SLOVENSKI STANDARD
oSIST prEN ISO 12185:2023

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Surova nafta, naftni in sorodni proizvodi - Določanje gostote - Laboratorijski merilnik gostote z nihajočim U cevnim senzorjem (ISO/DIS 12185:2022)

Crude petroleum, petroleum products and related products - Determination of density - Laboratory density meter with an oscillating U tube sensor (ISO/DIS 12185:2022)

Rohöl und Mineralölerzeugnisse - Bestimmung der Dichte - U-Rohr-Oszillationsverfahren (ISO/DIS 12185:2022)

Pétroles bruts, produits pétroliers et produits connexes - Détermination de la masse volumique - Densimètre de laboratoire à capteur à tube en U oscillant (ISO/DIS 12185:2022)

Ta slovenski standard je istoveten z: **prEN ISO 12185**

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75.040	Surova nafta	Crude petroleum
75.080	Naftni proizvodi na splošno	Petroleum products in general

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Crude petroleum, petroleum products and related products - Determination of density - Laboratory density meter with an oscillating U tube sensor

Pétroles bruts et produits pétroliers — Détermination de la masse volumique — Méthode du tube en U oscillant

ICS: 75.080

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Foreword

ISO (the International Organisation for Standardisation) 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 electro-technical 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. www.iso.org/directives 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.

International Standard ISO 12185 was prepared by Technical Committee ISO TC28, *Petroleum products and lubricants,* Subcommittee SC2 *Measurement of Petroleum& Related Products*

This second edition cancels and replaces the first edition (ISO 12185:1996), which has been technically revised. The main changes compared to the previous edition are as follows:

More specific requirements for the traceable calibration of laboratory density meters;

Rewording of the methodology when using density meters to take account of the wide variety of models now available.

The committee responsible for this document is ISO/TC 28/SC2/WG12.

The first edition of this standard, (ISO 12185:1996) was written at a time when there were relatively few models of laboratory density meter on the market, and the effect of sample viscosity on displayed density had only recently been reported.

There are now a considerable number of different manufacturers and models of laboratory density meter available worldwide. This edition of the standard has been written to encompass this wider range of instruments, many of which use different methodologies or algorithms to cope with the effect of viscosity on displayed density.

Most laboratory density meters in use today indicate a measured density. However, there are still a few meters in use which display oscillation frequency or period. The principles laid down in this standard can still be applied to these meters, but the calculations for adjustment, calibration, and determination of sample density will have to be carried out on the indicated frequency, using the manufacturer's equations

Crude petroleum, petroleum products and related products - Determination of density - Laboratory density meter with an oscillating U tube sensor

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

1 Scope

This International Standard specifies a method for the determination, using an oscillating U-tube density meter, of the density of crude petroleum and related products within the range 600 kg/m^3 to 1 100 kg/m^3 which can be handled as single-phase liquids at the test temperature and pressure.

This International Standard is applicable to liquids of any vapour pressure as long as suitable precautions are taken to ensure that they remain in single phase. Loss of light components will lead to changes in density during both the sample handling and the density determination.

This method is not intended for use with in-line density meters.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the additions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 91-1, *Petroleum measurement tables - Part 1: Tables based on reference temperatures of 15 °C and 60 °F*

ISO 91-2, *Petroleum measurement tables - Part 2: Tables based on a reference temperature of 20 °C*

ISO 3015, *Petroleum and related products from natural or synthetic sources — Determination of cloud point*

ISO 3170, *Petroleum liquids — Manual sampling*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 4259, *Petroleum products - Determination and application of precision data in relation to methods of test*

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

IP 389 *Determination of wax appearance temperature of middle distillate fuels by differential thermal analysis or differential scanning calorimetry.*

Tanaka M., Girard G., Davis R., Peuto A., Bignell N., Recommended table for the density of water between 0 °C and 40 °C based on recent experimental reports. Metrologia, **38**, 301-309 (2001)

Wagner W., Pruss A., The IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use. J. Phys. Chem. Ref. Data, **31**, 387-535 (2002)

PICARD A, DAVIS R S, GLÄSER M, FUJII K, Revised formula for the density of moist air (CIPM-2007)

Metrologia **45** 149–155 (2008)

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 Density

The mass of liquid per unit volume at a specified temperature. This is usually the mass of liquid expressed in kilograms, divided by its volume, expressed in cubic metres. The unit of measurement can be displayed as either kgm^{-3} or kg/m^3. When quoting liquid density, the temperature at which it has been measured shall also be quoted. (Example 840,0 kg/m^3 at 20,1 °C)

Note The SI unit of density is kg/m^3; the derived unit of measure g/cm^3 is commonly used in some industries.

