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Bunker cargo loading from oil terminal to bunker tanker using Coriolis mass flow meter

Chargement d'une cargaison de soute depuis le terminal pétrolier vers un navire avitailleur à l'aide d'un compteur massique à effet Coriolis

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Foreword

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This document was prepared by 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.*

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 objective of this document is to harmonize the method of quantity measurement by establishing a consistent method of measurement from cargo loading at oil terminals to bunker delivery using a Coriolis mass flow meter (MFM). This is to ensure oil loss control along the bunker supply chain.

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.

Bunker cargo loading from oil terminal to bunker tanker using Coriolis mass flow meter

1 Scope

This document specifies quantity measurement using a Coriolis mass flow meter (MFM) for bunker cargo loading from an oil terminal to a bunker tanker during custody transfer. Sampling requirements during the custody transfer are also included in this document.

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 3170, *Petroleum liquids — Manual sampling*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

ISO 6996[1)], *Bunkering — Meter verification using master Coriolis mass flow meter*

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

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

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

OIML R 117-1, *Dynamic measuring systems for liquids other than water — Part 1: Metrological and technical requirements*

API MPMS Chapter 4.8, *Manual of Petroleum Measurement Standards, Chapter 4.8 Operation of Proving Systems*

3 Terms and definitions

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

ISO and IEC maintain terminology 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
accuracy
closeness of agreement between a measured quantity value and a true quantity value of a measurand

[SOURCE: ISO/IEC Guide 99:2007, 2.13, modified — Preferred terms “measurement accuracy” and “accuracy of measurement” deleted. Notes to entry deleted.]

1) Under preparation. Stage at the time of publication: ISO/PRF 6996:2023.

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

Note 1 to entry: Types of adjustment include zero adjustment and offset adjustment.

Note 2 to entry: Adjustment should not be confused with *calibration* (3.9), which is a prerequisite for adjustment.

[SOURCE: ISO/IEC Guide 99:2007, 3.11, modified — Preferred term "adjustment of a measuring system" deleted. Note 1 to entry shortened. Note 3 to entry deleted.]

3.3
air buoyancy correction
correction applied to obtain the *mass in air* (3.22) from the *mass* (3.17) to take into account the reduction in mass due to the buoyancy effect of air

3.4
ancillary device
device intended to perform a particular function, directly involved in elaborating, transmitting or displaying measurement results

EXAMPLE Zero-adjustment device, repeating indicating device, printing device, memory device, totalizing indicating device, correction device, conversion device, pre-setting device, self-service device.

3.5
bunker cargo
fuels for use in marine engines and boilers

3.6
bunker cargo metering ticket
ticket (paper or electronic) issued at the end of a *bunker cargo* (3.5) loading

Note 1 to entry: The information listed on a ticket can be found in 9.6.2.

3.7
bunker tanker
petroleum product tanker that is used to load *bunker cargo* (3.5) from an oil terminal

3.8
bunker tanker representative
individual who represents the *bunker cargo* (3.5) receiver and is responsible for bunker cargo operations and documentation

3.9
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: ISO/IEC Guide 99:2007, 2.39, modified — Notes to entry deleted.]

3.10
calibration factor
numerical factor unique to each sensor derived during sensor *calibration* (3.9), which when programmed into the *transmitter* (3.41) ensures that the meter performs to its stated specification

[SOURCE: ISO 10790:2015, 3.1.10, modified — Term changed from "calibrating factor" to "calibration factor". Note 1 to entry modified and merged into the definition.]

3.11
calibration frequency
time interval between two consecutive *calibrations* (3.9)

3.12
commissioning
process whereby the critical precision parameters impacting custody transfer are verified and checked

Note 1 to entry: Any setting changes during commissioning or re-commissioning are traceable to factory settings and justified *adjustments* (3.2) to meet the *measurement uncertainty* (3.24) or type classification.

3.13
custody transfer point
point at which the *bunker cargo* (3.5) is defined as being loaded to the *bunker tanker* (3.7)

3.14
error
measured quantity value minus a reference quantity value

[SOURCE: ISO/IEC Guide 99:2007, 2.16, modified — Preferred terms “measurement error” and “error of measurement” deleted. Notes to entry deleted.]

