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Bunkering of marine fuel using the Coriolis mass flow meter (MFM) system

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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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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.

This document was prepared by a Project Group under the purview of Technical Committee ISO/TC *28* Petroleum and related products, fuels and lubricants from natural or synthetic sources, Subcommittee SC 2 Measurement of petroleum and related products, Working Group WG 13 Bulk transfer accountability.

This is the first edition of ISO 22192 : XXXX.

Introduction

This International Standard was developed for the benefit of the bunker industry comprising ship owners, operators, charterers, bunker suppliers, bunker craft operators and bunker surveyors and is intended to enhance the efficiency of bunkering operations and promote best practices in the measurement of bunker fuel delivered.

This International Standard sets out the international best practice which document principles, requirements and procedures in the application of mass flow metering to bunkering.

This International Standard does not alter the contractual obligations of the parties involved in the bunker delivery.

In this document, the following verbal forms are used:

— “shall” - indicates a requirement

— “should” - indicates a recommendation

— “may” - indicates a permission

— “can” – indicates a possibility or a capability

Bunkering of marine fuel using the Coriolis mass flow meter (MFM) system

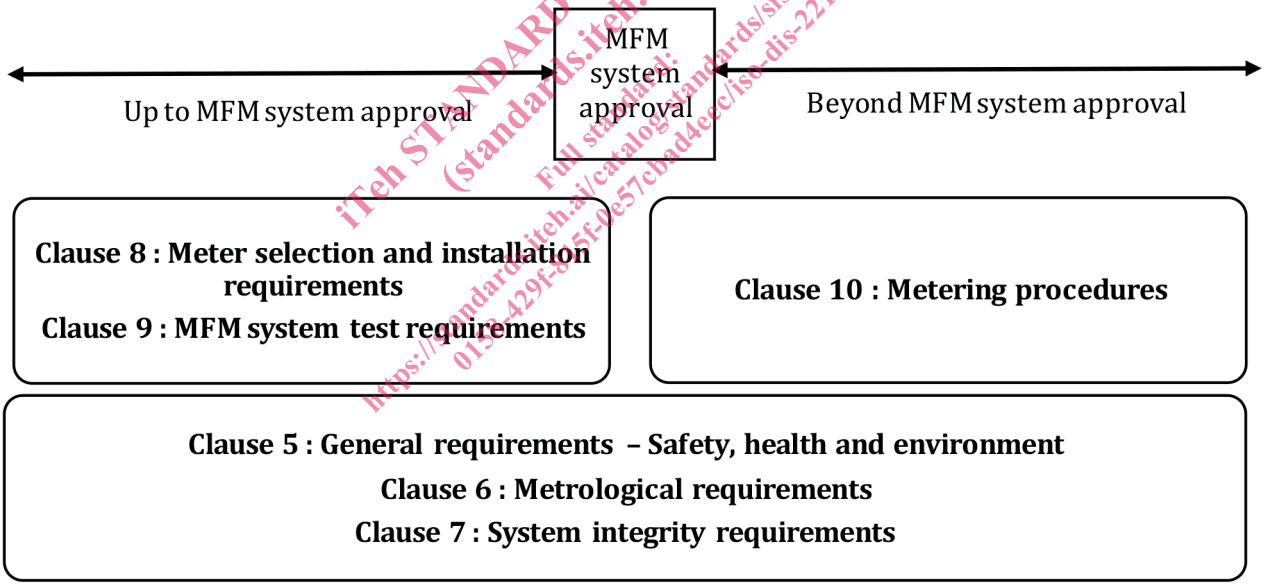
1 Scope

This International Standard specifies procedures and requirements for the transfer of bunkers to vessels by bunker tankers using the Coriolis mass flow meter (MFM) system. It encompasses the process leading to the approval of the MFM system as installed on bunker tankers and post-approval bunkering operation. It covers terminology, specifications, requirements and procedures on metrology, system integrity, metering system selection and installation, acceptance test, bunker delivery and dispute handling.

This International Standard neither governs the legal rights of the parties involved nor supersedes applicable international conventions and/or local legislation(s).

Local and international regulations, such as The International Convention for the Prevention of Pollution from Ships (MARPOL), apply to all parties involved in the transfer of bunkers.

The diagram below shows the execution of the MFM bunkering requirements at different stages.



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.

