SLOVENSKI STANDARD
oSIST prEN ISO 8222:2019

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Naftni merilni sistemi - Umerjanje - Temperaturne korekcije pri kalibriranju prostornine etalonskih posod (ISO/DIS 8222:2019)

Petroleum measurement systems - Calibration - Temperature corrections for use when calibrating volumetric proving tanks (ISO/DIS 8222:2019)

Messsysteme für Mineralölerzeugnisse - Kalibrierung - Temperaturkorrekturen zur Anwendung auf volumetrische Bezugsmessbehälter (ISO/DIS 8222:2019)

Systèmes de mesure du pétrole - Étalonnage - Corrections de température à utiliser lors de l'étalonnage des jauges étalons (ISO/DIS 8222:2019)

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75.180.30	Oprema za merjenje prostornine in merjenje	Volumetric equipment and measurements

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Petroleum measurement systems — Calibration — Temperature corrections for use when calibrating volumetric proving tanks

Systèmes de mesure du pétrole — Étalonnage — Corrections de température à utiliser lors de l'étalonnage des jauges étalons

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Foreword

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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.

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 Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 2, *Dynamic petroleum measurement*.

This third edition cancels and replaces the second edition (ISO 8222:2002: Petroleum measurement systems — Calibration — Temperature corrections for use when calibrating volumetric proving tanks), which has been extensively revised in both scope and content.

This revision extends the scope of ISO 8222:2002 to cover the design calibration and use of a wide range of volumetric measures and proving tanks. This revision is based on the draft TC 28 SC2 ISO DIS 12916:1998. This document was balloted to proceed to FDIS but no further action was taken and the document dropped from the programme.

Annex A of this document forms an integral part of this International Standard and contains the revised, extended and updated content from ISO 8222:2002. This provides options for formulae covering the properties of pure through to saline water, and also includes other materials and fluids used with volumetric measurement. Annex A provides formulae and updated formulae for other standards and measurements currently referring to ISO 8222:2002.

Introduction

Volumetric, or capacity, measures are used to provide an accurate measure of a volume hence providing a calibration reference for other volume measuring devices e.g. pipe displacement provers or flowmeters.

Volume measures are categorized in terms of capacity, test measures being below 20 l. Measures above 20 l are categorised as prover tanks. Standard measures are designed to comply with regulatory guidance and hence have specified volumes. Many measures have non-standard volumes specifically designed to suit an application e.g. measures to accompany a small volume prover.

Volumetric measures can be used to calibrate flowmeters, both duty and reference meters. They may also be used to calibrate secondary volume measures, pipe provers and storage tanks.

This document provides guidance for the design, calibration and use of volumetric measures in general, applies to all suitable liquids and is not restricted to hydrocarbon liquid applications.

Annex A provides the recommended formulae used in the calibration and use of volumetric measures and other volumetric measurements. This annex supersedes and extends the scope of ISO 8222:2002 by including pure and saline water properties. It now also includes the properties of hydrocarbon liquids and materials of construction of volumetric measuring devices.

This document gives guidance on both standard and non-standard measures. The requirements for regulatory or contractual requirements such as those given in OIML and National regulations will take precedence over the guidance given in this document.

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WARNING — The use of this document may involve hazardous materials, operations and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices.

1 Scope

1.1 This document describes the design, use and calibration of volumetric measures (capacity measures) which are intended for use in fixed locations in a laboratory or in the field. It also covers portable and mobile measures. The scope covers applications particularly, but not exclusively, in the petroleum industry. Volumetric measures are classified as test measures or prover tanks depending on capacity and design.

1.2 The document excludes pressurised measures as used for LPG and LNG and measures for cryogenic liquids. Measures described in this document are primarily designed, calibrated and used to measure volumes "to deliver", i.e. wetted and drained for a specified time before use. Many of the provisions will however apply equally to measures which are used "to contain", i.e. to measure a volume using a clean and dry measure.

1.3 Annex A provides a reference for formulae describing the properties of water and other materials used to define volume. This includes density, thermal expansion, compressibility and viscosity for pure, impure and saline water. It also provides property information for hydrocarbon liquids and materials used to construct measures.

1.4 Guidance is given regarding commonly expected uncertainties and calibration specifications.

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 4006:1991, *Measurement of fluid flow in closed conduits — Vocabulary and symbols*

JCGM 200:2012, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM 2012)*

3 Definitions and symbols

3.1 Definitions

For the purposes of this document, the following terms and definitions apply.
ISO and IEC maintain terminological databases for use in standardization at the following addresses:
— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http:www.iso.org/obp

3.1.1
accuracy
closeness of the agreement between the measured quantity value and a true quantity value of a measurand

[SOURCE: VIM:2012]

Note 1 to entry: The concept "measurement accuracy" is not a quantity and should not be given a numerical value. The quantitative expression of accuracy should be in terms of uncertainty. "Good accuracy" or "more accurate" implies small measurement error. Any given numerical value should be taken as indicative of this.

