

Reference fuels

**DG Joint Research Centre
Directorate for Energy, Transport & Climate
Sustainable Transport Unit**

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GTR 15 – Annex 3 – Reference fuels

ECE/TRANS/WP.29/GRPE/2017/9

Annex 3

Reference fuels

1. As there are regional differences in the market specifications of fuels, regionally different reference fuels need to be recognised. Example reference fuels are however required in this UN GTR for the calculation of hydrocarbon emissions and fuel consumption. Reference fuels are therefore given as examples for such illustrative purposes.
2. It is recommended that Contracting Parties select their reference fuels from this annex and bring any regionally agreed amendments or alternatives into this UN GTR by amendment. This does not however limit the right of Contracting Parties to define individual reference fuels to reflect local market fuel specifications.

Reg. 83– Annex 10 – Reference fuels

E/ECE/324/Rev.1/Add.82/Rev.4
E/ECE/TRANS/505/Rev.1/Add.82/Rev.4
Annex 10

2. Specifications of reference fuel to be used for testing vehicles equipped with positive-ignition engines at low ambient temperature – Type VI Test

Type: Petrol (E5)

Parameter	Unit	Limits ¹		Test method
		Minimum	Maximum	
Research octane number, RON		95.0	-	EN 25164 Pr. EN ISO 5164
Motor octane number, MON		85.0	-	EN 25163 Pr. EN ISO 5163
Density at 15 °C	kg/m ³	743	756	EN ISO 3675 EN ISO 12185
Vapour pressure	kPa	56.0	95.0	EN ISO 13016-1 (DVPE)
Water content	% v/v		0.015	ASTM E 1064
Distillation:				
- Evaporated at 70 °C	% v/v	24.0	44.0	EN-ISO 3405
- Evaporated at 100 °C	% v/v	50.0	60.0	EN-ISO 3405
- Evaporated at 150 °C	% v/v	82.0	90.0	EN-ISO 3405
- Final boiling point	°C	190	210	EN-ISO 3405
Residue	% v/v	-	2.0	EN-ISO 3405
Hydrocarbon analysis:				

EU winter diesel fuel grades

EUROPEAN STANDARD

EN 590

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2009

ICS 75.160.20

Supersedes EN 590:2004

English Version

Automotive fuels - Diesel - Requirements and test methods

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

Kraftstoffe für Kraftfahrzeuge - Dieselmotorkraftstoff -
Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 12 March 2009.

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.

CEN members are the national standards bodies of 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.

EU winter diesel fuel grades EN590

EN 590:2009 (E)

5.5 Climate dependent requirements and related test methods

5.5.1 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 or severe winter climates five different classes. Climate-dependent requirements are given in Table 2 (temperate climates) and Table 3 (arctic or severe winter climates). When tested by the methods given in Tables 2 and 3, automotive diesel fuel shall be in accordance with the limits specified in these Tables.

5.5.2 The cetane number limits for arctic or severe winter grades in Table 3 are lower than for the temperate class (Table 1), reflecting the correlation between ignition quality and density, and the low density of arctic or severe winter grades. The values for cetane number given in Table 3, included for correct vehicle operation, do not meet the requirements of the European Fuels Directive 98/70/EC [1], including Amendment 2003/17/EC [2]. These values are valid for use in countries where the European Fuels Directive 98/70/EC [1], including Amendment 2003/17/EC [2], does not apply or for countries where cetane number exceptions have been granted for arctic or severe winter grades.

Table 2 - Climate-related requirements and test methods - Temperate climates

Property	Unit	Limits						Test method ^a (See 2. Normative references)
		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 5.6.1

DIRECTIVE 2009/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 April 2009

amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC

(Text with EEA relevance)

ANNEX II

ENVIRONMENTAL SPECIFICATIONS FOR MARKET FUELS TO BE USED FOR VEHICLES EQUIPPED WITH COMPRESSION IGNITION ENGINES

Type: **Diesel**

Parameter ⁽¹⁾	Unit	Limits ⁽²⁾	
		Minimum	Maximum
Cetane number		51,0	—
Density at 15 °C	kg/m ⁽³⁾	—	845,0
Distillation:			
— 95 % v/v recovered at:	°C	—	360,0
Polycyclic aromatic hydrocarbons	% m/m	—	8,0
Sulphur content	mg/kg	—	10,0
FAME content — EN 14078	% v/v	—	7,0 ⁽³⁾

⁽¹⁾ Test methods shall be those specified in EN 590:2004. Member States may adopt the analytical method specified in replacement EN 590:2004 standard if it can be shown to give at least the same accuracy and at least the same level of precision as the analytical method it replaces.

