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Refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels — Metering of gas as fuel on LNG carriers during cargo transfer operations

Hydrocarbures réfrigérés et combustibles gazeux liquéfiés à base non pétrolière — Mesurage du gaz comme carburant sur les transporteurs de GNL pendant les opération de transfert de cargaison

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 28, *Petroleum products and related products of synthetic or biological origin*, Subcommittee SC 5, *Measurement of refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels*.

Introduction

Concerns over the emission of pollutants from ship exhausts prompted IMO to enact MARPOL Annex VI to the IMO Protocol of 1997 which sets limits on sulfur oxide and nitrogen oxide emissions. As for sulfur, as from 1 January 2012, the annex specifies a global cap mass fraction of 3,5 % on the sulfur content of fuel oil and special SOx emission control areas (SECAs) where the sulfur contents shall not exceed a mass fraction of 1,0 %. In order to comply with these requirements, the ships in general need to fit special facilities to limit SOx emissions unless they use low sulfur fuel oil.

However, liquefied natural gas (LNG) carrier is capable of utilizing BOG in ship's and shore tanks, and return gas during cargo transfer operation as fuel for their own power generation, if commercial value of such energy consumed on board is accountable as an element of custody transfer measurement.

This document provides the procedures needed for metering gas and assessing its calorific value and the requirements for metering devices.

Aspects of safety are not dealt with in this document. It is the responsibility of the user to ensure that the system meets applicable safety regulations.

Refrigerated hydrocarbon and non-petroleum based liquefied gaseous fuels — Metering of gas as fuel on LNG carriers during cargo transfer operations

1 Scope

This document specifies minimum requirements to quantify the boil-off gas (BOG) consumed on liquefied natural gas (LNG) carriers for their own functions, notably for power generation, during cargo transfer operations. BOG in this document refers to the low molecular gas returned from shore tanks to ships' tanks and the gas produced in ships' cargo tanks.

This document provides requirements for the metering of BOG and the subsequent calorific value calculations which can be taken into account when the energy transferred during cargo transfer is determined. This document also introduces performance requirements and calibration of the elements included in the BOG measurement system. A flowmeter of any type may be used to measure BOG as long as it meets the performance requirements specified in this document.

This document, with some modification, can also be applied to the measurement of BOG consumed by LNG carriers at sea.

2 Normative references

There are no normative references in this document.

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
boil off
process of evaporation of a liquid resulting from heat ingress or a drop in pressure

[SOURCE: ISO 10976:2015, 3.1.6]

3.2
boil-off gas
BOG
vapour (3.14) produced by *boil off* (3.1)

Note 1 to entry: BOG in this document refers to the low molecular gas returned from shore tanks to ships' tanks and the gas produced in ships' cargo tanks during cargo transfer operation.

[SOURCE: ISO 10976:2015, 3.1.7 — Note 1 to entry has been added.]

3.3
closing custody transfer measurement
custody transfer measurement (3.4) implemented after loading or discharging cargo from the tank(s)

3.4
custody transfer measurement
measurement of liquid level, liquid and vapour temperature, vapour pressure and analysis of the composition of LNG 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

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

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

3.6
flowmeter
flow measuring device which indicates the measured flowrate

3.7
gas dangerous space or zone
space or zone defined by the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)

3.8
indicating device
displaying device
set of components of a measuring instrument intended to indicate the measured value

3.9
intrinsic error
inherent error
error of a measuring device when it is tested against a reference standard under controlled conditions as specified by the manufacturer

3.10
LNG carrier
LNGC
cargo ship specifically constructed and used for the carriage of LNG in bulk

3.11
maximum permissible error
MPE
extreme value of measurement error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system

[SOURCE: ISO/IEC Guide 99:2007, 4.26, modified]

3.12
opening custody transfer measurement
custody transfer measurement (3.4) implemented before loading or discharging cargo from the tank(s)

3.13
uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

3.14
vapour
fluid in the gaseous state that is transferred to/from or contained within the cargo tank

3.15
verification
process of confirming the accuracy of an instrument by comparing to a source with known accuracy

4 Design requirements

4.1 General

Flowmeters shall be so constructed as not to leak gas in the atmosphere. In addition, all parts of a flowmeter in contact with BOG shall be chemically compatible with the product, to avoid both product contamination and corrosion of the flowmeter. Flowmeters installed in a gas dangerous space or zone shall be of gastight construction.

All electric components of a flowmeter for use in electrically classified areas shall meet the electrical area classification. They shall conform to applicable sections of the national and/or international electrical safety standards. All flowmeters shall be maintained in safe operating condition and manufacturers' maintenance instructions should be complied with.

4.2 Flowmeter

Flowmeters making use of any measurement principle may be used for the measurement of BOG. However, when selecting the flowmeter, consideration shall be given to the impact of the type of propulsion plant, constraints arising from the installation location and the nature of BOG flow on the meter's performance.

Regardless of the type of propulsion plant, flowmeters used for the measurement of BOG are always installed downstream of the low duty gas compressor and the gas heater on the fuel gas line to the propulsion plant. Typical installation and instrument specifications of flowmeters used for the measurement of BOG are shown in Annex A.

NOTE The consumption of BOG can be underestimated when the flow is below the minimum measureable flowrate.

4.3 Indicating device

Resolution of indicating device (totalizer) shall be better than or equal to 1 m^3 or 1 kg.

5 Accuracy requirement

Maximum permissible error of a flowmeter at the time of calibration at laboratory or factory (see 6.2) shall be ±2 % of reading throughout the expected operating range.

Maximum permissible error of the indicating device determined in accordance with 6.3 and 6.4 shall be ±1 % of the upper range limit of the expected operating range of the flowmeter. The accuracy of thermometers and pressure gauges associated with the flowmeters, if any, shall be better than or equal to ±0,5 °C and ±1 % of the reading throughout the expected operating range, respectively.

NOTE Maximum permissible errors shown on Table 1 and Table 3-1 in OIML R 140 are referred to.