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Ships and marine technology — Bunker fuel mass flow meters on receiving vessel — Requirements

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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).

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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 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

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

Accurate measurement of large quantities of bunker fuels received by ships around the world has historically been difficult, with many ships relying on outdated methods of verification, such as before-and-after manual measurement of fuel tank levels. The potential for inaccuracies is significant and can result in disputes between the fuel supplier and the ship.

This document addresses the need for standardization of meters used to accurately measure the quantity of fuel received. Traditionally, volumetric flow meters have raised accuracy concerns because of the potential for air and other gases to affect the measurement of the fluid. Also, entrained air can cause inaccurate shipboard tank readings during and immediately after bunkering.

Accurate measurement of bunker fuel receipt quantities using mass flow meters will result in greater efficiencies in the ship bunkering process and reduce disputes.

Ships and marine technology — Bunker fuel mass flow meters on receiving vessel — Requirements

1 Scope

This document specifies requirements for Coriolis mass flow meter (MFM) systems installed on and used by vessels for the accurate measurement of bunker fuels received. It defines metrology and security requirements as well as testing requirements of the MFM system for the receiving vessel. This document complements ISO 8217, ISO 22192 and OIML R117.

This document does not cover mass flow meters used for custody transfer, nor does it address overall bunker delivery procedural issues, such as delivery system integrity and transfer operations. It is not applicable to cryogenic fuels such as LNG.

For bunker delivery using a Coriolis mass flow meter system in a custody transfer role, refer to ISO 22192.

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.

3.1
bunker
bunker fuel
fuel (Class F) supplied to a vessel for its propulsion and/or operation

Note 1 to entry: Class F fuels are specified in ISO 8217.

3.2
mass flow meter
MFM
equipment designed to directly measure and indicate the mass of *bunker fuel* (3.1) received by a ship

3.3
maximum allowable working pressure
MAWP
highest stress to which a piping system component can be subjected, based on materials and design calculations

3.4
maximum mass flow rate
Q_{max}
maximum flow rate up to which the *MFM system* (3.5) has been qualified to operate in compliance with the required accuracy

Note 1 to entry: The maximum value is normally determined by the application.

3.5
MFM system
bunker fuel (3.1) receiving system, comprising the *mass flow meter* (3.2) and its ancillary devices, pipelines and seals between the vessel's bunker manifold and the mass flow meter

3.6
minimum mass flow rate
Q_{min}
minimum flow rate to which the metering system has been qualified to operate, in compliance with the required accuracy

Note 1 to entry: The minimum value is normally determined by the flow metering system.

3.7
minimum measured quantity
MMQ
smallest quantity of liquid for which the measurement is metrologically acceptable for a given system or element

4 Symbols and abbreviated terms

AC	alternating current
DC	direct current
DN	nominal diameter
IEC	International Electrotechnical Commission
LFC	low flow cut-off
Q_{max}	maximum flow rate
Q_{min}	minimum flow rate
P	pressure
MAWP	maximum allowable working pressure
MFM	mass flow meter
MMQ	minimum measured quantity
OIML	International Organization of Legal Metrology

5 Design and environment testing

5.1 Materials and equipment

MFM casings, as well as any pressure-retaining parts, shall be of metallic construction. Materials rendered ineffective by heat shall not be used in the construction of the meter casing or any pressure-retaining parts. All other parts shall be constructed of materials suitable for the service intended. Fasteners in contact with interior fluid shall be of corrosion-resistant materials.

Threaded fittings shall not be used in pipe sizes greater than DN 50.

5.2 Environmental tests

Unless otherwise specified, environmental tests shall be conducted on a prototype of each meter model.

MFM for marine applications should have documentation of completion of the following tests:

a) vibration,

b) temperature,

c) weather tightness.

The tests above should be acceptable to a member of the International Association of Classification Societies (IACS), based on environmental testing requirements for shipboard electrical/electronic equipment.

5.3 Hydrostatic test

Each MFM shall be subjected to a hydrostatic test at 1,5 times the MAWP in accordance with an appropriate test standard.

5.4 Temperature

MFM shall be designed to operate within an ambient temperature range of -40 °C to +60 °C.

5.5 Pressure rating

MFM shall have a minimum pressure rating of not less than 1 MPa (145 psig).

The maximum pressure of the fluid measured shall not affect the sensitivity of the measuring device or indicating mechanism.

5.6 Non-metallic materials

Gaskets, seals and O-rings used for the installation and construction of the meter that can come in contact with the fuel being measured shall be suitable for the application. Security seals should be fabricated of materials that do not deteriorate due to corrosion or UV exposure.

5.7 Marking

MFM shall be marked with the following minimum information:

a) manufacturer's identification mark, trademark or name;

b) designation selected by the manufacturer, if appropriate;

c) maximum allowable working pressure;

d) fluid flow direction, by an arrow or another indicator;

e) serial number (MFM);

f) transmitter model and serial number;

g) year of manufacture.

6 Metrological requirements

6.1 General

This clause specifies the MFM's metrological traceability, calibration and re-calibration requirements for the approval of the MFM system applicable to non-custody transfer bunkering. The MFM system should be operated within rated conditions as set out in these requirements to meet the 0,5 % expanded

measurement uncertainty for bunker fuel application (see 6.3.1). The MFM system performance should be confirmed during the commissioning and maintained during operation.

Verification on board shall be performed by a qualified and independent party (see Clause 9).

6.2 MFM requirements

6.2.1 Every MFM shall be calibrated before being installed on the ship and shall include its adjustment device(s) and ancillary device(s).

The device shall be calibrated with water as the fluid with a certification issued by either a national metrology institute or an appointed OIML Issuing Authority in accordance with the relevant OIML Recommendations, accompanied by relevant supporting documents, confirming that the MFM performance meets the requirement of maximum measurement uncertainty for bunker fuel fluid flow measurement to be not more than 0,2 %.

Alternatively, any hydrocarbon or synthetic oil with a density/viscosity similar to that of the bunker fuels specified in ISO 8217 may be used as the calibration fluid.

6.2.2 MFM shall be calibrated with direct traceability to an SI unit of mass by a laboratory meeting the requirements of ISO/IEC 17025. The calibration shall cover flowrates across the measurement range applications. See Annex A for an example of a MFM test.

6.3 MFM system requirements

6.3.1 The guideline of 0,5 % expanded measurement uncertainty should take into consideration the following uncertainty sources influenced by:

— MFM calibration;

— product condition, e.g. viscosity and density;

— process flow condition, e.g. aeration flow and flow turbulences, etc.;

— piping line system configuration and meter installations, which can affect measurement conditions;

— any other source that may influence the mass flow measurement.

6.3.2 Requirement of zero offset limit and zero verification.

— Zero setting is required during commissioning.

— Zero stability should be periodically checked by zero verification.

— Maximum permissible zero offset shall be not more than 0,2 % of Q_{min}.

6.3.3 The low flow cut-off (LFC) setting value shall be not more than 20 % of Q_{min}.

6.3.4 The process flow rate range shall not be less than Q_{min} and not more than Q_{max}.

7 Security requirements

7.1 General

This clause specifies the general requirements and procedures to ensure that the system integrity of the MFM system is confirmed during commissioning and maintained during operation.

