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Automotive fuels - Diesel - Requirements and test methods

Carburants pour automobiles - Combustible pour moteur diesel (gazole) - Exigences et méthodes d'essai

Kraftstoffe für Kraftfahrzeuge - Dieselkraftstoff - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 29 October 1999.

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

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 19 "Petroleum products, lubricants and related products", the secretariat of which is held by NNI.

This European Standard replaces EN 590:1998.

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of an identical text or by endorsement, at the latest by May 2000, and conflicting national standards shall be withdrawn at the latest by May 2000.

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

Significant technical changes between this European Standard and the previous edition are:

- Requirements of the European Fuels Directive 98/70/EC have been included on cetane number, density, distillation, polycyclic aromatic hydrocarbons, sulfur as well as references to test methods, including years of publication;
- The informative annex A has been added.

In this standard annex A is informative.

1 Scope

This European Standard specifies requirements and test methods for marketed and delivered automotive diesel fuel. It is applicable to automotive diesel fuel for use in diesel engine vehicles designed to run on automotive diesel fuel.

NOTE: For the purposes of this European Standard, the terms "% (*m/m*)" and "% (*V/V*)" are used to represent respectively the mass fraction and the volume fraction.

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.

EN 116, *Diesel and domestic heating fuels - Determination of cold filter plugging point.*

EN ISO 2160, *Petroleum products - Corrosiveness to copper - Copper strip test.*

EN ISO 3104, *Petroleum products - Transparent and opaque liquids - Determination of kinematic viscosity and calculation of dynamic viscosity.*

EN ISO 3170, *Petroleum liquids - Manual sampling.*

EN ISO 3171, *Petroleum liquids - Automatic pipeline sampling.*

prEN ISO 3405:1998, *Petroleum products - Determination of distillation characteristics.* (ISO/DIS 3405:1998)

EN ISO 3675:1998, *Crude petroleum and liquid petroleum products - Laboratory determination of density or relative density - Hydrometer method.* (ISO 3675:1998)

EN ISO 4259:1995, *Petroleum products - Determination and application of precision data in relation to methods of test.* (ISO 4259:1993)

EN ISO 4264, *Petroleum products - Distillate fuels - Calculation of cetane index.*

EN ISO 5165:1998, *Diesel fuels - Determination of ignition quality - Cetane method.* (ISO 5165:1998)

EN ISO 6245, *Petroleum products - Determination of ash.*

EN ISO 8754:1995, *Petroleum products - Determination of sulfur content - Energy-dispersive X-ray fluorescence method.* (ISO 8754:1992)

EN ISO 10370, *Petroleum products - Determination of carbon residue (micro method).*

EN ISO 12185:1996, *Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method.*

EN ISO 12205, *Petroleum products - Determination of the oxidation stability of distillate fuels.*

EN 12662, *Liquid petroleum products - Determination of contamination in middle distillates.*

prEN ISO 12937:1996, *Petroleum products - Determination of water - Coulometric Karl Fisher titration method.* (ISO/DIS 12937:1996)

EN ISO 13759, *Petroleum products - Determination of alkyl nitrate in diesel fuels - Spectrometric method.*

EN ISO 14596:1998, *Petroleum products - Determination of sulfur content - Wavelength-dispersive X-ray fluorescence spectrometry.* (ISO 14596:1998)

EN 22719, *Petroleum products and lubricants - Determination of flash point - Pensky-Martens closed cup method.*

EN 23015, *Petroleum products - Determination of cloud point.*

EN 24260:1994, *Petroleum products and hydrocarbons - Determination of sulfur content - Wickbold combustion method.* (ISO 4260:1987)

ISO 12156-1:1997, *Diesel fuels - Assessment of lubricity by HFRR.* (including Cor. 1:1998)

IP 391:1995, *Petroleum products - Determination of aromatic hydrocarbon types in middle distillates - High performance liquid chromatography method with refractive index detection.*

3 Sampling

Samples shall be taken as described in EN ISO 3170 or EN ISO 3171 and/or in accordance with the requirements of national standards or regulations for the sampling of automotive diesel fuel. The national requirements shall be set out in detail or shall be referred to by reference in a national annex to this European Standard.