International Recommendation OIML R117 *Dynamic measuring systems for liquids other than water*

ISO 8217, *Petroleum products — Fuels (class F) — Specifications of marine fuels*

ISO 13739, *Petroleum products – Procedures for transfer of bunkers to vessels*

ISO 17025, *General requirements for the competence of testing and calibration laboratories*

Joint Committee for Guides in Metrology JCGM 100 GUM, *Evaluation of measurement data – Guide to the expression of uncertainty in measurement*

The International Convention for the Prevention of Pollution from Ships (MARPOL) - Annex VI, *Prevention of air pollution from ships*

3 Terms and definitions

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

3.1
accuracy of measurement
closeness of the agreement between the result of a measurement and the conventional, true value of the measurement. Good accuracy implies small random and systematic errors. [ISO 10790] The quantitative expression of accuracy should be in terms of uncertainty of measurement

3.2
adjustment
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of quantity to be measured

Note 1 to entry: Types of adjustment of a measuring system include zero adjustment of a measuring system, offset adjustment and span adjustment (sometimes called gain adjustment)

Note 2 to entry: Adjustment of a measuring system should not be confused with calibration, which is a prerequisite for adjustment.

Note 3 to entry: After an adjustment of a measuring system, the measuring system shall be recalibrated

[SOURCE: JCGM 200]

3.3
batch aeration
parameter representing the non-homogeneous fluid flow which, when exceeded, mayintroduce errors exceeding the accuracy class

3.4
air buoyancy correction
the air buoyancy correction is to be applied to obtain the conventional mass from true mass to take into account the reduction in true mass due to the buoyancy effect of air

3.5
ancillary device
device intended to perform a particular function, directly involved in elaborating, transmitting or displaying measurement results

Main ancillary devices are:

— Zero adjustment device;

— Repeating indicating device;

— Printing device;

— Memory device;

— Totalising indicating device;

— Correction device;

— Conversion device;

— Pre-setting device;

— Self-service device.

3.6
bunker(s)
any fuel (Class F - ISO 8217) supplied to a vessel for its propulsion and/or operation

3.7
bunker delivery note (BDN)
proprietary document of the bunker supplier providing details of the quality and quantity of the bunker(s) delivered by the bunker tanker to the vessel

3.8
bunker metering ticket (BMT)
ticket printed at the end of bunkering operation

3.9
bunkering operation
bunker loading, bunker tanker to bunker tanker transfer operation or a bunker delivery operation

3.10
bunker supplier
company which contractually agrees with the buyer to deliver the product

3.11
bunker surveyor
person who inspects, measures, samples, investigates and reports as required on the bunkering operations

3.12
bunker tanker
bunker tanker supplying bunker(s) to the vessel

3.13
bunker tanker operator
company which operates the bunker tanker

3.14
bunker tanker representative
an individual who represents the bunker supplier and is responsible for bunkering operations and documentations

3.15
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]

3.16
calibration factor
numerical factor(s) unique to each sensor derived during sensor calibration, which when programmed into the transmitter ensures that the meter performs to its stated specification

[SOURCE: ISO 10790]

3.17
calibration interval
time interval between two consecutive calibrations

3.18
chief engineer
chief engineer of the vessel who is responsible for receiving bunkers and documentation of the bunkering operation

3.19
commissioning/re-commissioning
process whereby the critical precision parameters impacting custody transfer are verified/checked. Any setting changes during commissioning/ recommissioning is traceable to factory settings and justified adjustments to meet measurement uncertainty / type classification

3.20
conformity body
independent party or party accredited by national body that undertake conformity assessment activities such as verification, testing, inspection and certification

3.21
conventional mass
conventional mass value of a body is equal to the mass of a standard that balances this body under conventionally chosen conditions. The unit of the quantity "conventional mass" is the kilogram. Also known as mass in air

The conventionally chosen conditions are:

t_{ref} = 20 °C; ρ_o = 1.2 kg/m^3; ρ_c = 8 000 kg/m^3

[OIML D028]

3.22
custody transfer point
point at which, the bunker is defined as being delivered or loaded

3.23
drip sampling container
clean and dry containers used for collecting drip samples during the entire bunkering operation

3.24
initial zero adjustment
setting the indication of mass flow rate to zero with the flowrate completely stopped and fully filled flow meter according to approved procedure, before it is ready for custody transfer usage

3.25
linearity of mass flow meter
consistency of change in the scaled output of a Coriolis flow meter, for a related, scaled change in the input of the flow meter

[SOURCE: ASME MFC-11]

3.26
low flow cut-off
transmitter setting which sets the meter output(s) to zero flow if the flow rate falls below a preset value [ISO 10790]. This setting inhibits the registration of flow when the flow meter is not properly filled with subject fluid that can lead to large measurement errors.

3.27
mass
physical quantity which can be ascribed to any material object and which gives a measure of its quantity of matter [OIML D028] Also known as true mass

3.28
mass flow meter (MFM)
device consisting of a flow sensor (primary device) and a transmitter (secondary device) which primarily measures the mass flow by means of the interaction between a flowing fluid and the oscillation of a tube or tubes; it may also provide measurements of the density and the process temperature of the fluid

[SOURCE: ISO 10790]

3.29
mass flow meter system (MFM system)
comprises the mass flow meter, its ancillary devices, pipelines and sealing points between the pump suction and the custody transfer point

3.30
mass flow rate
flow rate at which the quantity of fluid which passes the MFM is expressed as mass and denoted in MT/h

[SOURCE: ISO 10790]

3.31
master
master of the bunker tanker or the vessel receiving bunker(s) as the case may be

3.32
maximum mass flow rate (Q_{max})
maximum flow rate, up to which, the MFM system has been qualified to operate in compliance with the required accuracy. The maximum value is normally determined by the application

3.33
measurand
quantity intended to be measured

[SOURCE: JCGM 200]

3.34
measurement uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

[SOURCE: JCGM 200]

3.35
measuring system
system comprising a mass flow meter, its ancillary devices and additional devices

3.36
meter reading
value obtained from the non-resettable totaliser(s).

3.37
meter stability
property of a measuring instrument, whereby, its metrological properties remain constant over time

Note 1 to entry: Stability may be quantified in several ways:

EXAMPLE 1 Example1: In terms of the duration of a time interval over which a metrological property changes by a stated amount

EXAMPLE 2 In terms of the change of a property over a stated time

[SOURCE: JCGM 200]

3.38
metering
measurement of quantity by the MFM System

3.39
metering profile
graphical overview of the process parameters recorded during a bunkering operation and retained for purpose of providing transparent assessment

3.40
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. The minimum value is normally determined by the flow metering system

3.41
minimum measured quantity (MMQ)
smallest quantity of liquid for which the measurement is metrologically acceptable for that system or element

3.42
non-resettable totaliser
device that indicates the total cumulated flow quantity through the MFM after it is secured for use in custody transfer such that its value is not resettable to zero or to other values

3.43
power supply device
device which provides the electronic devices with the required electrical energy, using one or several sources of AC or DC power

3.44
primary liquid flow standard
capable of performing calibration of a mass flow meter by gravimetric method, for the realisation of the quantity of mass flow in a given time, by way of direct traceability to the mass standard

3.45
repeatability
proximity of a match among a series of results obtained with the same method on identical test material, under the same conditions (same operator, same apparatus, same laboratory and short intervals of time)

3.46
resettable totaliser
device that indicates total flow quantity through the MFM from the start to the end of each batch and its value can be reset to zero

3.47
sample
bunker specimen defined by time, location and method of sampling

3.48
stored zero value
value stored in the electronics after the zero adjustment procedure. Stored zero value is recorded during every zero offset determination. Depending on manufacturer, the stored zero value can be in flow rate units or in time units or in % units

3.49
total quantity delivered
cumulative mass quantity measured between the start of delivery and end of delivery and transferred to the vessel

3.50
total quantity loaded
cumulative mass quantity measured between the start of loading and end of loading

3.51
traceability (Metrological)
property of a measurement result, whereby the result can be related to a reference through a documented unbroken chain of calibrations verified by a national metrology institute, each contributing to the measurement uncertainty

[SOURCE: JCGM 200]

3.52
transmitter
electronic control system providing the drive and transforming the signals from the flow sensor, to give output(s) of measured and inferred parameters; it also provides corrections derived from parameters such as temperature

3.53
update
installing new system components, hardware or software, which have no significant effect on the metering result. No testing is required after installation

3.54
upgrade
Installing new system components, hardware or software, which can have a significant effect on the metering result. New certification testing is required after installation

3.55
vessel
vessel receiving bunker(s)

3.56
zero offset
measurement output indicated under zero flow conditions

[SOURCE: ISO 10790]

Note 1 to entry: – zero offset might be caused by stress being applied to the oscillating tubes by the surrounding pipework and by process conditions

Note 2 to entry: - zero offset can be reduced by means of a zero adjustment procedure

3.57
zero offset limit
maximum allowable observed zero offset in relation to the stored zero value, used to determine when to re-zero the flow meter; generally defined by the manufacturer

[SOURCE: API MPMS 5.6]

3.58
zero stability
magnitude of the meter output deviation from the stored zero value at zero flow after the zero adjustment procedure has been completed, expressed by the manufacturer as an absolute value in mass per unit time

Note 1 to entry: The stated value for zero stability is valid for stable conditions where the fluid is free of bubbles and sediment

[SOURCE: ISO 10790]