3.1.2
adjustment
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of the quantity measured

[SOURCE: VIM:2012[1]]

EXAMPLE This entails bringing a measuring instrument (meter) into a satisfactory performance and accuracy.

Note 1 to entry: Adjustment should not be confused with calibration which will be prerequisite for adjustment.

Note 2 to entry: After adjustment a recalibration is usually required.

3.1.3
automatic pipette
overflow pipette
high precision measure, where the volume withdrawn is defined by a top overflow weir rather than a gauge scale

3.1.4
brim measure
field measure where the volume is defined by an overflow from the top edge of the neck

3.1.5
calibration
set of operations that establish, under specified conditions, the relationship between quantities indicated by an instrument and the corresponding values realized by standards

[SOURCE: VIM 1993[1] and VIM:2012[2]]

Note 1 to entry: Calibration should not be confused with adjustment of a measuring system.

Note 2 to entry: The term "proving" is used in the oil industry and has the same meaning but will include a check of the results against specified acceptance criteria.

3.1.6
calibrated volume
volume of a measure between a top and bottom datum as determined by calibration and expressed at a standard temperature

3.1.7
clingage
film of liquid that adheres to the inside surface of a volumetric measure after it has been emptied resulting in a residual volume

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3.1.8

correction factor
numerical factor by which the uncorrected result of a measurement at the measured conditions is multiplied

Note 1 to entry: Correction factors to standard conditions are used to convert a volume at observed conditions to the volume at another (standard) condition.

3.1.9
displacement plunger
plunger
device consisting of a piston which is used for adjusting the volume of a volumetric measure

3.1.10
drain time
total time taken to empty the measure or tank to leave a consistent residual volume

Note 1 to entry: Drain time commences when the drain valve is opened and ceases when closed after a defined time or condition. Drain time may be divided into two parts; first drain time and final drain time.

3.1.11
drain time (final)
in a two stage emptying process it follows the cessation of the first drain time and finishes at a defined time or condition e.g. rate of dripping

3.1.12
drain time (first)
in a two stage emptying process it is the time to drain the majority of the fluid from the measure

Note 1 to entry: The first drainage flow commences when the drain valve is opened and ends at a defined level or when flow breaks into a defined trickle or drip rate. This will be prior to the start of the final drain time.

Note 2 to entry: A dry measure may be employed where the product evaporates quickly e.g. petrol. These measures are usually specified elsewhere however many of the provisions and methods described in this document may apply.

3.1.13
dry measure
contents measure which is calibrated and used with the internal surface completely dry (i.e no clingage or residual volume)

Note 1 to entry: A dry measure is marked "to contain" the specified volume.

3.1.14
error
measured value minus a reference value

[SOURCE: VIM:2012]

Note1 to entry: Relative error is error divided by a reference value. This can be expressed as a percentage.

3.1.15
field measure
a measure designed to be used in the regular calibration of other devices

Note 1 to entry: While most field measures are portable, some may be in a fixed location.

3.1.16
gauge glass
clear tube in parallel with, or a window set into, the neck to show the level of liquid in the neck

Note 1 to entry: There will be an associated scale to indicate the measured volume.

3.1.17
nominal volume
design volume of a volumetric measure

3.1.18
Primary measure
A reference measure calibrated gravimetrically, normally by a National standard or suitably accredited laboratory.

3.1.19 proving
calibration with comparison to defined acceptance criteria

Note 1 to entry: Proving is a term used in the oil industry and is similar to "verification".

Note 2 to entry: Proving is a calibration, sometimes of limited measurement range, according to methods defined by standards, regulation or procedures providing a determination of the errors of a device and showing (proving) it performs to defined acceptance criteria.

3.1.20
proving tank
volumetric measure which generally has capacity greater than 20 L and has a bottom drain

Note 1 to entry: A prover tank may be free standing or mounted on a truck or trailer.

3.1.21
pour
individual quantities of liquid poured from, or received into, a volumetric measure

3.1.22
range
range of values
difference between the maximum and minimum values of a set of values

Note 1 to entry: This can be expressed as a half range (±) number. Relative range will normally be expressed as a percentage of a specified value e.g. mean, minimum or other calculated value.

3.1.23
reference (operating) conditions
operating conditions prescribed for evaluating the performance of the measure

Note 1 to entry: This is the range of ambient and fluid conditions with which the measure is evaluated, verified or operated.

3.1.24
reference measure
volumetric measure calibrated, used and maintained to provide traceability to other volume measures and devices, including pipe provers and reference flowmeters

Note 1 to entry: A reference measure should be calibrated gravimetrically (primary measure) or volumetrically by means of a primary measure which itself has been calibrated gravimetrically.

3.1.25
repeatability
(measurement precision)
closeness of agreement between indications or measured quantity values obtained by replicate measurements under specified conditions

[SOURCE: VIM:2012]

Note 1 to entry: Specified conditions will normally imply the same reference, same conditions, same operators and procedures and that the data are obtained sequentially over a short period of time.

