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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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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 document 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](http://www.iso.org/directives)).

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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](http://www.iso.org/members.html).

## Introduction

The objective of this document is to ~~harmonise~~harmonize the method of quantity measurement by establishing a consistent method of measurement from cargo loading at oil terminals to bunker delivery using ~~the~~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"~~"shall" indicates a requirement;
- ~~"Should"~~"should" indicates a recommendation;
- ~~"May"~~"may" indicates a permission;
- ~~"Can"~~"can" indicates a possibility or a capability.

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

## 1 Scope

This document ~~covers the specifies~~ quantity measurement using a Coriolis mass flow meter (MFM) for bunker cargo loading from an oil terminal to a bunker tanker during ~~the~~ 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.

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

~~International Recommendation OIML R117-1, Dynamic measuring systems for liquids other than water — Part 1: Metrological and technical requirements~~

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

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

ISO 3170, Petroleum liquids — Manual sampling

ISO 3171, Petroleum liquids — Automatic pipeline sampling

ISO 6996<sup>1</sup>, Bunkering — Meter verification using master Coriolis mass flow meter ~~(MFM)~~

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>

<sup>1</sup> Under preparation. Stage at the time of publication: ISO/DISPRE 6996:2023.

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— 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 — ~~notes 1, 2~~ Preferred terms “measurement accuracy” and ~~3~~ “accuracy of measurement” deleted. Notes to entry ~~have been removed~~ deleted.]

### 3.2

#### adjustment

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

Note 1 to entry: Types of adjustment ~~of a measuring system~~ include zero adjustment ~~of a measuring system~~ and offset adjustment.

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

[SOURCE: ISO/IEC Guide 99:2007, 3.11—, modified, ~~preferred — Preferred~~ term “adjustment of a measuring system” ~~has been removed; note~~ deleted. Note 1 to entry shortened. Note 3 to entry ~~has been removed~~ deleted.]

### 3.3

#### air buoyancy correction

correction applied to obtain the ~~conventional mass~~ *in air* (3.22) from ~~true~~ the mass (3.17) to take into account the reduction in ~~true~~ 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 ~~ps/~~ Zero-adjustment device, repeating indicating device, printing device, memory device, ~~totalising~~ ~~totalizing~~ indicating device, correction device, conversion device, pre-setting device ~~and~~, 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 1, 2 and 3~~Notes to entry ~~have been removed/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 — ~~the term has been~~Term changed from “calibrating factor” to “calibration factor” ~~and~~. Note 1 to entry ~~has been~~ 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 — ~~notes 1~~Preferred terms “*measurement error*” and ~~2~~“*error of measurement*” ~~deleted~~. Notes to entry ~~have been removed/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 ~~the~~ mass flow meter (3.18)

### 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 ~~preset~~pre-set value

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### 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

~~Note 1 to entry: This is also known as true mass.~~

[SOURCE: OIML ~~D028D~~ 28:2004, Clause 2, modified — ~~Note 1 to entry has been~~ 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 ~~the~~ *custody transfer point* (3.13) based on the quantity obtained from ~~the~~ *mass flow meter measuring system* (3.20)

### 3.20

#### mass flow meter measuring system

##### MFM measuring system

system comprising ~~the~~ *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 ~~the~~ *mass flow meter* (3.18) ~~is expressed as mass (3.17) and denoted in tonnes per hour~~

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: The unit of a mass in air is the kilogram. It is also known as conventional mass expressed in kilograms.~~

[SOURCE: OIML ~~D028D~~ 28:2004, Clause ~~4~~ 4, modified — “mass in air” added as preferred term.]

### 3.23

#### maximum mass flow rate

##### $Q_{\max}$

maximum flow rate, up to which, ~~the~~ *mass flow meter measuring system* (3.20) has been qualified to operate in compliance with the required *accuracy* (3.1)