operation. The monitoring and security area shall be established by the LNG provider and competent local authorities. Procedures for establishing monitoring and security areas are beyond the scope of this document. Restricted areas within the port facility, required by the International Ship and Port Security (ISPS) Code, may constitute a portion of the monitoring and security area, however, are typically larger in extent.

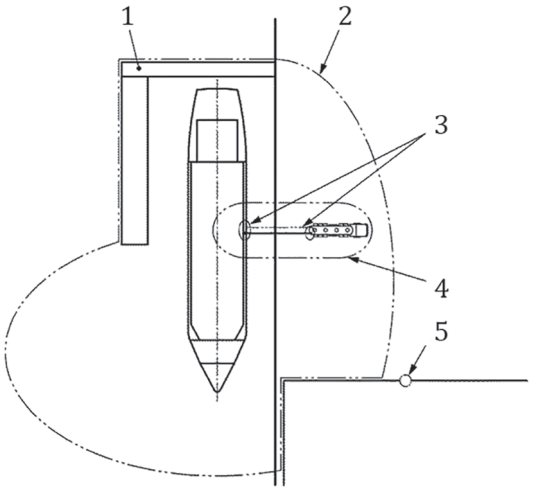


Key

1 hazardous zone
2 safety zone
3 monitoring and security area

Figure B.1 — Illustration of the relationship of the hazardous zone, safety zone and monitoring and security area

Physical barriers to prevent other vessels or personnel from approaching the bunkering site (i.e. breakwaters) may be considered and could allow the size of the monitoring/security area to be reduced in size (see Figure B.2).



Key

1 physical barrier
2 monitoring and security area
3 hazardous zone
4 safety zone
5 secure ISPS facility

Figure B.2 — Illustration of how existing security facilities and physical barriers may be used to reduce the size of the monitoring and security area

The extent of the safety zone can be determined by the following:

1) a deterministic approach calculating the distance to LFL based on a maximum credible release;

2) a risk-based approach.

The deterministic approach is based on a calculation of the distance to LFL for a maximum credible release conservatively defined as part of the HAZID. This calculation needs to consider both horizontal and vertical releases and subsequent dispersion.

If the probabilistic approach is used, this will normally result in a smaller safety zone compared with the distance to LFL for the maximum credible release. In such cases, it is important that the risk criteria to be used are agreed with by the national and/or local authorities that have jurisdiction over safety and security zones and the emergency response plan need to address scenarios where flammable gas may occur outside the safety zone.

Further, the safety distance shall never be zero and the safety zone shall never be less than the minimum distance as defined by national authorities and marine requirements for the receiving vessel.

B.2 Deterministic assessment of the safety zone

The safety zone is defined as the area within the distance to LFL as determined by a recognized and validated dispersion model for the maximum credible release as defined as part of the HAZID.

The maximum credible release shall reflect the characteristics of the bunkering facility (dimensions, capacity, transfer rate, temperature/pressure, and if installed, vapour return) as well as the safeguards that are implemented.

The HAZID should include all reasonable mechanisms for a release. Examples of maximum credible releases include but are not limited to:

a) release of the trapped inventory in the bunkering transfer line

A worst case scenario for a bunkering facility can be defined as the rupture of the bunkering line due to drift off of the vessel due to a collision or a mooring failure. The determination of the maximum credible release in this example is based on the following arguments:

— Collisions or loss of mooring is normally pre-warned and it is realistic to assume that ESD has been activated.

— ERS or break away couplings will be installed, but it is assumed that one fails. For installations with multiple transfer lines, it is therefore assumed that the inventory in one line is released while the others will be protected by the ERS/break away coupling.

Based on these assumptions, the release amount is determined as the inventory between the two ESD valves.

The graph in Figure B.3 shows the distance to LFL as a function of atmospheric LNG.