⁽²⁾ The values quoted in the specification are 'true values'. In the establishment of their limit values, the terms of EN ISO 4259:2006 'Petroleum products — Determination and application of precision data in relation to methods of test' have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account (R = reproducibility). The results of individual measurements shall be interpreted on the basis of the criteria described in EN ISO 4259:2006.

⁽³⁾ FAME shall comply with EN 14214.

Winter diesel fuel

Country	CFPP	EN Class	Cloud Point
Austria	-20 °C	F	
Belgium	-15 °C	E	
Czech Republic	-20 °C	F	
Denmark	-20 °C	F	-10 °C
Estonia	-26 °C	1	-16 °C
Finland	-26 °C (-44 °C)	1 (4)	-16 °C (-34 °C)
France	-15 °C	E	
Germany	-20 °C	F	
Italy	-10 °C (-20 °C)	D (F)	
Netherlands	-20 °C	F	
Norway	-24 °C (Arctic -32 °C)	1(2)	-16 °C (-22 °C)
Poland	-20 °C	F	
Spain	-10 °C	D	
Sweden	-24/-26 °C and -32/-35 °C	1 & 2	-16 °C & -22 °C
Switzerland	-20 °C	F	
UK	-15 °C	E	-5 °C

Proposal of Reference Diesel

Parameter	Unit	Limits		Test method
		Minimum	Maximum	
Cetane Index		46.0	-	EN ISO 4264
Centane number		51.0	-	EN ISO 5165
Density at 15 °C	kg/m ³	820	845	EN ISO 3675, EN ISO 12185
Distillation				
at 250 °C	% v/v	85	<65	EN ISO 3405
at 350 °C	% v/v			
-95% point	°C	-	360	
Flash point	°C	55	-	EN ISO 2719
CFPP	°C	Summer	-	
		Winter	-	-20
Viscosity at 40 C	mm ² /s	2.000	4.500	EN ISO 3104
PAH	% m/m	-	8.0	EN ISO 12916
Sulphur content	mg/kg	-	10.0	EN ISO 20846, EN ISO 20884
Copper corrosion (3 hours at 50 °C)		-	Class 1	EN ISO 2160
Carbon residue	% m/m	-	0.30	EN ISO 10370
Ash content	% m/m	-	0.01	EN ISO 6245
Total contamination	mg/kg	-	24	EN ISO 12662
Water content	mg/kg	-	200	EN ISO 12937
Lubricity (HFRR wear scan diameter at 60 °C)	µm	-	460	EN ISO 12156-1
Oxidation stability at 110 C	h	20	-	EN 15751
FAME	% v/v	-	7.0	EN 14078

Reference fuels



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5.4. E-Diesel (nominal 52 Cetane, B7)

Table A3/17

E-Diesel (nominal 52 cetane, B7)

Parameter	Unit	Limits ⁽¹⁾		Test method
		Minimum	Maximum	
Cetane Index		46.0		EN-ISO 4264
Cetane number ⁽²⁾		52.0	56.0	EN-ISO 5165
Density at 15 °C	kg/m ³	833.0	837.0	EN-ISO 12185
Distillation:				
— 50 % point	°C	245.0	—	EN-ISO 3405
— 95 % point	°C	345.0	360.0	EN-ISO 3405
— final boiling point	°C	—	370.0	EN-ISO 3405
Flash point	°C	55	—	EN ISO 2719
Cloud point	°C	—	-10	EN 116
Viscosity at 40 °C	mm ² /s	2.30	3.30	EN-ISO 3104
Polycyclic aromatic hydrocarbons	% m/m	2.0	4.0	EN 12916
Sulphur content	mg/kg	—	10.0	EN ISO 20846/ EN ISO 20884
Copper corrosion (3 hours, 50 °C)		—	Class 1	EN-ISO 2160
Conradson carbon residue (10 % DR)	% m/m	—	0.20	EN-ISO10370
Ash content	% m/m	—	0.010	EN-ISO 6245
Total contamination	mg/kg		24	EN 12662
Water content	mg/kg	—	200	EN-ISO12937
Acid number	mg KOH/g	—	0.10	EN ISO 6618
Lubricity (HFRR wear scan diameter at 60 °C)	µm	—	400	EN ISO 12156
Oxidation stability at 110 °C ⁽³⁾	h	20.0		EN 15751
FAME ⁽⁴⁾	% w/v	6.0	7.0	EN 14078

⁽¹⁾ The values quoted in the specifications are 'true values'. In establishing of their limit values the terms of ISO 4259 Petroleum products – Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

⁽²⁾ The range for cetane number is not in accordance with the requirements of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms of ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

⁽³⁾ Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice shall be sought from the supplier as to storage conditions and life.

⁽⁴⁾ FAME content to meet the specification of EN 14214.