STANDARD SHQIPTAR

SSH EN 590:2013+A1:2017

Lëndë djegëse e lëngët për automjete -Gazoil (Diesel) - Kërkesat dhe metodat e provës

Automotive fuels - Diesel - Requirements and test methods

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Automotive fuels - Diesel - Requirements and test methods

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

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This European Standard was approved by CEN on 26 July 2013 and includes Amendment 1 approved by CEN on 17 March 2017.

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Contents

European foreword

This document (EN 590:2013+A1:2017) 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of an identical text or by endorsement, at the latest by November 2017, and conflicting national standards shall be withdrawn at the latest by November 2017.

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

This document supersedes A1 EN 590:2013 A1.

This document includes Amendment 1 approved by CEN on 17 March 2017.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association [5]

A1 Requirements following amendment 2003/17/EC [2], 2009/30/EC [3], 2011/63/EU [4] and 2014/77/EU [12] to the European Fuels Quality Directive 98/70/EC [1], are taken into account. A1 Dates are included with all normative test method references in order to comply with the requirements of the European Commission; with the accompanying assurance by CEN/TC 19 that any referenced updated versions will always give similar accuracy and the same or better precision (see [4]). A1 The marking at the pump of this product is in line with the requirements of the Fuels Quality Directive and the Alternative Fuels Infrastructure Directive [11]. A1

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

— Inclusion of the revised EN 14214 FAME specification.

— Specific requirements concerning the limitation of use of methylcyclopentadienyl manganese tricarbonyl (MMT) as required by the EC have been incorporated.

— Addition of the Fuel Ignition Tester (EN 16144) as an alternate test method to the CFR engine test.

— Addition of Simulated Distillation by gas chromatography (GC), EN ISO 3924, as an alternate test method to distillation by EN ISO 3405.

— Introduction of the improved EDXRF determination technique for low sulfur contents, EN ISO 13032, in replacement of EN ISO 20847.

Annex A is normative and contains the precision data generated on the test methods, which are the result of inter-laboratory testing, carried out by working groups of CEN/TC 19. Many of the test methods included in this standard were the subject of inter-laboratory testing to determine the applicability of the method and its precision in relation to blends of automotive diesel fuel containing 10 % (*V/V*) or higher of different sources of fatty acid methyl esters (FAME).

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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 containing up to 7,0 %(*V/V*) Fatty Acid Methyl Ester.

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

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 116:2015, *Diesel and domestic heating fuels - Determination of cold filter plugging point - Stepwise cooling bath method*

EN 12662:2014, *Liquid petroleum products - Determination of total contamination in middle distillates, diesel fuels and fatty acid methyl esters*

EN 12916:2016, *Petroleum products - Determination of aromatic hydrocarbon types in middle distillates - High performance liquid chromatography method with refractive index detection*

EN 14078:2014, *Liquid petroleum products - Determination of fatty acid methyl ester (FAME) content in middle distillates - Infrared spectrometry method*

EN 14214:2012+A1:2014, *Liquid petroleum products - Fatty acid methyl esters (FAME) for use in diesel engines and heating applications - Requirements and test methods*

EN 15195:2014, *Liquid petroleum products - Determination of ignition delay and derived cetane number (DCN) of middle distillate fuels by combustion in a constant volume chamber*

EN 15751:2014, *Automotive fuels - Fatty acid methyl ester (FAME) fuel and blends with diesel fuel - Determination of oxidation stability by accelerated oxidation method*

EN 16144:2012, *Liquid petroleum products - Determination of ignition delay and derived cetane number (DCN) of middle distillate fuels - Fixed range injection period, constant volume combustion chamber method*

EN 16329:2013, *Diesel and domestic heating fuels - Determination of cold filter plugging point - Linear cooling bath method*

EN 16576:2014, *Automotive fuels - Determination of manganese and iron content in diesel - Inductively coupled plasma optical emission spectrometry (ICP OES) method*

EN 16715:2015, *Liquid petroleum products - Determination of ignition delay and derived cetane number (DCN) of middle distillate fuels - Ignition delay and combustion delay determination using a constant volume combustion chamber with direct fuel injection*

EN 16942:2016, *Fuels - Identification of vehicle compatibility - Graphical expression for consumer information*

EN 23015:1994, *Petroleum products - Determination of cloud point (ISO 3015:1992)*

EN ISO 2160:1998, *Petroleum products - Corrosiveness to copper - Copper strip test (ISO 2160:1998)*

A1 EN ISO 2719:2016[1], *Determination of flash point - Pensky-Martens closed cup method (ISO 2719:2016)* A1

A1 EN ISO 3104:1996[1], *Petroleum products - Transparent and opaque liquids - Determination of kinematic viscosity and calculation of dynamic viscosity (ISO 3104:1994)* A1

EN ISO 3170:2004, *Petroleum liquids - Manual sampling (ISO 3170:2004)*

A1 EN ISO 3171:1999, *Petroleum liquids - Automatic pipeline sampling (ISO 3171:1988)* A1

A1 EN ISO 3405:2011[1], *Petroleum products - Determination of distillation characteristics at atmospheric pressure (ISO 3405:2011)* A1

A1 EN ISO 3675:1998[1], *Crude petroleum and liquid petroleum products - Laboratory determination of density - Hydrometer method (ISO 3675:1998)* A1

A1 EN ISO 3924:2016, *Petroleum products - Determination of boiling range distribution - Gas chromatography method (ISO 3924:2016)* A1

A1 EN ISO 4259:2006[1], *Petroleum products - Determination and application of precision data in relation to methods of test (ISO 4259:2006)* A1

