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Date: 14 August 2023

Origin: International

Latest date for receipt of comments: 04 October 2023

Project No. 2022/00211

Responsible committee: PTI/12 Petroleum Measurement and Sampling

Interested committees:

Title: Draft BS ISO 11982 Refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels — Liquefied Natural Gas (LNG) as marine fuel — Measurement on board LNG bunkering ship.

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Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

DRAFT INTERNATIONAL STANDARD

ISO/DIS 11982

ISO/TC 28/SC 5

Secretariat: JISC

Voting begins on:
2023-08-11

Voting terminates on:
2023-11-03

Refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels — Liquefied Natural Gas (LNG) as marine fuel — Measurement on board LNG bunkering ship

Hydrocarbures réfrigérés et combustibles gazeux liquéfiés à base non pétrolière — Utilisation du Gaz Naturel Liquéfié (GNL) comme combustible marin — Mesurage à bord des navires avitailleurs de GNL

ICS: 75.180.30

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Reference number
ISO/DIS 11982:2023(E)

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Published in Switzerland

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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.

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For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 28, Petroleum and related products, fuels and lubricants from natural or synthetic sources, Subcommittee SC 5, Measurement of refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The world needs cleaner marine fuel. Sulphur contents restriction in marine fuel oil by IMO MARPOL ANNEX IV was an opportunity. Decarbonization trend surged at the same time.

Meanwhile, LNG as marine fuel is one of the most practical choices. It is considered as cleaner marine fuel than conventional fuel oils. It has been more than a half century since LNG mass transportation by marine vessels. The trade volume by one shipment is large, the total capacity of one hundred seventy thousand cubic meter is the standard size of LNG carrier currently. The trade quantity is calculated in accordance with the method that defined by the Sales and Purchase Agreement, contract between cargo supplier and receiver. The quantity calculation method is established in almost all cases, some agreements refer to ISO standards.

On the other hand, trade quantity of LNG as marine fuel by one shipment can be quite smaller than the conventional trade volume, maybe a few hundred cubic meters to a few ten thousand cubic meters only. Furthermore, the LNG containment system of the LNG bunkering ship is unlike the conventional LNG carriers' systems. Tank type of IMO type C, membrane and SPB type are available at this moment.

In addition to the difference in trade quantity and cargo containment system, there is a need of calculating the energy transferred during operations. This requires calculations of not only quantity but also quality of transferred liquid and vapour as well as utilised gas during the transfer operation. Taking these into consideration, this document is published.

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Refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels — Liquefied Natural Gas (LNG) as marine fuel — Measurement on board LNG bunkering ship

1 Scope

This document gives guidance for quantification of liquefied natural gas (LNG) as marine fuel on board LNG bunkering ships.

It is applicable to the measurement of LNG from any source, e.g. gas from conventional reservoirs, shale gas, coalbed methane, at the time of

- Ship to Ship (STS) transfer to LNG-fuelled ships,
- Ship to Ship (STS) transfer between LNG bunkering ships, and
- transfer to or from shore tanks or other facilities, with no regard to the type of tanks.

This document is also applicable to the quantification of biomethane and synthetic methane from fossil fuels or renewable sources.

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 6976:2016, *Natural gas — Calculation of calorific values, density, relative density and Wobbe indices from composition*

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:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

liquefied natural gas

LNG

liquid composed predominantly of methane

[SOURCE: ISO 6578:2017, 3.1.3]

3.2

LNG bunkering ship

ship that supplies LNG (3.1) as marine fuel to LNG-fuelled ships

3.3

LNG-fuelled ship

ship that utilises LNG (3.1) for the purpose of propulsion

3.4

LNG carrier

cargo ship specifically constructed and used for the carriage of *LNG* (3.1) in bulk

[SOURCE: ISO 10976:2015, 3.1.20]

3.5

custody transfer measurement

measurement of liquid level, liquid and *vapour* (3.11) temperature, *vapour pressure* (3.12) and analysis of the composition of *LNG* (3.1) to be delivered to/from a tank, by which volumetric and other data are determined to be a basis of payment of cost or assessment of duty

[SOURCE: ISO 19970:2016, 3.4]

3.6

custody transfer measurement system

CTMS

system that processes inputs from an *ATG* (3.7) system, thermometers, pressure gauges, etc., and provides *custody transfer measurement* (3.5) information on board, generating documents with regard to custody transfer of *LNG* (3.1)

Note 1 to entry: The ATG system can be incorporated as part of a CTMS.

