

**SLOVENSKI STANDARD**  
**oSIST prEN 13016-1:2016****01-november-2016**

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**Tekoči naftni proizvodi - Parni tlak - 1. del: Določevanje z zrakom nasičenega parnega tlaka (ASVP) in enakovrednega parnega tlaka suhega zraka (DVPE)**

Liquid petroleum products - Vapour pressure - Part 1: Determination of air saturated vapour pressure (ASVP) and calculated dry vapour pressure equivalent (DVPE)

Flüssige Mineralölerzeugnisse - Dampfdruck - Teil 1: Bestimmung des luftgesättigten Dampfdruckes (LGDD) und des berechneten Trockendampfdruckes (BTDD)

Produits pétroliers liquides - Pression de vapeur - Partie 1 : Détermination de la pression de vapeur saturée en air (PVSA) et de la pression de vapeur sèche calculée (PVSC)

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English Version

## Liquid petroleum products - Vapour pressure - Part 1: Determination of air saturated vapour pressure (ASVP) and calculated dry vapour pressure equivalent (DVPE)

Produits pétroliers liquides - Pression de vapeur -  
Partie 1 : Détermination de la pression de vapeur  
saturée en air (PVSA) et de la pression de vapeur sèche  
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Bestimmung des luftgesättigten Dampfdruckes (LGDD)  
und des berechneten Trockendampfdruckes (BTDD)

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 19.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## European foreword

This document (prEN 13016-1:2016) has been prepared by Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin”, the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13016-1:2007.

EN 13016-1:2007 has been updated by enlarging the scope to include ethanol blends of up to 85 %. The range for the instrument verification fluids has been widened and new typical/consensus values added in an informative annex. Next, the precision statements have been updated following a global evaluation in 2016.

EN 13016 consists of the following parts, under the general title *Liquid petroleum products - Vapour pressure*:

*Part 1: Determination of air-saturated vapour pressure (ASVP) and calculated dry vapour pressure equivalent (DVPE).*

*Part 2: Determination of absolute vapour pressure (AVP) between 40 °C and 100 °C.*

*Part 3: Determination of vapour pressure and calculated dry vapour pressure equivalent (DVPE) (Triple Expansion Method) (under development).*

This part is based on and developed in parallel with IP 394 [2] and ASTM D 5191 [3]. It describes a general determination method, whereas part 2 describes a determination method at elevated temperatures.

## Introduction

Vapour pressure is used as a classification criterion for the safe handling and carriage of petroleum products, feedstocks and components; it has a relationship to the potential for hydrocarbon emissions, under uncontrolled conditions, and thus is the subject of environmental scrutiny.

Vapour pressure limitations are often imposed to prevent pump cavitation during transfer operations.

Vapour pressure is one measure of the volatility characteristics of fuels used in many differing types of engines with large variations in operating temperatures. Fuels having a high vapour pressure may vaporize too readily in the fuel handling systems, resulting in decreased flow to the engine and possible stoppage by vapour lock. Conversely, fuels of low vapour pressure may not vaporize readily enough, resulting in difficult starting, slow warm-up and poor acceleration.

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[SIST EN 13016-1:2018](https://standards.iteh.ai/catalog/standards/sist/1aebfb5c-fba6-4528-9e4e-ece2d89c6570/sist-en-13016-1-2018)

<https://standards.iteh.ai/catalog/standards/sist/1aebfb5c-fba6-4528-9e4e-ece2d89c6570/sist-en-13016-1-2018>

## 1 Scope

This European Standard specifies a method for the determination of the total pressure, exerted *in vacuo*, by volatile, low viscosity petroleum products, components, ethanol blends up to 85 %, and feedstocks containing air. A dry vapour pressure equivalent (DVPE) can be calculated from the air containing vapour pressure (ASVP) measurement.

The conditions used in the test described in this standard are a vapour-to-liquid ratio of 4:1 and a test temperature of 37,8 °C.

The equipment is not wetted with water during the test, and the method described is therefore suitable for testing samples with or without oxygenates; no account is taken of dissolved water in the sample.

This method described is suitable for testing air-saturated samples that exert an air-saturated vapour pressure of between 7,0 kPa and 130,0 kPa at 37,8 °C.