EN ISO 4264:2007[2], *Petroleum products - Calculation of cetane index of middle-distillate fuels by the four-variable equation (ISO 4264:2007)*

EN ISO 5165:1998[1], *Petroleum products - Determination of the ignition quality of diesel fuels - Cetane engine method (ISO 5165:1998)*

EN ISO 6245:2002, *Petroleum products - Determination of ash (ISO 6245:2001)*

A1 EN ISO 10370:2014, *Petroleum products - Determination of carbon residue - Micro method (ISO 10370:2014)* A1

A1 EN ISO 12156-1, *Diesel fuel - Assessment of lubricity using the high-frequency reciprocating rig (HFRR) - Part 1: Test method (ISO 12156-1)* A1

A1 EN ISO 12185:1996[1], *Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method (ISO 12185:1996)* A1

EN ISO 12205:1996, *Petroleum products - Determination of the oxidation stability of middle-distillate fuels (ISO 12205:1995)*

EN ISO 12937:2000, *Petroleum products - Determination of water - Coulometric Karl Fischer titration method (ISO 12937:2000)*

EN ISO 13032:2012, *Petroleum products - Determination of low concentration of sulfur in automotive fuels - Energy-dispersive X-ray fluorescence spectrometric method (ISO 13032:2012)*

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1 Under revision.

2 This document is currently impacted by EN ISO 4264:2007/A1:2013.

EN ISO 13759:1996, *Petroleum products - Determination of alkyl nitrate in diesel fuels - Spectrometric method (ISO 13759:1996)*

EN ISO 20846:2011, *Petroleum products - Determination of sulfur content of automotive fuels - Ultraviolet fluorescence method (ISO 20846:2011)*

EN ISO 20884:2011, *Petroleum products - Determination of sulfur content of automotive fuels - Wavelength-dispersive X-ray fluorescence spectrometry (ISO 20884:2011)*

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

[A1] Information to be marked on dispensing pumps and nozzles used for delivering automotive diesel fuel, and the dimensions of the mark shall be in accordance with EN 16942. [A1]

Labelling shall be clearly visible, easily legible and displayed at any point where diesel with metallic additives is made available to consumers. The label shall contain: "Contains metallic additives" in the national language(s) and shall be laid down in the National Annex to this document.

5 Requirements and test methods

5.1 Dyes and markers

The use of dyes or markers is allowed.

5.2 Additives

5.2.1 General

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.

5.2.2 Methylcyclopentadienyl manganese tricarbonyl (MMT)

[A1] When methylcyclopentadienyl manganese tricarbonyl (MMT) is used, a specific labelling is required (see also Clause 4). The presence of the MMT is limited via a manganese content limit as in Tables 1 and 2. [A1]

5.3 Fatty acid methyl ester (FAME)

[A1] Diesel fuel may contain up to 7,0 % (*V/V*) of FAME complying with EN 14214:2012+A1:2014, in which case the climate dependent requirements set out in 5.4.2 of EN 14214:2012+A1:2014 do not apply. [A1]

NOTE 1 A suitable method for the separation and identification of FAME is given in EN 14331 [6].

Climate dependent requirements for FAME as a blending component for use in diesel fuel according to this document are set out in 5.4.3 of [A1] EN 14214:2012+A1:2014 [A1]. The specific grades shall be specified on a national basis according to local climatic conditions and the FAME volume in the diesel fuel.

The finished blend of diesel fuel shall also comply with the climate dependent requirements set out in 5.6. of this document.

Cold flow additives, when used in FAME, should be specifically matched to the base diesel fuel and FAME quality to ensure correct performance consistent with the requirements set out in this European Standard. The choice could result in incompatibility between the cold flow additives used in the FAME and the diesel fuel. The choice of cold flow additive technology should be a contractual matter between the fuel blender and the FAME supplier taking into account the climatic-dependent requirements of the finished diesel fuel.

NOTE 2 Cold flow requirements for FAME as a blend component in diesel fuel are set out in Tables 3a and 3b and the National Annex of [A1] EN 14214:2012+A1:2014 [A1], in order to control maximum content of saturated monoglycerides in the final EN 590 blend to ensure trouble-free operation. Work is on-going to identify a suitable test method for saturated monoglycerides or a performance test to control this aspect of low temperature performance.

In order to improve the oxidation stability of FAME, it is strongly recommended to add oxidation stability enhancing additives to FAME at the production stage and before storage, providing an oxidation stability similar to that obtained with 1 000 mg/kg of 2,6-di-tert-butyl-4-hydroxytoluene (BHT, officially designated by IUPAC as 2,6-bis(1,1-dimethylethyl)-4-methylphenol).

The similar action may be read as providing oxidation stability performance at least equal to that obtained with 1 000 mg/kg of BHT.

CAUTION — There is a potential risk of precipitate formation with oxidation stability enhancing additives at low temperatures in low aromatic arctic fuel. Caution should therefore be taken in the choice of oxidation stability enhancing additives to arctic grade FAME.

5.4 Other (bio-) components

[A1] Limits for FAME do not apply to other (non-petroleum derived) hydrocarbons, such as Hydrotreated Vegetable Oil (HVO), Gas To Liquid (GTL) or Biomass To Liquid (BTL) derived hydrocarbons, since these paraffinic diesel components are allowed in any proportions provided that the final blend complies with the requirements of this European Standard. The co-processing of renewable[3] feedstock at refineries is also allowed provided that the final fuel meets the requirements of this European Standard". [A1]

5.5 Generally applicable requirements and related test methods

5.5.1 When tested by the methods indicated in Table 1, automotive diesel fuel shall be in accordance with the limits specified in Table 1. The test methods listed in Table 1 have been assessed for application to automotive diesel containing FAME. Precision data from inter-laboratory test

[3] For clarification of renewable see Directive 2009/28/EC [15].

programmes are given in normative Annex A, where these were found to be different from the precision data given in the test methods for neat petroleum products.