In view of the sensitivity of some of the test methods referred to in this European Standard, particular attention shall be paid to compliance with any guidance on sampling containers which is included in the test method standard.

4 Pump marking

Information to be marked on dispensing pumps used for delivering automotive diesel fuel, and the dimensions of the mark shall be in accordance with the requirements of national standards or regulations for the marking of pumps for automotive diesel fuel. Such requirements shall be set out in detail or shall be referred to by reference in a national annex to this European Standard.

5 Requirements and test methods

5.1 Dyes and markers

The use of dyes or markers is allowed.

5.2 Additives

In order to improve the performance quality, the use of additives is allowed. Suitable fuel additives without known harmful side-effects are recommended in the appropriate amount, to help to avoid deterioration of driveability and emissions control durability. Other technical means with equivalent effect may also be used.

NOTE: Deposit forming tendency test methods suitable for routine control purposes have not yet been identified and developed.

5.3 Generally applicable requirements and related test methods

5.3.1 When tested by the methods indicated in table 1, automotive diesel fuel shall be in accordance with the limits specified in table 1.

5.3.2 The limiting value for the carbon residue given in table 1 is based on product prior to addition of ignition improver, if used. If a value exceeding the limit is obtained on finished fuel in the market, EN ISO 13759 shall be used as an indicator of the presence of a nitrate-containing compound. If an ignition improver is thus proved present, the limit value for the carbon residue of the product under test cannot be applied. The use of additives does not exempt the manufacturer from meeting the requirement of maximum 0,30 % (*m/m*) of carbon residue prior to addition of additives.

Table 1 - Generally applicable requirements and test methods

Property	Unit	Limits		Test method [a]
		minimum	maximum	
Cetane number [c]		51,0	–	EN ISO 5165:1998
Cetane index		46,0	–	EN ISO 4264
Density at 15 °C [b]	kg/m^3	820	845	EN ISO 3675:1998 EN ISO 12185:1996
Polycyclic aromatic hydrocarbons [d, e]	% (*m/m*)	–	11	IP 391:1995
Sulfur content [b]	mg/kg	–	350	EN ISO 14596:1998 EN ISO 8754:1995 EN 24260:1994
Flash point	°C	above 55	–	EN 22719
Carbon residue [f] (on 10 % distillation residue)	% (*m/m*)	–	0,30	EN ISO 10370
Ash content	% (*m/m*)	–	0,01	EN ISO 6245
Water content	mg/kg	–	200	prEN ISO 12937:1996
Total contamination	mg/kg	–	24	EN 12662
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Oxidation stability	g/m^3	–	25	EN ISO 12205
Lubricity, corrected wear scar diameter (wsd 1,4) at 60 °C	µm	–	460	ISO 12156-1
Viscosity at 40 °C	mm^2/s	2,00	4,50	EN ISO 3104
Distillation [g, h]				prEN ISO 3405:1998
% (*V/V*) recovered at 250 °C	% (*V/V*)		< 65	
% (*V/V*) recovered at 350 °C	% (*V/V*)	85		
95 % (*V/V*) recovered at	°C		360	

[a] See also 5.5.1

[b] See also 5.5.2.

[c] See also 5.5.3.

[d] For the purposes of this European Standard, polycyclic aromatic hydrocarbons are defined as the total aromatic hydrocarbon content less the mono-aromatic hydrocarbon content, both as determined by IP 391. IP 391 will be replaced by EN 12916 “Petroleum products - Determination of aromatic hydrocarbon types by high performance liquid chromatography with refractive index detection” upon publication.

[e] IP 391 is not able to distinguish between polycyclic aromatic hydrocarbons and fatty acid methyl esters (FAME). FAME, if present in diesel fuels, will give a bias which will increase the value for polycyclic aromatic hydrocarbons. An improved method for the determination of polycyclic aromatic hydrocarbons is under development by CEN/TC 19.

