



# SLOVENSKI STANDARD

## SIST EN 16906:2023

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Nadomešča:  
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### 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 Dieselmotoren  
— 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: **EN 16906:2023**

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EUROPEAN STANDARD

EN 16906

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## 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 avec moteur à taux de compression fixe

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

This European Standard was approved by CEN on 4 September 2023.

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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-CENELEC 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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

<b>Contents</b>	<b>Page</b>
European foreword.....	4
Introduction .....	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions .....	6
4 Principle .....	7
5 Reagents and materials.....	7
5.1 Reference materials .....	7
5.2 Check fuels.....	8
6 Apparatus.....	8
6.1 General.....	8
6.2 Mechanical equipment.....	9
6.3 Electrical equipment.....	10
6.4 Reference fuel dispensing equipment.....	11
7 Sampling.....	11
8 Standard operating and test conditions .....	12
9 Calibration, verification and quality control.....	12
10 Procedure.....	12
10.1 Engine check and warm-up .....	12
10.2 Bracketing procedure.....	13
10.2.1 Unknown sample.....	13
10.2.2 First primary reference fuel.....	13
10.2.3 Second primary reference fuel.....	13
10.2.4 Repeat readings .....	14
10.3 Procedure using a calibration graph.....	14
10.4 Shut-down of the engine .....	15
11 Calculation .....	15
11.1 Calculation for the bracketing procedure.....	15
11.2 Calculation for the calibration graph.....	15
12 Expression of results.....	16
13 Precision.....	16
13.1 General.....	16
13.2 Repeatability.....	16
13.3 Reproducibility.....	16
Annex A (informative) Evaluation example of the cetane number using a calibration graph.....	17
Annex B (informative) Auxiliary digital equipment.....	18
B.1 General.....	18
B.2 Apparatus.....	18
B.2.1 Oil-pressure sensor, installed at the oil pressure line.....	18

<b>B.2.2</b>	<b>Oil temperature sensor, combined with the additionally supplied oil dip-stick to be placed into the designated borehole. ....</b>	<b>18</b>
<b>B.2.3</b>	<b>Exhaust gas temperature sensor, placed to the exhaust-pipe.....</b>	<b>18</b>
<b>B.2.4</b>	<b>Cooling-water temperature sensor, installed at the water elbow joint.....</b>	<b>18</b>
<b>B.2.5</b>	<b>Injection Pick-up, placed on the injection nozzle. ....</b>	<b>18</b>
<b>B.2.6</b>	<b>Dead-Top Centre (DTC) Pick-up, installed at the fastener opposite to the flywheel. ....</b>	<b>18</b>
<b>B.2.7</b>	<b>Combustion Pick-up, inductive pressure difference sensor or absolute pressure sensor. ....</b>	<b>18</b>
<b>B.2.8</b>	<b>Vacuum sensor, installed at the entrance of the surge tank. ....</b>	<b>18</b>
<b>B.2.9</b>	<b>Ambient sensor, for absolute air pressure, temperature and humidity. ....</b>	<b>18</b>
<b>B.2.10</b>	<b>Intake air temperature sensor (optional), for monitoring the steady-state conditions for operating the engine. ....</b>	<b>18</b>
<b>B.2.11</b>	<b>Diesel flow meter (optional), for measuring the diesel flow rate.....</b>	<b>18</b>
<b>B.3</b>	<b>Set-up .....</b>	<b>18</b>
<b>B.4</b>	<b>Calibration.....</b>	<b>19</b>
	<b>Bibliography .....</b>	<b>20</b>

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**EN 16906:2023 (E)****European foreword**

This document (EN 16906:2023) 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 April 2024, and conflicting national standards shall be withdrawn at the latest by April 2024.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 16906:2017.

The main changes compared to the previous edition EN 16906:2017 are listed below:

- 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.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

## 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 "Combustion characteristic of 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 has been done and the results of this are incorporated in the precision report issued in 2019 [2] 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 seems to be sample specific biases for such product. CEN will initiate appropriate causal studies.

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**EN 16906:2023 (E)****1 Scope**

This document specifies a test method for the determination of cetane numbers (“CN”) of diesel fuels, 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 0 to 100, but typical testing is performed in the CN range from about 40 to about 75. The precision of this test method covers the CN range from 44 to about 66.

This document is applicable to distillate as well as paraffinic diesel fuels intended for use in diesel engines, including those containing up to a volume fraction of 10 % 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** 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 document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to take appropriate measures to ensure the safety and health of personnel prior to application of the document, 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 590, *Automotive fuels — Diesel — Requirements and test methods*

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

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

EN ISO 5165, *Petroleum products — Determination of the ignition quality of diesel fuels — Cetane engine method (ISO 5165)*

**3 Terms and definitions**

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

ISO and IEC maintain terminology 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 the 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, described in 10.3, may also be applied for the comparison of intake air mass.

## 5 Reagents and materials

### 5.1 Reference materials

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 990 g/kg shall be used as the designated cetane number of 100. The purity shall be determined by a gas chromatography test method.

#### 5.1.2 1-Methylnaphthalene (AMN), primary reference fuel

This reference material with a minimum purity of 950 g/kg shall be used as the designated cetane number of 0. The purity shall be determined by a gas chromatography test method.

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

This reference material with a minimum purity of 980 g/kg 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 published by DIN-FAM [3].

## EN 16906:2023 (E)

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

This reference material with a minimum purity of 980 g/kg 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 published by DIN-FAM [3].

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

### 5.2 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 to 66 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<sup>1</sup>. 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.

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.

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<sup>1</sup> The engine was developed by BASF SE on the basis of an MWM/KHD model KD12E engine. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN 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.