5.5.2 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.

5.5.3 Diesel fuel shall be free from any adulterant or contaminant that may render the fuel unacceptable for use in diesel engine vehicles.

NOTE For further information on preventing contamination by water or sediment that may occur in the supply chain, or for cross-contamination, it is advisable to check CEN/TR 15367-1 [A1] [7] [A1] or CEN/TR 15367-3 [A1] [8] [A1] respectively.

Table 1 — Generally applicable requirements and test methods for automotive diesel fuel

Property	Unit	Limits		Test method [a] (See Clause 2)
		minimum	maximum	
Cetane number		**51,0**	-	EN ISO 5165 [b] EN 15195 EN 16144 [A1] EN 16715 [A1]
Cetane index		46,0	-	EN ISO 4264
Density at 15 °C	kg/m³	820,0	**845,0**	EN ISO 3675 [c] EN ISO 12185
Polycyclic aromatic hydrocarbons [d]	% (*m/m*)	-	**8,0**	EN 12916
Sulfur content	**mg/kg**	-	**10,0**	EN ISO 20846 [e] EN ISO 20884 EN ISO 13032
Manganese content [f] [A1] *Deleted text.* [A1]	**mg/l**	[A1] *Deleted text.* [A1] -	[A1] *Deleted text.* [A1] **2,0**	[A1] EN 16576 [A1]
Flash point	°C	Above 55,0	-	EN ISO 2719
Carbon residue [g] (on 10 % distillation residue)	% (*m/m*)	-	0,30	EN ISO 10370
Ash content	% (*m/m*)	-	0,010	EN ISO 6245
Water content	[A1] % (*m/m*) [A1]	-	[A1] 0,020 [A1]	EN ISO 12937
Total contamination	mg/kg	-	24	EN 12662 [h]
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Fatty acid methyl ester (FAME) content [i]	% (*V/V*)	-	**7,0**	EN 14078
Oxidation stability [j]	g/m³ h	- 20	25 -	EN ISO 12205 EN 15751
[A1] Lubricity, wear scar diameter (WSD) at 60°C [A1]	µm	-	460	EN ISO 12156-1 [A1] [n] [A1]
Viscosity at 40 °C	mm²/s	2,000	4,500	EN ISO 3104
Distillation [k,l] % (*V/V*) recovered at 250 °C % (*V/V*) recovered at 350 °C **95 % (*V/V*) recovered at**	 % (*V/V*) % (*V/V*) °C	 85 	 < 65 **360**	EN ISO 3405 [m] EN ISO 3924

[A1] NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [12] [A1].

[a] See also 5.7.1.
[b] See also 5.7.4.
[c] See also 5.7.2.
[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 EN 12916.
[e] See also 5.7.3.
[f] See also 5.2.2.
[g] See also 5.5.2 and Annex A.
[h] Further investigation into the total contamination test method to improve the precision, particularly in the presence of FAME, is being carried out by CEN.
[i] FAME shall meet the requirements of EN 14214, see [3].
[j] When diesel fuel contains more than 2 %(*V/V*) FAME, oxidation stability as determined by EN 15751 is the requirement.
[k] For the calculation of the cetane index the 10 %, 50 % and 90 % (V/V) recovery points are also needed.
[l] The limits for distillation at 250 °C and 350 °C are included for diesel fuel in line with EU Common Customs tariff.
[m] EN ISO 3924 gives instructions to convert to ISO 3405-equivalent data. See also 5.7.5.
[n] [A1] At the time of publication this standard is under revision. This revision is focussed on correcting the ambient test conditions to reflect those met in the ILS conducted. This will not affect the precision of the test method. [A1]

5.6 Climate dependent requirements and related test methods

5.6.1 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 Table 2 and Table 3, automotive diesel fuel shall be in accordance with the limits specified in these tables.

A1 NOTE Attention is drawn to CEN/TR 16884 [13] on cold operability testing and fuel performance correlation. In addition, CEN has developed another technical report on cold filterability issues [14] that have been reported in some geographical areas at low temperatures above the cloud point of the fuel. Work to improve understanding of these issues and develop technical solutions is on-going within CEN and some national standardisation bodies. A1

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

Property	Unit	Limits						Test method [a] (See Clause 2)
		Grade A	Grade B	Grade C	Grade D	Grade E	Grade F	
CFPP	°C, max.	+5	0	−5	−10	−15	−20	EN 116 [b] EN 16329

[a] See also 5.7.1.

[b] See 5.7.6.

Table 3 — Climate-related requirements and test methods — Arctic or severe winter climates

Property	Units	Limits					Test method [a] (See Clause 2)
		class 0	class 1	class 2	class 3	class 4	
CFPP	°C, max.	−20	−26	−32	−38	−44	EN 116 [b] EN 16329
Cloud point	°C, max.	−10	−16	−22	−28	−34	EN 23015
Density at 15 °C	kg/m³,min. kg/m³, max.	800,0 845,0	800,0 845,0	800,0 840,0	800,0 840,0	800,0 840,0	EN ISO 3675 [c] EN ISO 12185
Viscosity at 40 °C	mm²/s, min. mm²/s, max.	1,500 4,000	1,500 4,000	1,500 4,000	1,400 4,000	1,200 4,000	EN ISO 3104
Cetane number EU [e]	minimum	51,0	51,0	51,0	51,0	51,0	EN ISO 5165 [d] EN 15195 EN 16144
Cetane number [f]	minimum	49,0	49,0	48,0	47,0	47,0	EN ISO 5165 [d] EN 15195 EN 16144
Cetane index	minimum	46,0	46,0	46,0	43,0	43,0	EN ISO 4264
Distillation [g,h] recovered at 180 °C recovered at 340 °C	 % (*V*/*V*), max. % (*V*/*V*), min.	 10,0 95,0	 10,0 95,0	 10,0 95,0	 10,0 95,0	 10,0 95,0	EN ISO 3405 [i] EN ISO 3924

[a] See also 5.7.1.

[b] See also 5.7.6.

[c] See also 5.7.2.

[d] See also 5.7.4.

[e] [A1] In countries where the European Fuels Directive 98/70 EC [1] including amendments 2003/17/EC [2], 2009/30/EC [3], 2011/63/EU [4] and 2014/77/EU [12] applies. [A1]

[f] [A1] In countries where the European Fuels Directive 98/70 EC [1] including amendments 2003/17/EC [2], 2009/30/EC [3], 2011/63/EU [4] and 2014/77/EU [12] does not apply. [A1]

[g] EU Common Customs Tariff definition of gas oil may not apply to the grades defined for use in arctic or severe winter climates.

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

[i] See also 5.7.5.

5.6.2 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.

5.7 Precision and dispute

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

5.7.2 In cases of dispute concerning density, [A1] EN ISO 12185 [A1] shall be used.

5.7.3 In cases of dispute concerning sulfur content, either EN ISO 20846 or EN ISO 20884 shall be used.

5.7.4 In cases of dispute concerning cetane number, EN ISO 5165 shall be used. For the determination of cetane number alternative methods to those indicated in Table 1 and Table 3 may also be used, provided that these methods originate from a recognised method series, and have a valid precision statement, derived in accordance with EN ISO 4259, 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.

5.7.5 In cases of dispute concerning distillation, EN ISO 3405 shall be used.

5.7.6 In cases of dispute concerning CFPP, EN 116 shall be used.

Annex A
(normative)

Details of inter-laboratory test programme

Table A.1 presents the precision data obtained in inter-laboratory testing programmes by CEN/TC 19 [9] and the EI [10], that differ from those of test methods listed in Table 1 and that at the time of publication of this European Standard were not yet revised.

NOTE The following methods were found to have precision data for 5 % (*V/V*) FAME blends similar to the published values:

— Ash content: EN ISO 6245,

— Oxidation stability: EN ISO 12205,

— CFPP: EN 116.

Table A.1 — Precision data updates

Property	Test method	Unit	CEN/TC 19 data for 5 % (*V/V*) FAME blend
Viscosity at 40 °C	EN ISO 3104	mm^2/s	r = 0,001 1 *X* R = 0, 018 *X*
Flash point	EN ISO 2719	°C	r = 2,0 R = 3,5
Carbon residue	EN ISO 10370	% (*m/m*)	r = 0,143 0 $X^{0,5}$ R = 0,212 5 $X^{0,5}$
where r is repeatability (EN ISO 4259) R is reproducibility (EN ISO 4259) *X* is the mean of two results being compared			

Bibliography

[1] Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC

[2] Directive 2003/17/EC of the European Parliament and of the Council of 3 March 2003 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC

[3] 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

[4] Directive 2011/63/EU of 1 June 2011 amending, for the purpose of its adaptation to technical progress, Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels

[5] Mandate M/394 - Mandate to CEN on the revision of EN 590 to increase the concentration of FAME and FAEE to 10% v/v, 13 November 2006

[6] EN 14331:2004, *Liquid petroleum products - Separation and characterisation of fatty acid methyl esters (FAME) from middle distillates - Liquid chromatography (LC)/gas chromatography (GC) method*

A1 *Deleted text.* A1

A1 [7] A1 CEN/TR 15367-1, *Petroleum products - Guidelines for good housekeeping - Part 1: Automotive diesel fuels*

A1 [8] A1 CEN/TR 15367-3, *Petroleum products - Guide for good housekeeping - Part 3: Prevention of cross contamination*

A1 [9] A1 CEN/TR 15160, *Petroleum and related products - Applicability of diesel fuel test methods for Fatty Acid Methyl Esters (FAME) - Information and results on round robin tests*

A1 [10] A1 EI Research Report on IP 398 and EN ISO 10370, under publication, available from the Energy Institute, 61 New Cavendish Street, London W1G 7AR, England

A1 [11] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure A1

A1 [12] Commission Directive 2014/77/EU of 10 June 2014 amending Annexes I and II of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels" A1

A1 [13] CEN/TR 16884, *Automotive fuels — Diesel fuel — Cold operability testing and fuel performance correlation* A1

A1 [14] CEN/TR 16982, *Diesel blends - Cold filterability issues* A1

A1 [15] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC" A1

STANDARD SHQIPTAR

SSH EN 228:2012+A1:2017

Lëndët djegëse për automjete - Benzinë pa plumb - Kërkesat dhe metodat e provës

Automotive fuels - Unleaded petrol - Requirements and test methods

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Standardet rishikohen kur është e nevojshme, prandaj është e domosdoshme që përdoruesi të marrë botimin e fundit si dhe amendamentet e tij, nëse ka të tilla.

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Carburants pour automobiles - Essence sans plomb - Exigences et méthodes d'essai

Kraftstoffe für Kraftfahrzeuge - Unverbleite Ottokraftstoffe - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 1 September 2012 and includes Amendment 1 approved by CEN on 17 March 2017.

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European foreword

This document (EN 228:2012+A1:2017) 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 November 2017, and conflicting national standards shall be withdrawn at the latest by November 2017.

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

This document supersedes A1 EN 228:2012 A1.

This document includes Amendment 1 approved by CEN on 17 March 2017.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This document was originally prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. In addition to other standards, it is intended to be complementary to the regulatory measures contained in various EU Directives.

The following is a list of significant technical changes between this European Standard and the previous edition:

— A1 New requirements following amendment 2009/30/EC [3], 2011/63/EU [4] and 2014/77/EU [11] to the European Fuels Quality Directive 98/70/EC [1], are taken into account. A1 Tables 1, 2, 3, 4 and A.1 explicitly differentiate between requirements included in the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3] and [4], and other requirements.

— Specific requirements concerning the limitation of use of methylcyclopentadienyl manganese tricarbonyl (MMT) as required by the EC have been incorporated.

— As the introduction of 10 % (*V/V*) of ethanol in unleaded petrol has an impact on refinery and blending processes, an update of the distillation characteristics has been considered and a new Table 3 with slightly adapted volatility classes (E70, E100 and VLI) has been introduced. Work is still ongoing to generate data that would support the idea that these changes do not affect cold starting and hot weather driveability aspects of the vehicles. These updates have been agreed upon with precaution and might be revised depending on fuel-related issues in the market.

— Further specification is given, by including separate tables on unleaded petrol grade for older vehicles that are not warranted to use unleaded petrol with a high biofuel content. A CEN/TR aiming at giving guidance on oxygenate blending has been prepared in parallel [5].

— Further clarification on how to determine the vapour pressure waiver for unleaded petrol containing ethanol, allowed on the market under exemption circumstances, is given in Annex A. The exact number of decimal points for the waiver has been clarified [4].

— Several new or revised test methods have been introduced. The European Fuels Directive 98/70/EC [1], including its Amendments [2] [3] [4], A1 [11] A1 refers to test methods in

EN 228:2004, with the requirement that updated analytical methods shall be shown to give at least the same accuracy and at least the same precision as the methods they replace.

— Removal of the allowance for 50 mg/kg sulfur content.

— Reference to the revised ethanol specification EN 15376.

[A1] The marking at the pump of this product is in line with the requirements of the Fuels Quality Directive and the Alternative Fuels Infrastructure Directive [12]. [A1]

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

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

This European Standard specifies two types of unleaded petrol: one type with a maximum oxygen content of 3,7 % (*m/m*) and a maximum ethanol content of 10,0 % (*V/V*) in Table 1, and one type intended for older vehicles that are not warranted to use unleaded petrol with a high biofuel content, with a maximum oxygen content of 2,7 % (*m/m*) and a maximum ethanol content of 5,0 % (*V/V*) in Table 2.

NOTE 1 The two types are based on European Directive requirements [3], [4], [A1] [11] [A1].

NOTE 2 For the purposes of this European Standard, the terms "% (*m/m*)" and "% (*V/V*)" are used to represent respectively the mass fraction, μ, and the volume fraction, φ.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 237:2004, *Liquid petroleum products — Petrol — Determination of low lead concentrations by atomic absorption spectrometry*

EN 238:1996/A1:2003, *Liquid petroleum products — Petrol — Determination of the benzene content by infrared spectrometry*

[A1] EN 1601:2014[1], *Liquid petroleum products — Unleaded petrol — Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography (O-FID)* [A1]

EN 12177:1998, *Liquid petroleum products — Unleaded petrol — Determination of benzene content by gas chromatography*

[A1] EN 13016-1:2007[1], *Liquid petroleum products — Vapour pressure — Part 1: Determination of air saturated vapour pressure (ASVP) and calculated dry vapour pressure equivalent (DVPE)* [A1]

EN 13132:2000, *Liquid petroleum products — Unleaded petrol - Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography using column switching*

[A1] EN 14275:2013, *Automotive fuels — Assessment of petrol and diesel fuel quality — Sampling from retail site pumps and commercial site fuel dispensers* [A1]

[A1] EN 15376:2014, *Automotive fuels — Ethanol as a blending component for petrol — Requirements and test methods* [A1]

EN 15553:2007, *Petroleum products and related materials — Determination of hydrocarbon types - Fluorescent indicator adsorption method*

[1] Under revision.

EN 16135:2011, *Automotive fuels — Determination of manganese content in unleaded petrol — Flame atomic absorption spectrometric method (FAAS)*

A1 EN 16136:2015, *Automotive fuels — Determination of manganese content in unleaded petrol — Inductively coupled plasma optical emission spectrometry (ICP OES) method* A1

A1 EN 16942:2016, *Fuels – Identification of vehicle compatibility – Graphical expression for consumer information* A1

EN ISO 2160:1998, *Petroleum products — Corrosiveness to copper — Copper strip test (ISO 2160:1998)*

EN ISO 3170:2004, *Petroleum liquids — Manual sampling (ISO 3170:2004)*

EN ISO 3171:1999, *Petroleum liquids — Automatic pipeline sampling (ISO 3171:1988)*

A1 EN ISO 3405:2011[1], *Petroleum products — Determination of distillation characteristics at atmospheric pressure (ISO 3405:2011)* A1

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

A1 EN ISO 4259:2006[1], *Petroleum products — Determination and application of precision data in relation to methods of test (ISO 4259:2006)* A1

A1 EN ISO 5163:2014, *Petroleum products — Determination of knock characteristics of motor and aviation fuels — Motor method (ISO 5163:2014)* A1

A1 EN ISO 5164:2014[1], *Petroleum products — Determination of knock characteristics of motor fuels — Research method (ISO 5164:2014)* A1

A1 EN ISO 6246:2017, *Petroleum products — Gum content of light and middle distillate fuels — Jet evaporation method (ISO 6246:2017)* A1

EN ISO 7536:1996, *Petroleum products — Determination of oxidation stability of gasoline — Induction period method (ISO 7536:1994)*

A1 EN ISO 12185:1996[1], *Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method (ISO 12185:1996)* A1

EN ISO 13032:2012, *Petroleum products — Determination of low concentration of sulfur in automotive fuels — Energy-dispersive X-ray fluorescence spectrometric method (ISO 13032:2012)*

EN ISO 20846:2011, *Petroleum products — Determination of sulfur content of automotive fuels — Ultraviolet fluorescence method (ISO 20846:2011)*

EN ISO 20884:2011, *Petroleum products — Determination of sulfur content of automotive fuels — Wavelength-dispersive X-ray fluorescence spectrometry (ISO 20884:2011)*

A1 EN ISO 22854:2016, *Liquid petroleum products - Determination of hydrocarbon types and oxygenates in automotive-motor gasoline and in ethanol (E85) automotive fuel - Multidimensional gas chromatography method (ISO 22854:2016)* A1

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 unleaded petrol. 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.

It is essential that for sampling of unleaded petrol the containers used to take and store the samples before testing are not contaminated, especially with lead and/or sulfur.

4 Pump marking

[A1] Information to be marked on dispensing pumps and nozzles used for delivering unleaded petrol, and the dimensions of the mark shall be in accordance with EN 16942. [A1]

Labelling shall be clearly visible, easily legible and displayed at any point where unleaded petrol with metallic additives is made available to consumers. The label shall contain: "Contains metallic additives" in the national language(s) and shall be laid down in the National Annex to this document.

[A1] *Deleted text.* [A1]

[A1] It is also recommended that additional pump marking be applied to specify the RON supplied. [A1]

5 Requirements and test methods

5.1 [A1] Bio-components [A1]

5.1.1 [A1] Ethanol [A1]

Unleaded petrol may contain up to 10,0 % (*V/V*) of ethanol complying with EN 15376.

When ethanol is used as a blending component, it may contain denaturants, if required by European and national regulations. These denaturants are permitted provided they do not cause harmful side effects to vehicles and fuel distribution systems.

NOTE Further advice on handling and blending oxygenates in general can be found in [6]. Further guidance on blending oxygenates in accordance with the requirements of 2009/30/EC is given in CEN/TR 16435 [5].

A traceable record of biological origin is recommended. For the determination of biological origin of ethanol, an alternative is age determination, which is based on the beta(minus) decay of the radioactive carbon isotope C 14. This method [9] is considered too laborious for frequent testing, but it may be considered a useful tool to determine cases where the audit trail approach is contested.

5.1.2 [A1] Other (bio-)components

Limits for adding ethanol and other oxygenates as listed in Table1 and Table 2 do not apply to other hydrocarbons, such as synthetic hydrocarbons, and other renewable[2] hydrocarbons, since these components are allowed in any proportions provided that the final blend complies with the

[2] For clarification of renewable, see [13].

requirements of EN 228. The co-processing of renewable feedstock at refineries is also allowed provided that the final fuel meets the requirements of EN 228. A1

5.2 Dyes and markers

The use of dyes and markers is allowed provided they do not cause harmful side effects to vehicle and fuel distribution systems.

5.3 Additives

5.3.1 General

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

A1 *Deleted text.* A1

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

5.3.2 Phosphorus

In order to protect automotive catalyst systems, compounds containing phosphorus shall not be added to unleaded petrol.

5.3.3 Methylcyclopentadienyl Manganese Tricarbonyl (MMT)

When methylcyclopentadienyl manganese tricarbonyl (MMT) is used, a specific labelling is required (see Clause 4).

MMT is a metallic additive that may be used in unleaded petrol.

A1 *Deleted text.* A1

5.4 Generally applicable requirements and test methods

When tested by the methods indicated in Tables 1, 2, 3 and 4, unleaded petrol, according to its maximum oxygen content, shall be in accordance with the limits specified respectively in Tables 1 and 3, or 2 and 4.

Member States may decide to continue to permit the placing on the market of unleaded regular grade petrol. This separate grade needs to conform to all requirements set out in Tables 1, 2 3 and 4 of this European Standard with the exception of a minimum motor octane number (MON) of 81 and a minimum research octane number (RON) of 91. The requirements and test methods are then to be laid down in a National Annex to this document.

Methods of test included as normative references in this European Standard, when updated, shall give at least the same accuracy and at least the same level of precision as the methods they replace.

A1 Unleaded petrol shall be free from any adulterant or contaminant that can render the fuel unacceptable for use in petrol engine vehicles designed to run on unleaded petrol. A1

NOTE For further information on preventing contamination in the supply chain or for cross-contamination it is advisable to check CEN/TR 15367, Parts 2 and 3 respectively [7, 8]. A determination method for high boiling components in unleaded petrol is being under development by CEN.

Table 1 — Requirements and test methods for unleaded petrol with a maximum oxygen content of 3,7 % (*m/m*)

Property	Units	Limits Min	Limits Max	Test Method [a] (See 2. Normative references)
Research octane number, RON		**95,0**	--	EN ISO 5164 [b]
Motor octane number, MON		**85,0**	--	EN ISO 5163 [b]
Lead content	mg/l	--	**5,0**	EN 237
Density (at 15 °C) [c]	kg/m³	720,0	775,0	EN ISO 3675 EN ISO 12185
Sulfur content [c]	mg/kg	--	**10,0**	EN ISO 13032 EN ISO 20846 EN ISO 20884
Manganese content [d] A1 *Deleted text.* A1	 mg/l	A1 *Deleted text.* A1 --	A1 *Deleted text.* A1 **2,0**	EN 16135 EN 16136
Oxidation stability	minutes	360	--	EN ISO 7536
Existent gum content (solvent washed)	mg/100 ml	--	5	EN ISO 6246
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Appearance [e]		clear and bright		Visual inspection
Hydrocarbon type content [c] **- olefins** **- aromatics**	*% (V/V)*	 -- --	 **18,0** **35,0**	EN 15553 EN ISO 22854
Benzene content [c]	*% (V/V)*	--	**1,00**	EN 238 EN 12177 EN ISO 22854
Oxygen content [c, i]	*% (m/m)*	--	**3,7**	EN 1601 EN 13132 EN ISO 22854
Oxygenates content [c] **- methanol** [f] **- ethanol** [g] **- iso-propyl alcohol** **- iso-butyl alcohol** **- tert-butyl alcohol** **- ethers (5 or more C atoms)** **- other oxygenates** [h]	*% (V/V)*	 -- -- -- -- -- -- --	 **3,0** **10,0** **12,0** **15,0** **15,0** **22,0** **15,0**	EN 1601 EN 13132 EN ISO 22854

A1 NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. A1

[a] See also 5.7.1.

[b] A1 A correction of 0,2 for MON and RON shall be subtracted for the calculation of the final result, before reporting according to the requirement of the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. A1 See also 5.6 and 5.7.2.

[c] See also 5.7.2.

[d] See also 5.3.3.

[e] Appearance shall be determined at ambient temperature.

[f] Stabilising agents shall be added.

[g] Ethanol when used as a blending component shall conform to EN 15376 (see 5.1). Stabilising agents may be added.

[h] Other mono-alcohols and ethers with a final boiling point no higher than prescribed in Table 3.

[i] A1 EN 13131 contains no precision statement for an oxygen content above 3 % (*m/m*). A1 Based on the round robin data from the last six years, CEN/TC 19 accepts an average reproducibility value of *R = 0,37* for all test methods.

Table 2 — Requirements and test methods for unleaded petrol with a maximum oxygen content of 2,7 % (*m/m*)

Property	Units	Limits Min	Limits Max	Test Method [a] (See 2. Normative references)
Research octane number, RON		95,0	--	EN ISO 5164 [b]
Motor octane number, MON		85,0	--	EN ISO 5163 [b]
Lead content	mg/l	--	5,0	EN 237
Density (at 15 °C) [c]	kg/m³	720,0	775,0	EN ISO 3675 EN ISO 12185
Sulfur content [c]	mg/kg	--	10,0	EN ISO 13032 EN ISO 20846 EN ISO 20884
Manganese content [d] *Deleted text.*	mg/l	*Deleted text.* --	*Deleted text.* 2,0	EN 16135 EN 16136
Oxidation stability	minutes	360	--	EN ISO 7536
Existent gum content (solvent washed)	mg/100 ml	--	5	EN ISO 6246
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Appearance [e]		clear and bright		Visual inspection
Hydrocarbon type content [c], **- olefins** **- aromatics**	% *(V/V)*	 -- --	 18,0 35,0	EN 15553 EN ISO 22854
Benzene content [c]	% *(V/V)*	--	1,00	EN 238 EN 12177 EN ISO 22854
Oxygen content [c]	% *(m/m)*	--	2,7	EN 1601 EN 13132 EN ISO 22854
Oxygenates content [c] **- methanol** [f] **- ethanol** [g]	% *(V/V)*	 -- --	 3,0 5,0	EN 1601 EN 13132 EN ISO 22854
- iso-propyl alcohol [h] **- iso-butyl alcohol** [h] **- tert-butyl alcohol** [h] **- ethers (5 or more C atoms)** [h] **- other oxygenates** [h, i]		}	Volume blending restricted to 2,7 % *(m/m)* maximum oxygen content	

NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11].

[a] See also 5.7.1

[b] A correction of 0,2 for MON and RON shall be subtracted for the calculation of the final result, before reporting according to the requirement of the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. See also 5.6 and 5.7.2.

[c] See also 5.7.2.

[d] See also 5.3.3.

[e] Appearance shall be determined at ambient temperature.

[f] Stabilising agents shall be added.

[g] Ethanol when used as a blending component shall conform to EN 15376 (see 5.1). Stabilising agents may be added.

[h] The oxygen content of the finished unleaded petrol shall not exceed 2,7 % *(m/m)*. See CEN/TR 16435 [5] on oxygenate blending for information.

[i] Other mono-alcohols and ethers with a final boiling point no higher than prescribed in Table 4.

5.5 Climatically dependent requirements and test methods

5.5.1 Water tolerance

Given the known potential for some petrol to absorb water, suppliers shall ensure that no water segregation occurs under the range of climatic conditions experienced in the country concerned. When there is a risk of water separation, anti-corrosion additives shall be incorporated.

NOTE For further information on preventing contamination by water or sediment that may occur in the supply chain or for cross-contamination it is advisable to check CEN/TR 15367, Parts 2 and 3 respectively [7, 8].

5.5.2 Volatility requirements

To meet hot and cold vehicle driveability requirements under the European seasonal and geographical conditions, ten volatility classes are defined as given in Table 3, Table 4 and illustrated in Figure 1 and Figure 2. Each country shall, in a national annex to this European Standard, specify for each type of unleaded petrol which of these ten volatility classes apply during which period of the year for defined regions of the country.

Class A shall apply during summer, starting not later than 1 May and ending not before 30 September. In countries with low ambient summer temperatures, as defined in [3], Class B shall apply during summer, starting not later than 1 June and ending not before 31 August.