[SOURCE: ISO 18132-1:2011, 2.1.4]

3.7

automatic tank gauge

ATG

instrument that automatically measures and displays liquid levels or ullages in one or more tanks, either continuously, periodically or on demand

[SOURCE: ISO 10976:2015, 3.1.4]

3.8

tank capacity table

tank table

calibration table

capacity table

table showing the capacities of, or volumes in, a tank corresponding to various liquid levels measured from a reference point

[SOURCE: ISO 8911:2013, 3.18]

3.9

trim

difference between the fore and aft draught of the vessel

Note 1 to entry: When the aft draught is greater than the forward draught, the vessel is said to be trimmed by the stern. When the aft draught is less than the forward draught, the vessel is said to be trimmed by the head.

[SOURCE: ISO 8911:2013, 3.19]

3.10

list

transverse inclination of a ship

Note 1 to entry: It is expressed in degrees.

[SOURCE: ISO 8911:2013, 3.7]

3.11**vapour**

fluid in the gaseous state that is transferred to/from or contained within the cargo tank

[SOURCE: ISO 10976:2015, 3.1.29]

3.12**vapour pressure**

pressure at which a liquid and its *vapour* ([3.11](#)) are in equilibrium at a given temperature

[SOURCE: ISO 10976:2015, 3.1.30]

3.13**absolute pressure**

total of the gauge pressure plus the pressure of the surrounding atmosphere

[SOURCE: ISO 10976:2015, 3.1.1]

3.14**bunker delivery note****BDN**

proprietary document of the bunker supplier providing details of the quality and quantity of the bunker(s) delivered by the LNG bunkering ship to the LNG-fuelled ship

[SOURCE: ISO 22192:2021, 3.6, modified — replaced the bunker tanker and the vessel to the LNG bunkering ship to the LNG-fuelled ship]

3.15**gross calorific value**

amount of heat that would be released by the complete combustion with oxygen of a specified quantity of gas, in such a way that the pressure, p_1 , at which the reaction takes place remains constant, and all the products of combustion are returned to the same specified temperature, t_1 , as that of the reactants, all of these products being in the gaseous state except for water, which is condensed to the liquid state at t_1

Note 1 to entry: t_1 and p_1 are combustion reference temperature and combustion reference pressure, respectively.

[SOURCE: ISO 6976:2016, 3.1, modified — Note 1 to entry has been replaced.]

3.16**net calorific value**

amount of heat that would be released by the complete combustion with oxygen of a specified quantity of gas, in such a way that the pressure, p_1 , at which the reaction takes place remains constant, and all the products of combustion are returned to the same specified temperature, t_1 , as that of the reactants, all of these products being in the gaseous state

[SOURCE: ISO 6976:2016, 3.2, modified — Note 1 to entry has been removed.]

3.17**Methane Number**

rating indicating the knocking characteristics of a fuel gas

Note 1 to entry: It is comparable to the octane number for petrol. One expression of the Methane Number is the volume percentage of methane in a methane-hydrogen mixture, that in a test engine under standard conditions has the same tendency to knock as the fuel gas to be examined.

[SOURCE: ISO 14532:2014, 2.6.6.1]

3.18

Wobbe index

calorific value on a volumetric basis at specified reference conditions, divided by the square root of the relative density at the same specified metering reference conditions

Note 1 to entry: The Wobbe index is specified as superior (denoted by the subscript “S”) or inferior (denoted by the subscript “I”), depending on the calorific value.

[SOURCE: ISO 14532:2014, 2.6.4.3]

3.19

calibration

operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

[SOURCE: JCGM 200:2012, 2.39]

3.20

verification

process of confirming the accuracy of an instrument by comparing to a source with known *uncertainty* ([3.22](#))

[SOURCE: ISO 10976:2015, 3.1.31]

3.21

biomethane

methane rich gas derived from biogas or from gasification of biomass by upgrading with the properties similar to natural gas

[SOURCE: ISO 14532:2014, 2.1.1.15]

3.22

flowmeter

flow measuring device which indicates the measured flowrate

[SOURCE: ISO 19970:2016, 3.6]

3.23

uncertainty

non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

[SOURCE: ISO 19970:2016, 3.13]

4 Onboard measurement

4.1 Outline

Proper onboard measurement is mandatory to have reliable energy determination. Energy transferred will be calculated via volume/mass and composition of the product transferred. There are two kinds of measurement principle, one is static and the other is dynamic. The measurement equipment which related with the cargo measurement shall be calibrated and verified with reasonable uncertainty.

Either volume or mass, or both, of LNG bunker is obtained by measurement onboard LNG bunkering ships. On the other hand, parameters such as density, calorific value, Methane Number etc. are calculated from the LNG bunker composition. These quantity and quality are required by contract between supplier and receiver. The items described in bunker delivery note (BDN) reflect those in the contract between supplier and receiver. Refer [Annex D](#) for example of parameters of BDN.