[f] See also 5.3.2.

[g] For the calculation of the cetane index the 10 %, 50 % and 90 % (*V/V*) recovery points are also needed.

[h] The limits for distillation at 250 °C and 350 °C are included for diesel fuel in line with EU Common Customs tariff.

5.4 Climate dependent requirements and related test methods

5.4.1 For climate-dependent requirements options are given to allow for seasonal grades to be set nationally. The options are for temperate climates six CFPP (cold filter plugging point) grades and for arctic climates five different classes. Climate-dependent requirements are given in table 2. Table 2 is divided into two sections, one for temperate climates (table 2a) and one for arctic climates (table 2b). When tested by the methods given in tables 2a and 2b, automotive diesel fuel shall be in accordance with the limits specified in these tables.

5.4.2 The cetane number limits for arctic grades in table 2b are lower than for the temperate grade (table 1), reflecting the correlation between ignition quality and density, and the low density of arctic grades. The values for cetane number given in table 2b do not meet the requirements of Directive 98/70/EC, and are included for use in countries where Directive 98/70/EC does not apply or for countries where cetane number exceptions have been granted for arctic grades.

5.4.3 In a national annex to this European Standard each country shall detail requirements for a summer and a winter grade and may include (an) intermediate and/or regional grade(s) which shall be justified by national meteorological data.

Table 2 - Climate-related requirements and test methods

Table 2a - Temperate climates

Property	Unit	Limits						Test method [a]
		Grade A	Grade B	Grade C	Grade D	Grade E	Grade F	
CFPP	°C, max.	+5	0	-5	-10	-15	-20	EN 116
[a] See also 5.5.1.								

Table 2b - Arctic climates

Property	Units	Limits					Test method [a]
		class 0	class 1	class 2	class 3	class 4	
CFPP	°C, max.	-20	-26	-32	-38	-44	EN 116
Cloud point	°C, max.	-10	-16	-22	-28	-34	EN 23015
Density at 15 °C [b]	kg/m^3, min. kg/m^3, max.	800 845	800 845	800 840	800 840	800 840	EN ISO 3675:1998 EN ISO 12185:1996
Viscosity at 40 °C	mm^2/s, min. mm^2/s, max.	1,50 4,00	1,50 4,00	1,50 4,00	1,40 4,00	1,20 4,00	EN ISO 3104
Cetane number [c]	minimum	49,0	49,0	48,0	47,0	47,0	EN ISO 5165:1998
Cetane index	minimum	46,0	46,0	46,0	43,0	43,0	EN ISO 4264
Distillation [d, e]							
% (*V/V*) recovered at 180 °C	% (*V/V*).max.	10	10	10	10	10	prEN ISO
% (*V/V*) recovered at 340 °C	% (*V/V*),min.	95	95	95	95	95	3405:1998

[a] See also 5.5.1.
[b] See also 5.5.2.
[c] See also 5.5.3.
[d] EU Common Customs Tariff definition of gas oil may not apply to the grades defined for use in arctic climates.
[e] For the calculation of the cetane index the 10 %, 50 % and 90 % (*V/V*) recovery points are also needed

5.5 Precision and dispute

5.5.1 All test methods referred to in this European Standard include a precision statement. In cases of dispute, the procedures described in EN ISO 4259:1995 for resolving the dispute, and interpretation of the results based on the test method precision shall be used.

5.5.2 In cases of dispute concerning density, EN ISO 3675:1998 shall be used.
In cases of dispute concerning sulfur content, EN ISO 14596:1998 shall be used.

Further methods for the determination of sulfur content at levels below 350 mg/kg are under development by CEN/TC 19.

5.5.3 For the determination of cetane number alternative methods may also be used in cases of dispute, provided that these methods originate from a recognised method series, and have a valid precision statement, derived in accordance with EN ISO 4259:1995, which demonstrates precision at least equal to that of the referenced method. The test result, when using an alternative method, shall also have a demonstrable relationship to the result obtained when using the referenced method.

Annex A
(Informative)

Bibliography

A.1 Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC.