
**Petroleum products and crude petroleum —
Determination of vapour pressure —
Reid method**

*Produits pétroliers et pétrole brut — Détermination de la pression de
vapeur — Méthode Reid*

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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 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 electrotechnical standardization.

International Standard are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 3007 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

This third edition cancels and replaces the second edition (ISO 3007:1986), of which it constitutes a technical revision.

Annexes A, B and C form an integral part of this International Standard.

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Petroleum products and crude petroleum — Determination of vapour pressure — Reid method

WARNING — The use of this International Standard 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 International 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 of the vapour pressure of liquid petroleum products consisting of essentially or wholly of hydrocarbon components, or containing oxygenated hydrocarbons of specific types and at specified maximum concentrations. The method does not apply outside these concentration levels, nor to any blends containing methanol or other oxygenated hydrocarbons not covered in note 1.

NOTE 1 The maximum concentration of ethers containing 5 or more carbon atoms is 15 % (V/V), and for ethanol is 10 % (V/V). For higher alcohols, the maximum concentration is 7 % (V/V).

NOTE 2 For the purposes of this International Standard, the term “%(V/V)” is used to represent the volume fraction of a material.

For petroleum products containing methanol, or other oxygenated hydrocarbons outside the scope of note 1, a dry vapour-pressure test method should be used. For liquefied petroleum gases, ISO 4256 should be used. The test method may be applied to volatile crude petroleum with a vapour pressure exceeding 10 kPa, although the precision has not been evaluated.

Four procedures are described in this International Standard. Procedures A and B are alternative apparatus configurations for products with a Reid vapour pressure up to 180 kPa, Procedure C is applied to liquid products with a Reid vapour pressure above 180 kPa, and Procedure D applies to aviation gasolines with a Reid vapour pressure of approximately 50 kPa.

Vapour pressure is an important physical property of volatile liquids, and has critical performance implications for automotive and aviation gasolines. Vapour pressure is also one of the properties affecting atmospheric evaporation, and is therefore increasingly used in regulations relating to emissions and air quality control. Vapour pressure is also a critical property limiting the performance and safety of operation of equipment during transfer operations.

NOTE Because the external atmospheric pressure is counteracted by the atmospheric pressure initially in the vapour chamber, the Reid vapour pressure is approximately the “absolute” vapour pressure at 37,8 °C. The Reid vapour pressure differs from the true vapour pressure of the sample owing to slight vaporization of the sample and the pressure of water vapour and air in the confined space.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, such publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3170:1988, *Petroleum liquids — Manual sampling*.

3 Term and definition

For the purposes of this International Standard, the following term and definition applies.

3.1

Reid vapour pressure

absolute vapour pressure exerted by a liquid under the specific conditions of test temperature, vapour:liquid ratio, and air and water saturation described in this International Standard

4 Principle

The liquid chamber of the Reid vapour-pressure apparatus is filled with the chilled sample and connected to the vapour chamber that has been preheated to 37,8 °C. The assembled apparatus is immersed in a bath at 37,8 °C until constant pressure is observed. The pressure reading, corrected if necessary, is the Reid vapour pressure.

5 Apparatus

The apparatus for Procedures A, C and D is described in annex A. The apparatus for Procedure B is described in annex B.

5.1 Cooling bath, to cool the samples to 0 °C to 1 °C and the liquid chamber to below 5 °C. An ice water bath or a refrigerator, with freezer compartment, are suitable.

NOTE Solid carbon dioxide is not a suitable cooling medium due to its solubility in gasolines, which may lead to erroneous results.

6 Samples and sampling

6.1 The extreme sensitivity of vapour-pressure measurements to losses through evaporation and the resulting changes in composition, is such as to require the utmost precaution and the most meticulous care in the taking and handling of samples.

6.2 Unless otherwise specified, the samples shall be obtained by the procedures described in ISO 3170.

NOTE The taking of automatic in-line samples is not recommended for this International Standard, unless a variable-volume sample receiver is used. The use of a fixed-volume receiver, pressurized or not, may result in light-end loss from the product.