3.15
linearity
consistency of change in the scaled output of a Coriolis *mass flow meter* (3.18), for a related, scaled change in the input of a mass flow meter

3.16
low flow cut-off
transmitter (3.41) setting which sets the meter output(s) to zero flow if the flow rate falls below a pre-set value

3.17
mass
true mass
physical quantity which can be ascribed to any material object and which gives a measure of its quantity of matter

[SOURCE: OIML D 28:2004, Clause 2, modified — Admitted term added.]

3.18
mass flow meter
MFM
device consisting of a flow sensor (primary device) and a *transmitter* (3.41) (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

3.19
mass flow meter bunker system
MFM bunker system
bunker cargo (3.5) custody transfer system combined with system integrity which determines the loaded quantity at a *custody transfer point* (3.13) based on the quantity obtained from a *mass flow meter measuring system* (3.20)

3.20
mass flow meter measuring system
MFM measuring system
system comprising a *mass flow meter* (3.18) and its *ancillary devices* (3.4) that produces the measured quantity at the *point of measurement* (3.32) in all conditions of fluid flow in accordance with the metrological requirements

3.21
mass flow rate
flow rate at which the quantity of fluid which passes through a *mass flow meter* (3.18)

Note 1 to entry: It is expressed as *mass* (3.17) and denoted in tonnes per hour.

3.22
mass in air
conventional mass
conventional mass value of a body equal to the *mass* (3.17) of a standard that balances this body under conventionally chosen conditions

Note 1 to entry: It is expressed in kilograms.

[SOURCE: OIML D 28:2004, Clause 4, modified — "mass in air" added as preferred term.]

3.23
maximum mass flow rate
Q_{max}
maximum flow rate up to which a *mass flow meter measuring system* (3.20) has been qualified to operate in compliance with the required *accuracy* (3.1)

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

3.24
measurement uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

[SOURCE: ISO/IEC Guide 99:2007, 2.26, modified — Admitted terms "uncertainty of measurement" and "uncertainty" deleted. Notes to entry deleted.]

3.25
meter reading
value obtained from the *non-resettable totalizer(s)* (3.31) or *resettable totalizer(s)* (3.34)

3.26
meter stability
property of a measuring instrument, whereby its metrological properties remain within the bounds of specifically defined criteria over time

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

— Example 1: 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: ISO/IEC Guide 99:2007, 4.19, modified — "meter stability" replaced "stability of a measuring instrument" and "stability" as the term. "within the bounds of specifically defined criteria over time" replaced "constant in time" in the definition.]

3.27
metering
measurement of quantity by a *mass flow meter measuring system* (3.20)

3.28
metering profile
graphical overview of the process parameters recorded during a bunkering operation and retained for the purpose of providing transparent assessment

3.29
minimum mass flow rate
Q_{min}
lowest flow rate required to which a metering system has been qualified to operate in compliance with the required *accuracy* (3.1)

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

3.30
minimum loaded quantity
smallest quantity of *bunker cargo* (3.5) for which the measurement is metrologically acceptable for a *mass flow meter measuring system* (3.20)

3.31
non-resettable totalizer
device that indicates the total cumulated flow quantity through a *mass flow meter* (3.18) after it is secured for use in a custody transfer such that its value is not resettable to zero or to other values

3.32
point of measurement
location on a terminal where a *mass flow meter* (3.18) is installed and at which the measured quantity (*mass in air* (3.22)) is computed and indicated

3.33
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)

[SOURCE: ISO 22192:2021, 3.39]

3.34
resettable totalizer
device that indicates total flow quantity through a *mass flow meter* (3.18) from the start to the end of each batch and its value can be reset to zero

3.35
sample
bunker cargo (3.5) specimen defined by time, location and method of sampling

3.36
stored zero value
value stored in the electronics after a zero-adjustment procedure

Note 1 to entry: Stored zero value is recorded during every zero-offset determination.

3.37
surveyor
person engaged to independently inspect, measure, sample, investigate and report as required on the *bunker cargo* (3.5) operations

3.38
terminal representative
individual who represents or is appointed by the terminal and who is responsible for *bunker cargo* (3.5) operations and documentation

3.39
third party
person or organization that is unrelated to the manufacturer or supplier of the object of conformity or their customers

EXAMPLE Third-party testing laboratory, inspection body, certification body.