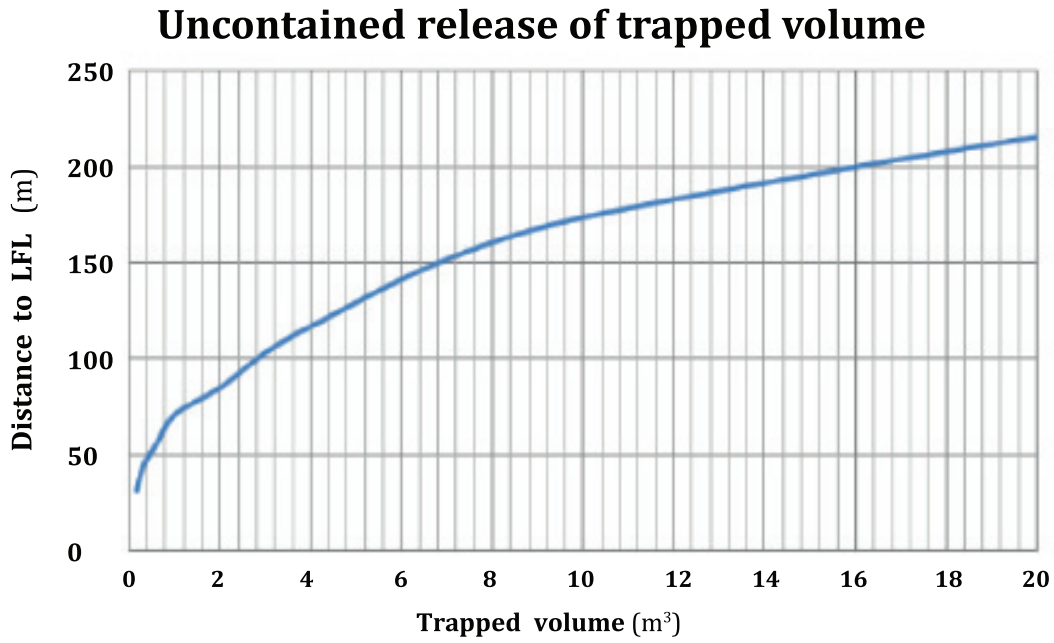


Figure B.3 — Distance to LFL as a function of the release volume

b) release of LNG through a broken instrument connection

The maximum credible release is defined as a broken instrument connection. Such scenarios may occur without automatic detection and is conservatively represented by a continuous release through a 25 mm hole. ESD is not activated and the pressure inside the transfer system is maintained by the cargo pumps. The distance to LFL as a function of the system pressure is shown in Figure B.4.

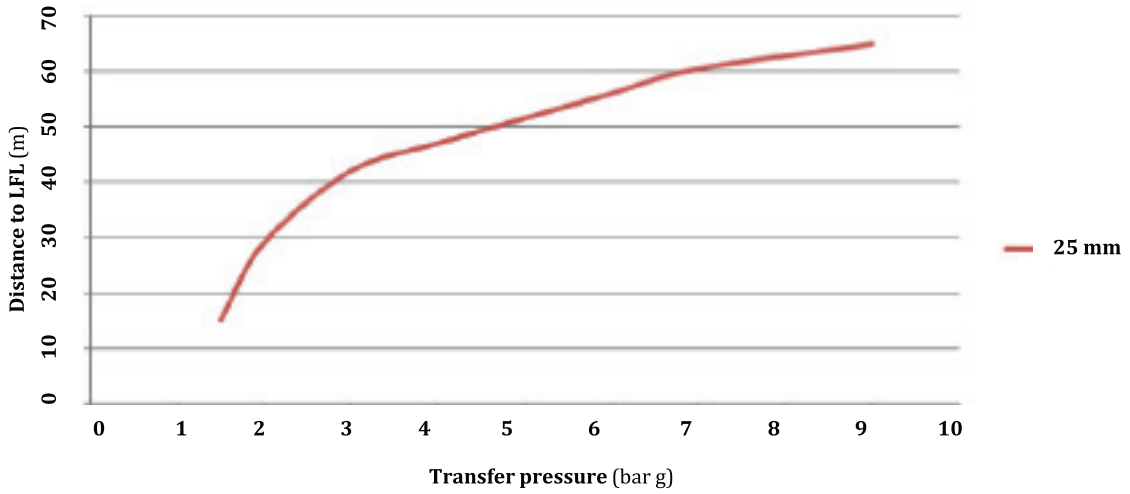


Figure B.4 — Distance to LFL as a function of the system pressure (assuming a 25 mm hole)

B.3 Risk-based approach for the safety zone

A smaller safety zone may be accepted, provided that it can be demonstrated by the Quantitative Risk Assessment that risk acceptance criteria can be met for first, second and third party personnel.

— The risk assessment should address all release scenarios as identified in the HAZID and reflect validated (or conservative) failure data.

— The risk assessment can recognize implemented, “hard-wired” safeguards based on conservative assumptions.

— The modelling of the release and dispersion need to take into account the following:

  — hole size reflecting the installed equipment and validated failure data. If validated failure data is not available, conservative assumptions shall be made;

  — release height and dispersion elevation;

  — outflow conditions;

  — evaporation/flashing of LNG reflecting LNG properties and heat transfer from ground/water;

  — heavy gas dispersion;

  — weather/wind conditions;

  — properties of the LNG, reflecting release conditions.

