SLOVENSKI STANDARD
oSIST prEN 16906:2022

01-april-2022

Tekoči naftni proizvodi - Ugotavljanje kakovosti vžiga dizelskih goriv - Motorna metoda s fiksnim kompresijskim razmerjem

Liquid petroleum products - Determination of the ignition quality of diesel fuels - Fixed compression ratio engine method

Flüssige Mineralölerzeugnisse — Bestimmung der Zündwilligkeit von Dieselkraftstoffen — Verfahren mit einem Prüfmotor mit konstantem Verdichtungsverhältnis

Produits pétroliers liquides — Détermination de la qualité d'allumage des combustibles Diesel — Méthode du moteur à taux de compression fixe

Ta slovenski standard je istoveten z: **prEN 16906**

ICS:

13.220.40	Sposobnost vžiga in obnašanje materialov in proizvodov pri gorenju	Ignitability and burning behaviour of materials and products
75.160.20	Tekoča goriva	Liquid fuels

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 16906

April 2022

ICS 75.160.20

Will supersede EN 16906:2017

English Version

Liquid petroleum products - Determination of the ignition quality of diesel fuels - Fixed compression ratio engine method

Produits pétroliers liquides ¿ Détermination de la qualité d'allumage des combustibles Diesel ¿ Méthode du moteur à taux de compression fixe

Flüssige Mineralölerzeugnisse - Bestimmung der Zündwilligkeit von Dieselkraftstoffen - Verfahren mit einem Prüfmotor mit konstantem Verdichtungsverhältnis

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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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European foreword ..... Error! Bookmark not defined.

Introduction ..... Error! Bookmark not defined.

1 Scope ..... Error! Bookmark not defined.

2 Normative references ..... Error! Bookmark not defined.

3 Terms and definitions ..... Error! Bookmark not defined.

4 Principle ..... Error! Bookmark not defined.

5 Reagents and materials ..... Error! Bookmark not defined.

6 Apparatus ..... Error! Bookmark not defined.
6.1 General ..... Error! Bookmark not defined.

7 Sampling ..... Error! Bookmark not defined.

8 Standard operating and test conditions ..... Error! Bookmark not defined.

9 Calibration, verification and quality control ..... Error! Bookmark not defined.

10 Procedure ..... Error! Bookmark not defined.
10.1 Engine check and warm-up ..... Error! Bookmark not defined.
10.2 Bracketing procedure ..... Error! Bookmark not defined.
10.2.1 Unknown sample ..... Error! Bookmark not defined.
10.2.2 First primary reference fuel ..... Error! Bookmark not defined.
10.2.3 Second primary reference fuel ..... Error! Bookmark not defined.
10.2.4 Repeat readings ..... Error! Bookmark not defined.
10.3 Procedure using a calibration graph ..... Error! Bookmark not defined.
10.4 Shut-down of the engine ..... Error! Bookmark not defined.

11 Calculation ..... Error! Bookmark not defined.
11.1 Calculation for the bracketing procedure ..... Error! Bookmark not defined.
11.2 Calculation for the calibration graph ..... Error! Bookmark not defined.

12 Expression of results ..... Error! Bookmark not defined.

13 Precision ..... Error! Bookmark not defined.
13.1 General ..... Error! Bookmark not defined.
13.2 Repeatability ..... Error! Bookmark not defined.
13.3 Reproducibility ..... Error! Bookmark not defined.

Annex A (informative) **Evaluation example of the cetane number using a calibration graph** .. Error! Bookmark not defined.

Annex B (normative) **Auxiliary digital equipment** ..... Error! Bookmark not defined.
B.1 General ..... Error! Bookmark not defined.
B.2 Apparatus ..... Error! Bookmark not defined.
B.3 Set-up ..... Error! Bookmark not defined.
B.4 Calibration ..... Error! Bookmark not defined.

Bibliography ..... Error! Bookmark not defined.

European foreword

This document (prEN 16906:2022) 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 16906:2017.

The major updates towards the former version are:

— new title;

— new scope and precision based on proficiency testing scheme data within DIN-FAM;

— introduction of a new low cetane primary reference fuel, pentamethylheptane (PMH);

— introduction of a statistical observable bias with EN ISO 5165 in the expression of results section.

Introduction

The test method described in this document is based on DIN 51773 [1], which had been developed in the German group, DIN NA 062-06-43 AA “Engine testing of liquid fuels”, and which has been used very successfully since more than 40 years. It was originally known as the 'BASF engine'.

The described method is an alternative quantitative determination of the cetane number of middle distillate fuels intended for use in compression ignition engines.

A correlation study between this method and EN ISO 5165 [2] has been done and the results of this are incorporated in the precision report issued in 2019 [3] and in this document.