This document is applicable to fuels containing oxygenated compounds up to the limits stated in the relevant EC Directive 85/536/EEC [4], and for ethanol-fuel blends up to 85 % ethanol

NOTE For the purposes of this European Standard, the terms “% (m/m)” and “% (V/V)” are used to represent the mass and volume fractions respectively.

WARNING —The use of this Standard can 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 users of this standard to take appropriate measures to ensure the safety and health of personnel prior to application of the standard, and fulfil statutory and regulatory requirements for this purpose.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 3170, *Petroleum liquids — Manual sampling (ISO 3170)*

ISO 3007, *Petroleum products and crude petroleum — Determination of vapour pressure — Reid method*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### air-saturated vapour pressure

total pressure

ASVP

observed pressure exerted *in vacuo* consisting of the partial pressure of petroleum products, components and feedstocks, in the absence on non-dissolved water, and the partial pressure of dissolved air

### 3.2

#### Reid vapour pressure

RVP

vapour pressure as determined by ISO 3007

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**3.3 dry vapour pressure equivalent**  
DVPE  
vapour pressure equivalent value calculated by a statistical correlation formula to a dry Reid vapour pressure

**4 Principle**

A cooled air-saturated sample of known volume is injected into a thermostatically controlled evacuated chamber, or into a chamber that is evacuated by means of a moveable piston after sample introduction, the internal volume of which is five times that of the total test portion introduced into the chamber. After injection into the chamber, the sample is allowed to reach thermal equilibrium at the test temperature 37,8 °C. The resulting total pressure in the chamber is equivalent to the vapour pressure of the sample and the partial pressure of the dissolved air and is measured using a pressure sensor and indicator. The measured total vapour pressure can be converted to a dry vapour pressure equivalent (DVPE) by use of a correlation formula.

**5 Reagents and materials**

Use chemicals of 99 % (*m/m*) minimum purity for quality control check samples for verification of apparatus.

5.1 Pentane

5.2 2,2 Dimethylbutane

5.3 2,3 Dimethylbutane

5.4 Cyclopentane

5.5 Toluene

**6 Apparatus****6.1 Instrument**

**6.1.1** The instrument shall conform to the general requirements given in 6.1.2 to 6.1.6 and be installed, operated and maintained in accordance with the manufacturer's manual.

NOTE Full details of suitable instruments are not given because of differences in the way that the basic principles are applied by individual manufacturers.

**6.1.2** The system shall be configured to enable the test chamber to be evacuated and isolated, the sample to be drained, and the system flushed and purged as necessary.

**6.1.3** The test chamber shall be vacuum-tight, with a provision for introducing the sample, and shall be capable of containing between 5 ml and 50 ml of liquid and vapour with an accuracy of 1 %. The test chamber shall be capable of controlling the temperature of the sample to achieve the specified test temperature to within  $\pm 0,1$  °C and shall be capable of indicating the temperature to a resolution of at least 0,1 °C.

NOTE 1 The test chambers used in the instruments that generated the precision statements were constructed from either aluminium or stainless steel.



NOTE 2 Test chambers with capacities less than 5 ml or greater than 50 ml may be used but the precision of the method can be affected.

**6.1.4** The apparatus shall be capable of measuring the vapour pressure of small samples of petroleum products, components and feedstocks over the range 0,0 kPa to 177,0 kPa, by means of a pressure transducer.

**6.1.5** If a vacuum pump is required for use with the instrument, it shall be capable of reducing the pressure in the test chamber to less than 0,01 kPa absolute.

**6.1.6** If a vacuum-tight syringe or similar equipment is required for measuring or injecting the required volume of sample into the test chamber, it shall be sized appropriately to the required sample size with an accuracy of at least 1 %.

**6.2 Cooling equipment**, air or iced-water bath or refrigerator, capable of cooling the samples to a temperature of between 0 °C and 1 °C, where a suitably safe refrigerator should be used with highly volatile petroleum products.

**6.3 Barometer**, pressure measuring device, capable of measuring atmospheric pressure within an accuracy of 0,2 kPa or better and calibrated and/or verified against an instrument certified by an authorized certification body.

**6.4 Vacuum gauge for calibration**, covering at least the range 0,01 kPa to 0,67 kPa, calibrated and/or verified against an instrument certified by an authorized certification body.

