INTERNATIONAL STANDARD

ISO 18132-1

First edition
2006-01-15

Refrigerated light hydrocarbon fluids — General requirements for automatic level gauges —

Part 1: Gauges onboard ships carrying liquefied gases

Hydrocarbures légers réfrigérés — Exigences générales pour jauges de niveau automatiques —

Partie 1: Jauges à bord de navires transportant des gaz liquéfiés

Reference number
ISO 18132-1:2006(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

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

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

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

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

ISO 18132-1 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 5, *Measurement of light hydrocarbon fluids*.

ISO 18132 consists of the following parts, under the general title *Refrigerated light hydrocarbon fluids — General requirements for automatic level gauges*:

— *Part 1: Gauges onboard ships carrying liquefied gases*

— *Part 2: Gauges in refrigerated-type shore tanks*

ISO 18132-1 together with ISO 18132-2 constitute a technical revision of ISO 8309:1991, ISO 10574:1993 and ISO 13689:2001, which are provisionally retained until ISO 18132-2 has been published.

Introduction

Large quantities of light hydrocarbons, consisting of compounds having one to four carbon atoms, are stored and transported by sea as refrigerated liquids at pressures close to atmospheric. These liquids can be divided into two main groups: liquefied natural gas (LNG) and liquefied petroleum gas (LPG).

During loading operation of these liquefied gases from shore tanks to on-board ship, vapour generated from ship's cargo tank is returned to shore tanks using a vapour-return line.

Occasionally, vapour returned from ship's cargo tanks is received not only in the original shore tank from which the liquefied gases are delivered, but also in other shore tanks depending on the operational conditions of the terminal.

Similarly, during unloading operation of these liquefied gases from ship's cargo tanks to shore tank, vapour generated at the shore tank at which the liquefied gases are received is returned to the ship's cargo tank using a vapour-return line.

Occasionally, where the volume of vapour generated in the shore tank at which the liquefied gases are received is extremely large beyond the capacity of a vapour-return line, the vapour is consumed as it is as a part of the fuel in the terminal.

To ensure accurate quantitative determination of liquefied gases, custody transfer needs to be implemented onboard the ship and not at the shore tanks during both loading and unloading, avoiding the influence of volume of the vapour returned to the shore tank or to the ship's cargo tanks in loading and/or unloading operation.

Liquid level/ullage is one of several important measurement parameters needed for a correct quantitative determination of the liquefied gas content of a (marine) tank. Appropriate use of a level/ullage measurement according to this part of ISO 18132 can also require measurements or data from

a) ship's and/or tank's inclination

b) ship tank's (volumetric) calibration

c) cargo composition and/or cargo physical data(e.g. density, dielectric constant)

d) tank condition, such as vapour pressure, vapour and liquid temperature

e) gauge locations

It is necessary to control the effect of each one of these data types on the overall error in the cargo quantity figure. Further guidelines on necessary observations for marine level gauging and cargo quantity calculations are given in Annexes A and B.

It is the aim of ISO 18132 to remove the technical dependency and to ensure that the market is open for all newcomers in this industrial sector.

Refrigerated light hydrocarbon fluids — General requirements for automatic level gauges —

Part 1: Gauges onboard ships carrying liquefied gases

1 Scope

This part of ISO 18132 gives general requirements for the specification, installation and testing of level gauges used in the measurement of liquid levels onboard ships carrying refrigerated light hydrocarbon fluids at close to atmospheric pressure (mainly LNG/LPG).

2 Normative references

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

IEC 60079-0, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements*

IMO IGC Code 1993, *Gas carrier code: 1994 and 1996 amendments*

3 Terms and definitions

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

3.1
datum level
reference level, equal to the zero level in the tank calibration table, from which liquid level is calculated

3.2
hazardous area
space where gas or vapour may form flammable mixture, as described in IEC 60079-0 and IMO IGC Code 1993

3.3
upper reference point
basic point for measurement of ullage set on the level-gauge centre-line near the gauge flange

NOTE The height of the upper reference point is the distance between the datum level and the upper reference point.