6.3 For procedures A, B and D, the sample containers shall be of 1 litre capacity, and shall be filled to 70 % to 80 % capacity with the sample. For Procedure C, the sample container shall be of a minimum of 0,5 litre capacity.

NOTE With agreement between all the parties concerned, smaller samples, down to 0,3 litre minimum, may be taken when sampling inerted vessels for vapour-pressure measurement exclusively. These samples should be placed in sample containers with the ullage requirements specified in 6.3. Precision on samples of less than that specified in 6.3 has not been determined.

6.4 Sample containers shall be leak-free. Discard containers found to have any visible leak, and obtain a new sample.

6.5 Official samples frequently require specific sampling arrangements, including a separate sample for the Reid vapour-pressure determination, and possibly the presence of a cooling bath or an insulated carrier at the sampling site (see also the note to 6.3). Regulations and/or specifications shall be consulted for any special instructions for sampling before samples are taken.

6.6 In all cases, protect the samples between the sampling point and the cooling bath (5.1) from excessive heat.

6.7 The Reid vapour-pressure determination shall be performed on the first test portion withdrawn from the sample container. The remaining sample in the container shall not be used for a second determination. If necessary, obtain a new sample.

6.8 The sample container and its contents shall be cooled to 0 °C to 1 °C before opening. Sufficient time to reach this temperature shall be ensured by direct measurement of the temperature of a similar liquid in a like container placed in the cooling bath at the same time as the sample.

7 Sample preparation

7.1 With the sample at a temperature of 0 °C to 1 °C, remove the sample container from the cooling bath and wipe dry with absorbent material. Verify that the container is 70 % to 80 % full, either by visual examination if the container is transparent, or, if the container is not transparent, by the use of a suitable gauge.

7.2 If the container is less than 70 % full, discard the sample. If the container is more than 80 % full, pour out enough sample to bring the volume in the container to within the 70 % to 80 % range. Under no circumstances shall any sample poured out be returned to the container.

7.3 Reseal the container if necessary, and replace it in the cooling bath for a sufficient time for the temperature to equilibrate to 0 °C to 1 °C.

7.4 For Procedures A, B and D only, remove the sample container from the cooling bath at 0 °C to 1 °C, open it momentarily, reseal it, and shake it vigorously for 10 s to 20 s. Return it to the bath for a minimum of 2 min. Repeat this procedure twice more, and then return the sample to the cooling bath until ready for sample transfer.

7.5 For procedure C, do not disturb the sample in the cooling bath until it is removed for sample transfer.

8 Apparatus preparation

8.1 Liquid chamber

Completely immerse the open liquid chamber in an upright position in the cooling bath (5.1) for at least 10 min until it reaches a temperature below 5 °C. For Procedures A, B, and D, also immerse the sample transfer connection (A.5 and Figure 1) for the same cooling period.

NOTE The freezer compartment of the refrigerator may be used to minimize the time required.

8.2 Vapour chamber

The purged (see 11.1 to 11.3) vapour chamber and pressure sensor shall be connected together and placed in a water bath (A.3) at 37,8 °C to a depth that ensures that at least 25 mm of water is above the highest level of the vapour chamber. Keep it in the water bath for a minimum of 10 min, and do not remove it until the liquid chamber has been filled with sample.

9 Sample transfer

9.1 For Procedures A, B and D, remove the chilled sample container from the cooling bath (5.1), uncap it, and insert the chilled transfer connection (see Figure 1). Remove the liquid chamber from the cooling bath or refrigerator, empty it, or confirm that it is empty by inversion, and place it rapidly over the sample delivery tube of the transfer connection. Invert the entire system rapidly, so that the liquid chamber is upright with the end of the delivery tube extending to approximately 6 mm of the bottom of the liquid chamber. Fill the liquid chamber to overflowing, ensuring that the sample is free of air bubbles by lightly tapping the liquid chamber against the work surface. Withdraw the delivery tube from the liquid chamber while allowing the sample to continue flowing up to complete withdrawal. Figure 2 illustrates the above operations.

CAUTION — Ensure that suitable containment of excess sample is provided, and that no potential ignition sources are adjacent. Make suitable provision for the safe disposal of excess sample.