**6.5 Pressure measuring device**, transducer having a minimum measuring range from 0 kPa to 177 kPa, calibrated and/or verified against an instrument certified by an authorized certification body, with an accuracy of 0,8 kPa and a resolution of  $\leq 0,1$  kPa.

**6.6 Temperature measuring device**, in the required temperature ranges, with a resolution of 0,1 °C and scale error of less than 0,1 °C, calibrated and/or verified against an instrument certified by an authorized certification body.

## 7 Sampling

**7.1** Due to the extreme sensitivity of vapour pressure measurements to losses through evaporation and the resulting changes in composition, the utmost precaution and the most meticulous care shall be taken in the drawing and handling of samples.

**7.2** Samples shall be drawn in accordance with EN ISO 3170. However, the water displacement technique shall not be used.

NOTE The drawing of samples using automatic techniques, such as those described in EN ISO 3171 [5], is not recommended unless the technique has been proven not to lose light ends from the product or component being sampled. Loss of light ends can affect the vapour pressure measurement.

**7.3** For routine testing, the sample shall be supplied in a sealed container, constructed of suitable material, of at least 250 ml capacity. For referee testing, a 250 ml or 1 000 ml container shall be used. The container shall be a minimum of 70 % (V/V) full of sample at the time of receipt. See also 15.1.

**7.4** Samples shall be placed in a cool place as soon as possible after they have been obtained and held there until the test has been completed.

To protect the samples from excessive temperatures prior to testing, it is recommended to store the samples in the cooling equipment described in 6.2.

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**7.5** Samples in leaking containers shall not be considered for testing, but shall be discarded and new samples obtained.

**8 Sample preparation**

**8.1** The vapour pressure determination shall be the first test on a sample. For referee testing, only one test portion shall be taken from the container; for routine testing, it is permitted for further samples to be taken from the same container and 8.2 to 8.6 shall be followed.

**NOTE** An ASTM precision evaluation in 2003 [6] indicated that no bias was observed compared with the first test portion when a second test portion was taken from a 1 l sample container but a slight loss of vapour pressure was observed when taken from a 250 ml sample container.

**8.2** Before the sample container is opened, place it in the cooling equipment (6.2) and allow sufficient time for the container and contents to cool to between 0 °C and 1 °C.

Sufficient time to reach this temperature may be ensured by direct measurement of the temperature of a similar liquid in a similar container placed in the same bath at the same time as the sample.

**8.3** With the sample at 0 °C to 1 °C, remove the container from the cooling equipment and wipe dry with an absorbent material. Unseal the container (if it is not transparent) and examine the sample content.

**8.4** The sample content shall be 70 % (V/V) to 80 % (V/V) of the container capacity. Discard the sample if its volume is less than 70 % (V/V) of the container capacity. If the container is more than 80 % (V/V) full, pour out a sufficient amount of sample to bring the container contents within the 70 % (V/V) to 80 % (V/V) range. Under no circumstances shall any sample be returned to the container if it has been previously poured out. Reseal the container and return it to the cooling equipment (6.2).

**8.5** To ensure that the sample is air-saturated, remove the container from the cooling equipment when the sample is at 0 °C to 1 °C. Wipe the container dry with absorbent material, unseal it quickly and reseal it immediately taking care that no water enters, and shake vigorously. Return to the cooling equipment for a minimum of 2 min.

**8.6** Repeat 8.5 two more times. Return the sample to the cooling equipment until commencing the test.

**9 Preparation of apparatus**

**9.1** Prepare the instrument for operation in accordance with the manufacturer's instructions.

**9.2** Prepare the test chamber, as required to avoid contamination of the test portion, according to the manufacturer's instructions. Where an evacuated chamber is used, visually determine from the instrument display that the test chamber pressure is stable and does not exceed 0,1 kPa. When the pressure is not stable, or exceeds this value, check that no traces of volatile components are present in the chamber from a previous sample or check the calibration of the transducer.

**9.3** If a syringe is used for injection of the test portion, cool it to between 0 °C and 1 °C in an air bath or refrigerator before drawing in the sample. Avoid water contamination of the syringe reservoir by suitably sealing the outlet of the syringe during the cooling process.