3.4
liquid level
distance between the liquid surface in a tank and the datum level

3.5
ullage
distance between the liquid surface in a tank and the upper reference point, measured along the vertical measurement axis

3.6
lower reference point
point fixed as reference for measuring the liquid level that is usually set near the tank bottom

3.7
overall error
error composed of error factors related to the measurement, its corrections, data transmission, local indicator and/or remote indicator, but not including error factors related to installation and deformation of the tank

3.8
accuracy test
tests for determining the extent of errors

4 Safety precautions

4.1 General

Where it is applicable, safety precautions described in ISO International Standards, government regulations and rules of the classification societies to which the LNG/LPG carriers have been registered must be observed when using level gauges. Also safety and material compatibility precautions described in ISGOTT must be observed. In addition, the manufacturers' recommendations on the use and installation of the level gauges should be followed.

4.2 Equipment precautions

4.2.1 All level gauges shall be capable of withstanding the pressure, temperature and other environmental conditions likely to be encountered in marine service.

4.2.2 All level gauges shall withstand the vapour pressure of liquid in the tank.

4.2.3 All level gauges should be specified and installed in accordance with the appropriate national and/or international (IMO, IEC, CENELEC, ISGOTT, API, ISO, etc.) marine electrical safety standards and applicable Class society Rules. All level gauges should be certified for use in the hazardous-area classification appropriate to their installation.

All level gauges should be maintained in safe operating condition and the manufacturers' maintenance instructions should be complied with.

4.2.4 Design and installation of all level gauges be subject to the approval of the classification societies.

4.2.5 All level gauges shall be provided with an appropriate measure against static electricity.

5 Conformity to public standards and others

All level gauges shall be in conformity with requirements specified not only in this part of ISO 18132 but also with national standards, requirements of classification society and other official requirements. In addition, when the requirements specified in the sales and purchase contract of the cargo to be agreed between sellers and buyers differ from that specified in this part of ISO 18132, the level gauges are recommended to conform not only to this part of ISO 18132 but also to the sales and purchase contract.

6 Specification of level gauges

6.1 Tolerance against cargo conditions

All level gauges shall be capable of withstanding conditions, such as cryogenic and corrosive conditions, of the cargo as loaded in ship cargo tanks and the level gauges shall also withstand any vibration and cargo level movements, e.g. sloshing at sea, offloading, including a boiling surface, likely to be encountered in marine service.

6.2 Provisions for routine maintenance

All level gauges shall withstand vapour from cargo tanks, and enable routine maintenance to be performed without compromising the integrity of the tank. This includes means of verification whereby the level gauge accuracy can be checked at high and low tank levels with the tank in service.

6.3 Minimal malfunctions

Level gauge malfunctions shall be minimized and remote system diagnostics shall be provided.

6.4 Countermeasures against sudden malfunctions

In order to cope with the worst situation of malfunctions occurring in cargo tanks that are in service, the level gauge shall be designed to enable appropriate maintenance from the outside of the tank as much as practical.

6.5 Electro-magnetic compatibility

The level gauge shall be designed for electro-magnetic compatibility complying with class requirements, which means that the gauge shall neither interfere with nor be affected by interference from other equipment.

6.6 Overall error

Overall error shall be confined to within ± 7,5 mm throughout the measurable span.

6.7 Confirmation of functioning

All level gauges shall be designed to enable confirmation of functioning even under service. For this purpose, at least one verification point shall be arranged in the tank and not in conflict with normal measurement within the intended range (0 % to 100 % volume) of cargo liquid levels.

6.8 Minimization of the unmeasurable zone

All level gauges shall be designed so as to minimize their unmeasurable zone, especially at minimum levels, as applicable to different containment systems.

6.9 Instantaneous response

All level gauges shall provide instantaneous dynamic response in tracking cargo tank level variations encountered in normal cargo handling situations and at sea as applicable at the time of custody transfer report generation.

6.10 Display of averaged level

For level gauges that are designed to execute repeated automatic level measurement scans in all cargo tanks, level measurements per respective cargo tank shall be automatically averaged for display.