Note 2 to entry: Repeatability can be expressed as the range (difference between the maximum and minimum) values of error or K-factor. Alternatively, repeatability can be expressed as a function of the standard deviation of the values.

Note 3 to entry: Dividing repeatability by the mean will give the relative value which can be expressed as a percentage. It is noted some standards suggest dividing by the minimum value.

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3.1.26
residual volume
volume or quantity remaining in the measure after draining for the defined drain time

3.1.27
resolution
quantitative expression of the ability of an indicating device to distinguish meaningfully between closely adjacent values of the quantity indicated

3.1.28
scale datum
fixed reference point or mark, established at manufacture or initial calibration, from which subsequent adjustments to the scale can be referred

Note 1 to entry: This may be an engraved mark on the neck or another defined fixed point such as a support bracket. The location should be referenced on calibration certificates.

3.1.29
secondary measure
volumetric measure which is calibrated by a primary measure

3.1.30
standard conditions
conditions of temperature and pressure to which measurements of volume or density are referred to standardize the quantity

Note 1 to entry: These are the specified values of the conditions to which the measured quantity is converted.

Note 2 to entry: For the petroleum industry, these are usually 15 °C, 20 °C or 60 °F and 101.325 kPa.

Note 3 to entry: Standard conditions may refer to the liquid or the volume of the measure. These may be different.

Note 4 to entry: Quantities expressed at standard conditions are shown by prefixing the volume unit by "S", e.g. 4 Sm^3 or 700 kg/Sm^3.

Note 5 to entry: Definition taken from Energy Institute HM 0 and OIML R 117. Some other petroleum standards employ the term "base" conditions.

Note 6 to entry: "Reference" conditions are conditions of use (influence quantities) prescribed for testing the performance of a measuring instrument [SOURCE: VIM:1993].

3.1.31
standard measure
volumetric measure which is designed to meet the requirements of regulatory standards (e.g. OIML R 120, NIST 105-3)

3.1.32
standard volume
(base volume)
volume expressed as being at standard conditions

3.1.33
strike measure
brim measure where the volume is defined from the top edge of the neck which has been designed to be "struck" by sliding a ground glass disk over it to leave a consistent volume within the measure

3.1.34
test measure
hand portable volumetric measure up to 20 l capacity

Note 1 to entry: A test measure may be inverted to drain or fitted with a bottom drain.

Note 2 to entry: A test measure may also be non-portable, in a fixed frame or on a vehicle. It may in some cases be classified as a prover tank.

3.1.35
thermowell
metal pocket which protrudes through, or is attached to, the wall of a pipe or volumetric measure to hold a temperature measuring device

3.1.36
to contain (volume)
the base volume of liquid a measure will contain with respect to its reference line or datum when filled from a clean dry condition

3.1.37
to deliver (volume)
the base volume of liquid which can be withdrawn from or filled into a pre-wetted measure with respect to its reference line or datum and following specified drainage times and procedures

Note 1 to entry: A wet condition is obtained by filling the measure and draining it for the specified drain time and procedure.

Note 2 to entry: The "to deliver" volume will always be less than the "to contain" volume due to the volume of residual liquid left on the walls of the measure after the specified drain time.

Note 3 to entry: A measure marked "to deliver" can be used either to withdraw or to fill volumes as long as the wetting and drainage procedures are followed.

3.1.38
to fill
to receive
technique for using or calibrating a volumetric measure by filling, from top or bottom, with liquid from the device under test or the reference (volumetric or gravimetric). May be designated as 'In'.

3.1.39
to withdraw
water draw
technique for using or calibrating a volumetric measure by withdrawing liquid from the measure into the device under test or the reference (volumetric or gravimetric). Water draw is usually applied to the calibration of pipe provers.

Note 1 to entry: May be designated as "Ex".

3.1.40
traceability
property of a measuring instrument enabling measurements made by it to be related to a national or international standard

[source: VIM:2012]

3.1.41
transfer point
point or location in a fluid transfer where the quantity and accountability of the fluid passes from one measurement system to another

3.1.42
uncertainty
non-negative parameter characterizing the dispersion of the quantity values attributed to a measurand based on the information used

[SOURCE: VIM:2012]

Note 1 to entry: The uncertainty is normally expressed as a half width range along with the probability distribution with that range. It can be expressed as a value or as a percentage of the perceived true value.

3.1.43
volumetric measure
measure used to provide an accurate measure of a volume hence providing a calibration reference for other volume measuring devices e.g. pipe displacement provers or flowmeters

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3.1.44
water pour
technique for calibrating a measure by decanting liquid from a reference measure (automatic pipette) or a gravimetric system to a device under test

3.1.45
wet measure
volumetric measure which has been wetted and drained before use in accordance with defined drain times and procedures given in the calibration certificate and specification

3.1.46
wetted area
portion of the internal surface of a volumetric measure which has been in contact with the liquid during use

3.1.47
weir
device, usually a horizontal edge, where a consistent liquid level is established to provide a datum