The testing of pure FAME (which is in the scope of EN ISO 5165) has been excluded from the scope for the time being as there seem to be sample specific biases for such product. CEN will initiate appropriate causal studies.

1 Scope

This document specifies a test method for the determination of cetane numbers ("*CN*") in diesel fuel, using a standard single cylinder, four-stroke cycle, indirect injection engine. The cetane number provides a measure of the ignition characteristics of diesel fuels in compression ignition engines. The cetane number is determined at constant speed in a compression ignition test engine equipped with a swirl chamber.

The cetane number scale covers the range from zero to 100, but typical testing is performed in the range from about 40 *CN* to about 75 *CN*. The precision of this test method covers the range from 44 *CN* to about 66 *CN.*

This document is applicable to distillate as well as paraffinic diesel fuels intended for use in diesel engines, including those containing fatty-acid methyl esters (FAME), ignition-improvers or other diesel fuel additives.

When this engine test procedure is used for other fuels such as synthetics and vegetable oils, samples with fuel properties that interfere with the gravity-based pre-supply pressure to the fuel pump e.g. due to high viscosity can only be used to a limited extent. Precision data for such fuels are not available at this stage.

NOTE 1 For the purpose of this document the expressions "%(m/m)" and "%(V/V)" are used to represent the mass faction and volume fraction respectively of a material.

NOTE 2 The test method is also suitable for determining cetane numbers outside the range of the scope, however, the precision statement only applies for fuels in the specified range.

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 the user 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 are referred to in the text in such a way that some or all of their content constitutes requirements 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)*

EN ISO 3171, *Petroleum liquids - Automatic pipeline sampling (ISO 3171)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
ignition quality
property of a fuel which causes a self-ignition under standard operating conditions in a diesel engine

3.2
ignition delay
ID
period of time between the start of fuel injection and the start of combustion expressed in degrees of crank angle rotation

3.3
cetane number
CN
measure of an ignition quality of a diesel fuel obtained by comparing it with reference fuel blends of known cetane numbers and the fuel to be measured in a standardized test engine under controlled conditions

3.4
accepted reference value
ARV
value agreed upon as a reference for comparison

Note 1 to entry: The value is derived as (1) a theoretical or established value, based in scientific principles, (2) an assigned value, based on experimental work of some national or international organization, or (3) a consensus value, based on collaborative experimental work under the auspices of a scientific or engineering group.

4 Principle

The cetane number of a fuel is determined by comparing its combustion characteristics in a test engine with those for blends of reference fuels of known cetane number under standard operating conditions. This is accomplished by comparing the intake air mass at a given ignition delay. A multiple calibration procedure may also be applied for the comparison of intake air mass.

5 Reagents and materials

5.1 Reference materials

NOTE Store and use primary reference fuels in the dark or in amber containers at temperatures of 20 °C or higher to avoid solidification of n-Cetane which has a melting point of 18 °C.

5.1.1 n-hexadecane (n-Cetane), primary reference fuel

This reference material with a minimum purity of 99,0 %(*m/m*) shall be used as the designated cetane number of 100. The purity shall be determined by a gas chromatography test method. An appropriate test method is under development at DIN-FAM..

5.1.2 1-Methylnaphthalene (AMN), primary reference fuel

This reference material with a minimum purity of 95,0 %(*m/m*) shall be used as the designated cetane number of zero. The purity shall be determined by a gas chromatography test method. An appropriate test method is under development at DIN-FAM..

5.1.3 2,2,4,4,6,8,8-Heptamethylnonane (HMN), primary reference fuel

This reference material with a minimum purity of 98,0 %(*m/m*) shall be used as the designated cetane number of 15. The purity shall be determined by a gas chromatography test method. An appropriate test method is under development at DIN-FAM.

5.1.4 2,2,4,6,6-Pentamethylheptane (PMH), primary reference fuel

This reference material with a minimum purity of 98,0 %(*m/m*) shall be used as the designated cetane number of 16,3. The purity shall be determined by a gas chromatography test method. An appropriate test method is under development at DIN-FAM.

Primary reference fuel blends are volumetrically proportioned mixtures of these materials, which define the *CN* scale.

5.2 Reference fuel dispensing equipment

For preparing the required blends of reference fuels calibrated burettes or volumetric ware with a maximum of 500 ml capacity and a maximum volumetric tolerance of ± 0,2 % shall be used. The burettes shall be outfitted with a delivery valve and a delivery tip to accurately control the dispensed volumes. The delivery tip shall be of such size and design that shut-off tip discharge does not exceed 0,5 ml. The rate of delivery from the dispensing system shall not exceed 500 ml/min. The set of burettes or volumetric ware shall be installed in such a manner that all components of each batch or blend are dispensed at the same temperature.

