SLOVENSKI STANDARD

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Tekoļ i naftni proizvodi ï Parni tlak ï 1. del: Doloļ evanje z zrakom nasiļ enega 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 (ASVP) und Berechnung des trockenen Dampfdruckäquivalentes (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 seche équivalente calculée (PVSE)

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EUROPEAN STANDARD

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

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

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

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

Contents

Page

Foreword

This document (EN 13016-1:2007) 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of an identical text or by endorsement, at the latest by March 2008, and conflicting national standards shall be withdrawn at the latest by March 2008.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 13016-1:2000, which has been updated by the explicit addition of DVPE to better reflect 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 a determination method 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 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 and a test temperature of 37,8 °C.

For referee testing the requirement to employ 1 l sample containers is mandatory. However, due to sample container size restrictions in taking automatic samples from vapour-locks either onboard a ship or from some land based storage tanks, the precision for 250 ml containers forms part of this standard and shall be used for referee purposes.

NOTE 1 This standard states precision for both 1 l and 250 ml sample containers. Annex A provides information on the precision values when using 50 ml at 37,8 °C or using 1 l samples at 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 "% (*m/m*)" and "% (*V/V*)" are used to represent the mass, respectively 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)*

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 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

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 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 ºC. 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 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

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 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 ± 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 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.

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.

NOTE 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 0,1 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 0,67 kPa, calibrated and/or verified against an instrument certified by an authorized certification body.

6.5 Pressure measuring device, having a minimum measuring range from 0 kPa to 177 kPa, calibrated and/or verified against an instrument certified by an authorized certification body.

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 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 [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.

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 or a 250 ml sample container shall be used. The container shall be a minimum of 70 % (*V/V*) full of sample at the time of receipt.

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 temperatures 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.