— Ignition probabilities shall reflect installations and operations and be applied with reference to IEC 600079-10-1 for:

  — the hazardous areas;

  — inside the safety zone;

  — outside the safety zone.

— The risk assessment shall normally assume that:

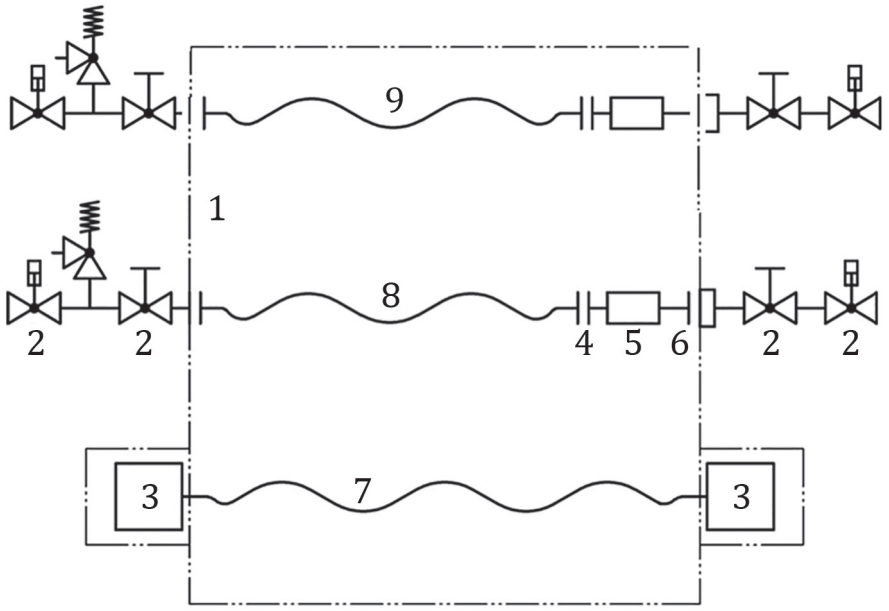
  — first party personnel (crew and bunkering personnel) are continuously present in the safety zone during bunkering;

  - second party personnel (port and terminal operator, other vessel crew) are continuously present directly outside the safety zone during bunkering;
  - third party personnel (passengers and other persons visiting the site) can be present, but will not be continuously exposed to the risk;
  - third party personnel continuously present (residential areas, schools and hospitals) will be outside the risk contour for third party acceptance.
- The risk assessment shall assess all hazard scenarios identified in the HAZID and as a minimum assess flash fires, jet fires, pool fires.
- The impact on personnel shall primarily assess the initial events. Escalating events will be delayed and the impact should consider the efficiency of evacuation and emergency preparedness.
- The risk assessment should consider the risk exposure for first, second and third party personnel.

If the risk is acceptable in accordance with the acceptance criteria (as agreed with authorities), the smaller safety zone is acceptable.

Annex C
(informative)

Illustrations



LNG Provider **LNG Receiving Vessel**

Key

1 scope
2 automatic and manual ESD valves
3 ESD junction box
4 insulation flange
5 emergency release coupling
6 QC/DC (if used)
7 ship/shore or ship/ship ESD link
8 loading system (systems include: vessel to vessel transfer arms, articulated rigid piping and hoses)
9 vapour return system