Other blending systems that allow the preparation of volumetrically-defined blends or volumetrically-defined blends by gravimetric measurements based on the density of the individual components are also permitted, provided the system meets the requirement for maximum 0,2 % tolerance limits.

5.3 Check fuels

Diesel fuels with known cetane number statistically validated by interlaboratory studies or proficiency testing schemes (PTS) with other test engines may be used for checking the engine qualification only. The typical cetane number range of a check fuel is from 44 *CN* to 66 *CN* which represents the Cetane number of diesel fuels within the European market.

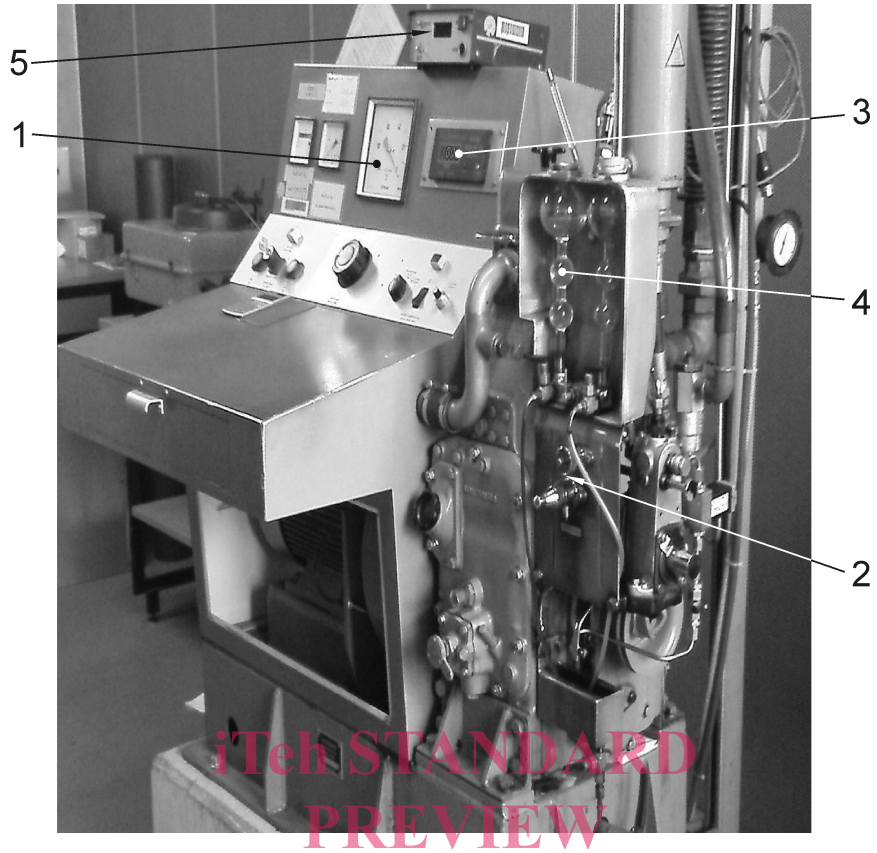
6 Apparatus

6.1 General

The 4-stroke single cylinder engine as shown in Figure 1 shall be used. It comprises a standard crankcase with fuel pump assembly and a cylinder head assembly of the pre-combustion type, a thermal-siphon recirculating jacket coolant system, double fuel tank system with selector valving, injector assembly with specific injector nozzle, electrical controls and a suitable exhaust pipe.

NOTE The engine was developed by BASF SE on the basis of a MWM/KHD model KD12E engine.

The engine shall be connected to a special electric power-absorption motor, which acts as a motor driver to start the engine and as a means to absorb power at constant speed when combustion is occurring.



Key

1 air flow meter
2 control device for start of injection and fuel amount
3 display for start of injection
4 assembly for fuel flow measurement
5 display for ignition delay

Figure 1 — Test engine assembly

6.2 Mechanical equipment:

6.2.1 Fuel injection pump and nozzle.

The fuel injection pump including leakage oil stop, nozzle holding assembly and the injection nozzle.

NOTE The parts [BOSCH Type PE 1A M50, BOSCH KB 42 SDAV, BOSCH DLOS 103] which have proven to be suitable, are trade names of a product supplied by BOSCH. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN or CENELEC of the product named. Equivalent products may be used if they can be shown to lead to the same results e. g. by an interlaboratory study.

6.2.2 Injection-timing adjustment.

The fuel pump, installed on a panel, is driven by the camshaft and adjusted using an injection timing device.

6.2.3 Fuel flow measurement system.

To keep the fuel flow constant and to adjust the injected amount of fuel per pump stroke to the specified value the control rod of the injection pump is equipped with a micro-adjustment. The fuel consumption shall be measured by using two switchable burettes.