SLOVENSKI STANDARD

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Tekoļi naftni proizvodi ï Parni tlak ï 2. del: Doloļevanje absolutnega parnega tlaka (AVP) med 40 ÁC in 100 ÁC

Liquid petroleum products - Vapour pressure - Part 2: Determination of absolute pressure (AVP) between 40 oC and 100 oC

Flüssige Mineralölerzeugnisse - Dampfdruck - Teil 2: Bestimmung des absoluten Dampfdruckes (AVP) im Temperaturbereich zwischen 40 °C und 100 °C

Produits pétroliers liquides - Pression de vapeur - Partie 2 : Détermination de la pression de vapeur absolue (PVA) entre 40 °C et 100 °C

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Liquid petroleum products - Vapour pressure - Part 2: Determination of absolute pressure(AVP) between 40 °C and 100 °C

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This European Standard was approved by CEN on 28 July 2007.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 13016-2:2007) 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 European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2008, and conflicting national standards shall be withdrawn at the latest by March 2008.

This document supersedes EN 13016-2:2000, which has been revised editorially to clarify a number of steps related to sampling, calibration of the pressure transducer and the procedure. No new precision evaluations have been carried out. The equation to calculate the absolute vapour pressure in the informative Annex A has been corrected.

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 1 is based on and developed in parallel with IP 394 [1] and ASTM D 5191 [2]. It describes a general determination method, whereas this part describes one at elevated temperatures.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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.

1 Scope

This European Standard specifies a method for the determination of absolute vapour pressure of liquid petroleum products at elevated temperatures.

The conditions used in the test described in this standard are a vapour to liquid ratio of 3:2 and an initial injection temperature of 37,8 °C or 30,0 °C.

The method described is suitable for testing air-saturated samples that exert an air-saturated vapour pressure of between 9 kPa and 500 kPa at temperatures between 40 °C and 100 °C.

This European Standard is applicable to fuels containing oxygenated compounds up to the limits stated in the relevant EC Directive 85/536/EEC [3].

NOTE 1 If a sample injection is into a test chamber which is raised to 37,8 °C and the vapour to liquid ratio is 4:1, the initial measurement corresponds with the measurement in Part 1 of this standard.

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

WARNING — 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

The following referenced documents are indispensable for the application of this document. 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 3170:2004)*

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
absolute vapour pressure
AVP
air-saturated vapour pressure minus the partial pressure due to dissolved air in the liquid

4 Principle

A cooled air-saturated sample of known volume is introduced into an evacuated, temperature-controlled chamber in two equal test portions. The volume of the chamber is five times that of the sample introduced to provide a vapour-to-liquid ratio of 4:1. The vapour-to-liquid ratio following the second injection is 3:2. After

the injection of each test portion, the air-saturated vapour pressure is determined. The partial pressure of the dissolved air is calculated from the two resulting pressures.

The temperature of the test chamber is then increased to a specified value and the air-saturated vapour pressure determined. The absolute vapour pressure (AVP) is calculated by subtracting the partial pressure of the dissolved air in the liquid, which has been corrected for temperature and compensated for compressive effects and solubility, from the air-saturated vapour pressure. The procedure may be repeated at further test temperatures.

5 Reagents

Pentane, reagent grade 99,5 % (*V/V*) minimum purity.

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.

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.

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 provision for the introduction of the sample, and shall be capable of containing between 5 ml and 15 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 ± 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 aluminum or stainless steel.

NOTE 2 Test chambers with capacities less than 5 ml or greater than 15 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 pressure range 9,0 kPa to 500,0 kPa and at temperatures between 40 °C and 100 °C, by means of a pressure transducer, with an accuracy of 0,8 kPa and a resolution of 0,1 kPa.

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 a 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.

6.3 Barometer for calibration, 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.

6.4 Vacuum gauge for calibration, covering at least the range 0 kPa to 177 kPa, calibrated and/or verified against an instrument certified by an authorized certification body.

6.5 Pressure measuring device for the apparatus, having a minimum measuring range from 0 kPa to 500 kPa, 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 and/or in accordance with the requirements of National Standards or regulations for the sampling of the product under test. However, the water displacement technique shall not be used.

NOTE Drawing samples using automatic techniques, such as those described in EN ISO 3171 [4], 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 may effect the vapour pressure measurement.

7.3 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.

NOTE The precision of the method can be different if container capacities differ from 1 l.

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.

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

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.

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.

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.

8.3 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.

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 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 (6.2).