Figure C.1 — Typical LNG bunkering transfer system

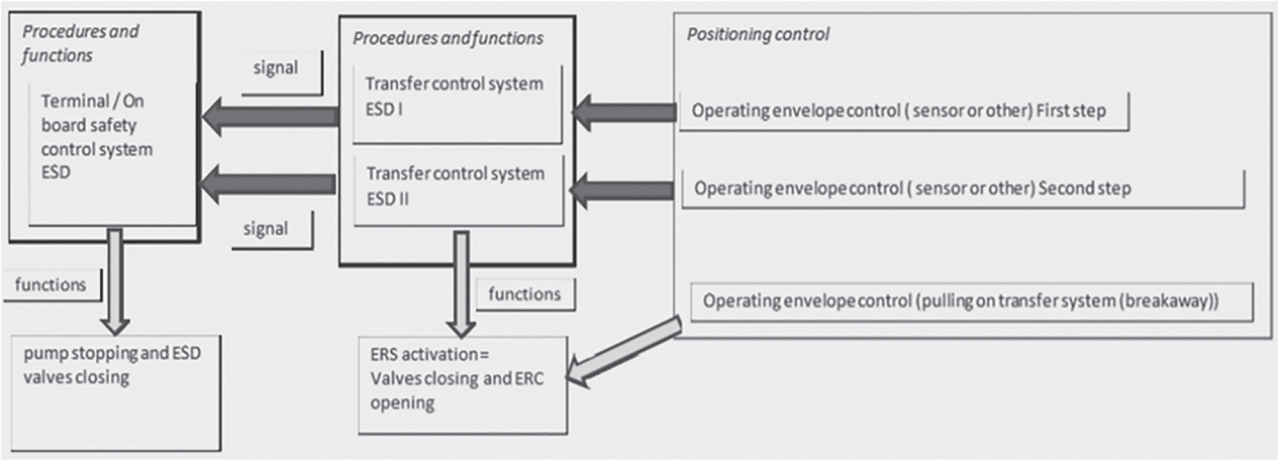


Figure C.2 — Example of functional diagram with both ESD I and ESD II

ESD I: First step alarm and procedure on transfer system side, coming from operating envelope control or operator action with a signal to generate an ESD at the terminal (ESD II as per terminal language).

ESD II: Second alarm and procedure on transfer system side to generate physical disconnection (activation of the ERS valves and ERC).

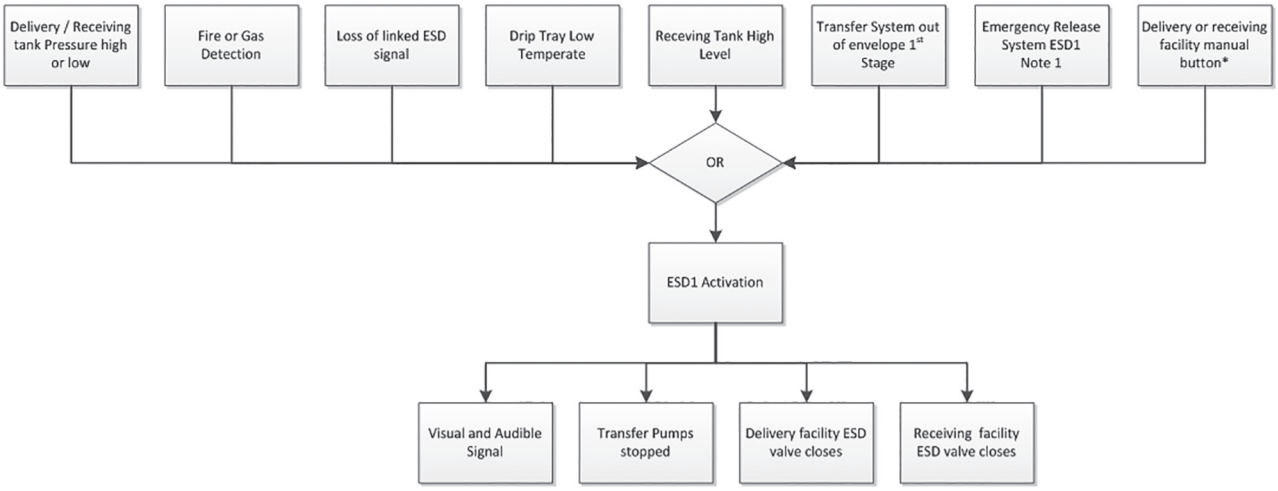


Figure C.3 — Example of ESD initiators

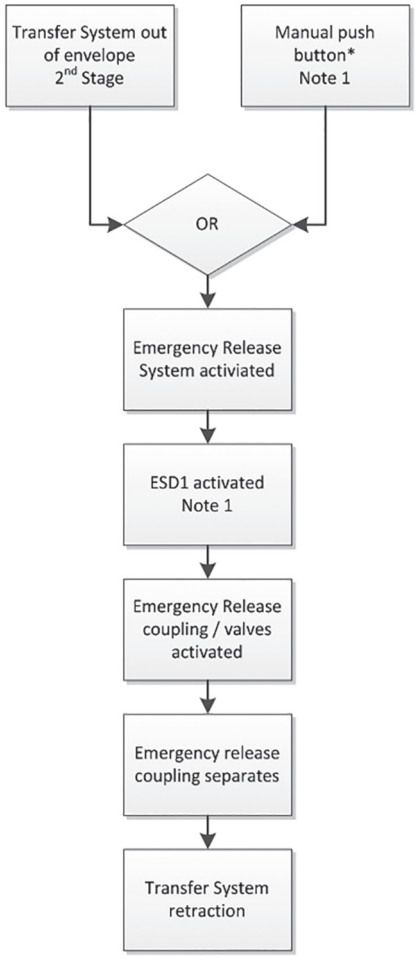


Figure C.4 — Note 1 — Example of ERS initiators

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