3.2 Displayed density

The density of the sample as displayed by the density meter.

May either be the density measured at the temperature that the meter has been set to, or a density at another temperature, which has been calculated by the meter using an algorithm chosen by the meter user. To avoid confusion when reporting the displayed density, the temperature to which this density refers should also be quoted.

3.3 Reference temperature

Temperature at which the sample density needs to be reported. This temperature will normally be one of 15 °C, 20 °C, or 25 °C, or the Celsius equivalent of 60 °F. Such a reference temperature is normally stipulated by the National Authorities or commercial agreement.

3.4 Test temperature

Temperature of the sample in the density meter cell.

Note Choose a temperature at which the sample is a single-phase liquid, and the sample viscosity is within the meter's specification.

3.5 Adjustment

A set of operations carried out on a density meter to bring it into a state of performance suitable for use.

NOTE Most, but not all, laboratory density meters can be adjusted using water and either air or another liquid.

Adjustment of a density meter should not be confused with calibration. After a meter has been adjusted it must be calibrated to find the error in the displayed density.

3.6 Calibration

The operation that establishes, under specified conditions, the relationship between the value indicated by the density meter and the certified value of the liquid density standard. When taken in association

with the associated measurement uncertainties, this process provides a method for obtaining a density measurement result from an instrument indication.

Note A meter must be calibrated after it has been adjusted. One or more traceable liquid density standards should be injected, and the displayed result compared with the certified density. This will give the calibration offset for the meter.

Some meters have the facility to store the calibration offset, and automatically correct any subsequent indicated density. Where this is not the case, all subsequent readings will need to be corrected for this offset by applying the appropriate correction manually.

Note 1 to entry Some models of density meter may call the calibration step “secondary adjustment”.

3.7 Liquid density standard

A liquid whose density has been determined using a method giving results which are traceable to the SI system of units. It must be accompanied by a certificate that provides the value of the density at one or more temperatures, the associated uncertainty, and a statement of metrological traceability. Ideally, such a certificate should be issued by an ISO17025 accredited laboratory.

4 Principle

The test sample is introduced into the cell of a density meter which has previously been adjusted and calibrated. The density of the sample is calculated from the indicated density, by applying such corrections as have been determined during the calibration stage.

The cell oscillates constantly at its characteristic resonant frequency. This frequency is a function of the mass of the cell. The mass of the cell is a function of the density of its contents. This means that the liquid in the cell must be free of gas bubbles . The higher the sample density, the lower the oscillation frequency. Sample density is calculated from the frequency.

Accurate temperature control of the cell is important as density changes with temperature.

5 Apparatus

5.1 Density meter

Meters can often be programmed to indicate two or more forms of density results, which may or may not be “corrected” for viscosity. If a meter can indicate a “viscosity corrected” density, this value should always be used. Note: Research has shown that the “viscosity correction” can be greater than 1 kg/m^3 for very viscous samples in certain models of meter.

Most modern density meters have integral thermostats to maintain cell temperature. Older models may need a circulating constant-temperature bath, capable of maintaining the temperature of the circulating liquid to within ±0,05 °C of the required temperature.

Note 2 to entry Problems have been experienced with certain density meters due to condensation gathering on the cell sensors and electronics when the cell temperature is held below the dew-point of the ambient air. If there is risk of this occurring, the surrounding air should be kept dry.

Many laboratory density meters are equipped with autosamplers to allow for automatic operation. Any autosampler fitted must be designed to ensure the integrity of the test sample prior to and during analysis. The autosampler must be designed so as to ensure that a representative sub-sample is injected into the density meter. Autosampler behaviour should be monitored on a regular basis, especially if the samples contain dissolved gases or other lighter boiling components.