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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)

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Will supersede EN 13016-1:2000

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 équivalente  
calculée (PVSE)

Flüssige Mineralölzeugnisse - Dampfdruck - Teil 1:  
Bestimmung des luftgesättigten Dampfdruckes (ASVP) und  
Berechnung des trockenen Dampfdruckäquivalentes  
(DVPE)

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

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

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## Foreword

This document (prEN 13016-1:2005) has been prepared by Technical Committee CEN/TC 19 “Petroleum products, lubricants and related products”, the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13016-1:2000, which has been updated by the explicit addition of DVPE that better reflects its use in EN 228 [1]. The range for the instrument verification fluids has been widened and typical/consensus values added in an informative Annex. A revision to the sample introduction has been included as this was part of the original procedure that precision was based on. Editorial clarification of the sampling, sample preparation and calibration of the pressure transducer have been included. The precision statements have been updated following a global evaluation in 2003.

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.*

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 one at elevated temperatures.

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## 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 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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## 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, 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, a sample size of 700 ml to 800 ml, and a test temperature of 37,8 °C.

NOTE 1 Annex A gives information on the precision values when using 50 ml and 250 ml samples or using a test temperature of 50,0 °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 9,0 kPa and 150,0 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].

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

**WARNING — The use of this 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 to determine the applicability of regulatory limitations prior to use.**

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 3170, *Petroleum liquids - Manual sampling (ISO 3170:2004)*.

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

## 3 Terms and definitions

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

### 3.1

#### **air-saturated vapour pressure**

total pressure

ASVP

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

### 3.2

#### **Reid vapour pressure**

RVP

vapour pressure as determined by ISO 3007

### 3.3

#### dry vapour pressure equivalent

DVPE

vapour pressure equivalent value calculated by a statistical correlation equation to a dry Reid vapour pressure

## 4 Principle

A known volume of cooled, air-saturated sample is injected into a thermostatically controlled evacuated chamber, the volume of which is five times that of the sample 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 equation.

## 5 Apparatus

### 5.1 Instrument

5.1.1 The instrument shall conform to the general requirements given in 5.1.2 to 5.1.6.

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

The instrument shall be installed, operated and maintained in accordance with the manufacturer's manual.

5.1.2 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.

5.1.3 The test chamber shall be vacuum-tight, with provision for the introduction of 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 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.

5.1.4 The apparatus shall be capable of measuring the vapour pressure of small samples of petroleum products, components and feedstocks over the range 9,0 kPa to 150,0 kPa, by means of a pressure transducer, with an accuracy of 0,8 kPa and a resolution of 0,1 kPa.

5.1.5 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.

5.1.6 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 %.

5.2 **Cooling equipment**, air or iced-water bath or refrigerator, capable of cooling the samples to a temperature of between 0 °C and 1 °C.

NOTE A suitably safe refrigerator should be used with highly volatile petroleum products.

5.3 **Barometer**, capable of measuring atmospheric pressure within an accuracy of 0,1 kPa or better and calibrated and/or verified against an instrument certified by an authorized certification body.



**5.4 Vacuum gauge or pressure transducer**, covering at least the range 0 kPa to 0,67 kPa, calibrated and/or verified against an instrument certified by an authorized certification body.

**5.5 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.

## 6 Sampling

**6.1** 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.

**6.2** 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 effect the vapour pressure measurement.

**6.3** For routine testing, the sample shall be supplied in a sealed container, constructed of suitable material, of either 1 l capacity or in a container of a different capacity with the same ullage requirement. For referee testing, a 1 l sample container shall be used. The container shall be a minimum of 70 % (V/V) full of sample at the time of receipt.

**6.4** 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.

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

## 7 Sample preparation

**7.1** 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 clauses 7.2 to 7.6 shall be followed.

**NOTE** An ASTM precision evaluation in 2003 [6] indicated that no bias was observed compared to 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.

**7.2** Before the sample container is opened, place it in the cooling equipment (5.2) and allow sufficient time for the container and contents to cool to between 0 °C and 1 °C.

**NOTE** 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.

**7.3** With the sample at a temperature of 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.

**7.4** 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 sufficient 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 poured out previously. Reseal the container and return it to the cooling equipment (5.2).

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

**7.6** Repeat 7.5 twice more. Return the sample to the cooling equipment until commencing the test.

## 8 Preparation of apparatus

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

**8.2** 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, determine visually 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 no traces of volatile components are present in the chamber from a previous sample or check the calibration of the transducer.

**8.3** 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 sealing the outlet of the syringe suitably during the cooling process.

## 9 Calibration of apparatus

### 9.1 Pressure transducer

**9.1.1** Check the calibration of the transducer at 37,8 °C on a six monthly basis or when required as indicated from the quality control checks. The calibration of the transducer shall be checked using two reference points; zero pressure (< 0,1 kPa) and the ambient barometric pressure.

**NOTE** A mercury column barometer is the most accurate and suitable device for calibrating the atmospheric pressure display of the apparatus, however, these barometers are either calibrated at 0 °C or are manufactured using the density of mercury as defined at 0 °C. This means that, when the barometer is used in the laboratory at ambient temperature, the reading of the barometer will be slightly high, for example, at 20 °C the correction is minus 0,33 kPa.

**9.1.2** Connect the calibrated vacuum gauge or pressure transducer (5.4) to the vacuum source in line with the test chamber. When the calibrated gauge or transducer registers a pressure less than 0,1 kPa, adjust the transducer control to zero or to the actual reading on the calibrated gauge or transducer as dictated by the instrument design and the manufacturer's instructions.

**9.1.3** Open the test chamber to the atmosphere and observe the transducer reading. If the pressure reading is not within 0,1 kPa of the ambient barometric pressure (which has been corrected for temperature in accordance with 9.1.1), adjust the transducer span control until the appropriate reading is observed. Ensure that the instrument is set to display the total pressure and not a calculated or corrected value.

**9.1.4** Repeat 9.1.2 and 9.1.3 until the zero and barometric pressures read to within  $\pm 0,1$  kPa without further adjustment.

**NOTE** Some instruments automate the calibration procedure and carry out these repeat operations automatically.

### 9.2 Temperature measuring device

Check the calibration of the temperature measuring device used to monitor the temperature of the sample in the test chamber, against a calibrated temperature device (5.5) at least every 6 months or when needed as indicated from the quality control checks. The temperature readings shall agree to within  $\pm 0,1$  °C at the test temperature. When a calibrated liquid-in-glass thermometer is used to check the calibration of the