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# International Standard



# 5661

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## **Petroleum products — Hydrocarbon liquids — Determination of refractive index**

*Produits pétroliers — Hydrocarbures liquides — Détermination de l'indice de réfraction*

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5661 was developed by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, and was circulated to the member bodies in December 1981.

It has been approved by the member bodies of the following countries:

Austria	India	South Africa, Rep. of
Belgium	Iraq	Spain
Brazil	Israel	Sri Lanka
Canada	Japan	Sweden
Czechoslovakia	Korea, Rep of	Switzerland
Egypt, Arab Rep. of	Netherlands	Turkey
France	Peru	United Kingdom
Germany, F.R.	Poland	USA
Hungary	Romania	USSR

The member bodies of the following countries expressed disapproval of the document on technical grounds:

Australia  
Ireland

# Petroleum products — Hydrocarbon liquids — Determination of refractive index

## 1 Scope and field of application

**1.1** This International Standard specifies a method for the determination of the refractive index of transparent and light-coloured hydrocarbon liquids such as are used in capacitors, transformers, circuit breakers and in cables of the oil-filled type.

**1.2** This method is applicable to liquids having refractive indices in the range 1,33 to 1,7 and at temperatures of 20 to 30 °C. It is not applicable, within the accuracy stated to liquids having colours darker than 4 colour to ISO 2049, or to liquids having bubble points so close to the test temperature that a reading cannot be obtained before substantial deterioration takes place.

### NOTES

1 Liquid certified reference materials are available for the range 1,33 to 1,50, but not above this range. The accuracy of the method is not readily checked in the range 1,5 to 1,7.

2 Although measurements may be made at temperatures up to 70 °C, the accuracy of the method under these conditions has not been evaluated.

**1.3** The refractive index of a liquid varies with its composition and with the nature and amount of contaminants held in solution. If the refractive index of an unused liquid is known, determinations made on the same liquid after periods of service may form a basis for estimating any change in composition or the degree of contamination resulting from dissolution of extraneous material. The refractive index may also be used, in conjunction with other physical properties, to assess the hydrocarbon types present in petroleum fractions.

## 2 Reference

ISO 2049, *Petroleum products — Determination of colour*.

## 3 Definition

For the purpose of this International Standard, the following definition applies.

**3.1 refractive index:** The ratio of the velocity of light (of specified wavelength) in air at a given temperature and pressure to its velocity in the substance under test.

### NOTES

1 Refractive index may also be defined as the sine of the angle of incidence divided by the sine of the angle of refraction, as light passes from air into the substance. This is the relative index of refraction. If the absolute refractive index (i.e., referred to a vacuum) is desired, this value should be multiplied by the factor 1,000 27, the absolute refractive index of air.

2 The numerical value of the refractive index of liquids is an inverse function of both the wavelength of the light and temperature. For mineral oils, a test temperature of 20 °C and a wavelength of 589,3 nm, equivalent to the mean wavelength of the doublet in the sodium spectrum, are commonly used.

## 4 Materials

### 4.1 Solvent

Any suitable clean volatile solvent may be used. Acetone or aliphatic hydrocarbon solvents boiling below 80 °C have been found to be satisfactory.

## 5 Apparatus

**5.1 Refractometer,** critical angle type, having a refractive index range of approximately 1,33 to 1,7 and a manufacturer's stated accuracy of 0,000 2. The refractive index scale should be subdivided into units of not greater than 0,001 and permit estimation to 0,000 2. Instruments with or without achromatizing compensating prisms are suitable.

**5.2 Glass certified reference material,** accurate to 0,000 1 with the value of the refractive index engraved upon its upper face.

**5.3 White light source,** for use with instruments equipped with compensating prisms; a 40 W light bulb has been found satisfactory.

**5.4 Sodium arc lamp,** for use with non-compensated instruments requiring a monochromatic light source.

**5.5 Thermostatted bath and circulating pump,** capable of supplying water to the jacketed prisms of the refractometer and of maintaining the temperature constant to within  $\pm 0,1$  °C of the desired test temperature.

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**6 Procedure**

**6.1** Periodically check the adjustment of the refractometer using the solid reference standard supplied with the instrument. If the reading obtained differs by more than 0,000 2 from the value of the standard, adjust the instrument according to the instructions provided by the manufacturer.

**6.2** Adjust the bath thermostat to the desired temperature, reading this temperature on the refractometer thermometer on the discharge side. Maintain the flow of water so that the desired temperature is reached and maintained within  $\pm 0,1$  °C.

**6.3** Clean the instrument prism faces in accordance with the manufacturer's instructions before each test. If no special instructions are provided, clean the prisms with a suitable volatile solvent and cotton wool of surgical quality and wipe the surfaces immediately with dry cotton wool. Allow 2 min for temperature equalization before applying the test portion to the prism.

**6.4** Apply a test portion to the surface of the refracting prism using a glass rod with a rounded end, or to the capillary opening, using a dropping pipette, so that the space between the prisms is completely fitted. Allow 2 min for temperature equalization.

**6.5** Adjust the light source to allow the incident radiation to strike the illuminating prism. Move the telescope of the instrument until the field division is visible. If the instrument is not fitted with compensating prisms, further position the light source so that the field division boundary is sharp and maximum contrast between the light and dark portions of the field is obtained.

**6.6** If the instrument is fitted with compensating prisms, adjust the compensating prisms until the field consists of a light and dark portion and the colour fringes at the field division boundary are eliminated.

**6.7** Turn the fine adjustment screw and align the field division with the intersection of the cross-hairs in the telescope.

**6.8** Read the refractive index from the graduated scale through the microscope provided, estimating the fourth decimal place.

**6.9** Repeat the measurement, using different test portions, until three readings have been obtained that do not vary by more than 0,000 2. Record the refractive index as the average of these readings, rounded to four decimal places.

**7 Accuracy**

**7.1** The refractive index determination is accurate to 0,000 3 over the range for which calibration standards are available, i.e., 1,33 to 1,5.

**8 Test report**

The test report shall contain at least the following information:

- a) the type and identification of the product tested;
- b) the reference to this International Standard or to a national standard;
- c) the result of the test (see 6.9) and the temperature at which the measurement was made. For example, " $n_D' = 1,33$ ";
- d) any deviation, by agreement or otherwise, from the procedure specified; and
- e) the date of the test.