Each country shall apply one or more volatility classes with VLI (Class C1, D1, E1, or F1) for the transition periods on either side of summer. Each transition period shall be a minimum of four weeks. When transition periods are deemed critical, the critical transition period(s) shall be a minimum of eight weeks. During the remaining period, one or more winter classes shall apply with or without VLI (Class C, C1, D, D1, E, E1, F or F1).

The application of the vapour pressure waiver permitted for unleaded petrol containing bioethanol is restricted to countries having fulfilled the requirements as laid down in [3].

When such waiver is permitted and applied, due reference shall be made in a national annex to this Standard and the waiver shall apply to Annex A.

Table 3 — Volatility classes for unleaded petrol with a maximum oxygen content of 3,7 % (*m/m*)

Property	Units	Limits						Test method [a]
		class A	class B	class C/C1	class D/D1	class E/E1	class F/F1	(See 2. Normative references)
Vapour pressure (VP)	kPa, min	45,0	45,0	50,0	60,0	65,0	70,0	EN 13016-1[b]
	kPa, max	**60,0**	**70,0**	80,0	90,0	95,0	100,0	
% evaporated at 70°C, E70	% (*V/V*), min	22,0	22,0	24,0	24,0	24,0	24,0	EN ISO 3405
	% (*V/V*), max	50,0	50,0	52,0	52,0	52,0	52,0	
% evaporated at 100°C, E100	**% (*V/V*), min**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	EN ISO 3405
	% (*V/V*), max	72,0	72,0	72,0	72,0	72,0	72,0	
% evaporated at 150°C, E150	**% (*V/V*), min**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	EN ISO 3405
Final Boiling Point FBP	°C, max	210	210	210	210	210	210	EN ISO 3405
Distillation residue	% (*V/V*), max	2	2	2	2	2	2	EN ISO 3405
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max	--	--	C --	D --	E --	F --	
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max			C1 1064	D1 1164	E1 1214	F1 1264	

A1 NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. A1

[a] See also 5.7.1.

[b] Dry Vapour Pressure Equivalent (DVPE) shall be reported.

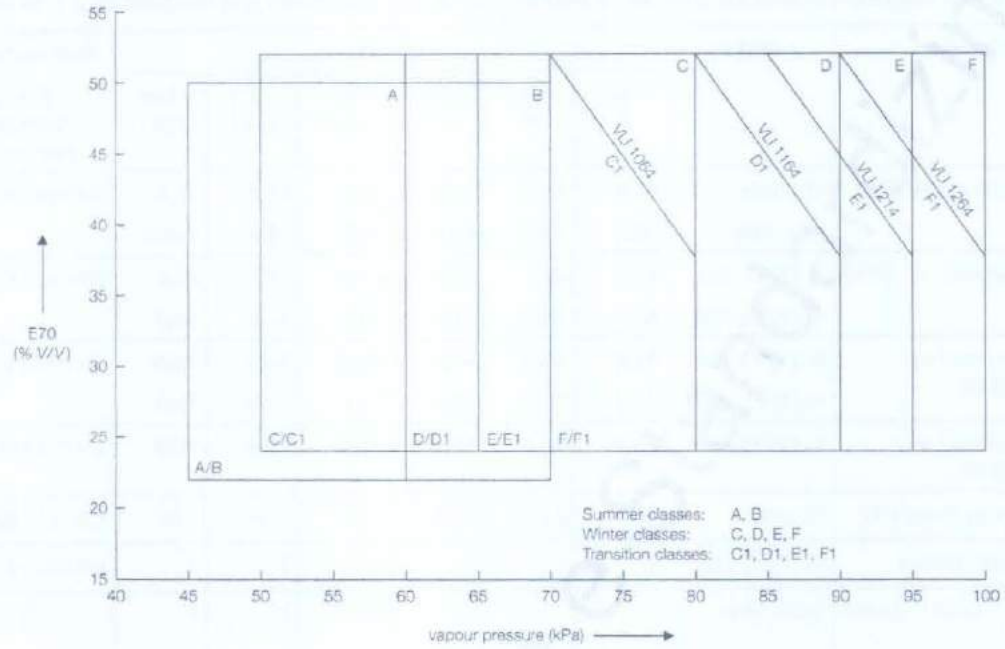

Figure 1 — Relation between VP, E70 and VLI for the ten different volatility classes for unleaded petrol with a maximum oxygen content of 3,7 % (*m/m*)

Table 4 — Volatility classes for unleaded petrol with a maximum oxygen content of 2,7 % (*m/m*)

Property	Units	Limits						Test method [a]
		class A	class B	class C/C1	class D/D1	class E/E1	class F/F1	(See 2. Normative references)
Vapour pressure (VP)	kPa, min	45,0	45,0	50,0	60,0	65,0	70,0	EN 13016-1[b]
	kPa, max	**60,0**	**70,0**	80,0	90,0	95,0	100,0	
% evaporated at 70°C, E70	% (*V/V*), min	20,0	20,0	22,0	22,0	22,0	22,0	EN ISO 3405
	% (*V/V*), max	48,0	48,0	50,0	50,0	50,0	50,0	
% evaporated at 100°C, E100	**% (*V/V*), min**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	EN ISO 3405
	% (*V/V*), max	71,0	71,0	71,0	71,0	71,0	71,0	
% evaporated at 150°C, E150	**% (*V/V*), min**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	EN ISO 3405
Final Boiling Point FBP	°C, max	210	210	210	210	210	210	EN ISO 3405
Distillation residue	% (*V/V*), max	2	2	2	2	2	2	EN ISO 3405
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max	--	--	C --	D --	E --	F --	
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max			C1 1050	D1 1150	E1 1200	F1 1250	

[A1] NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. [A1]

[a] See also 5.7.1.

[b] Dry Vapour Pressure Equivalent (DVPE) shall be reported.

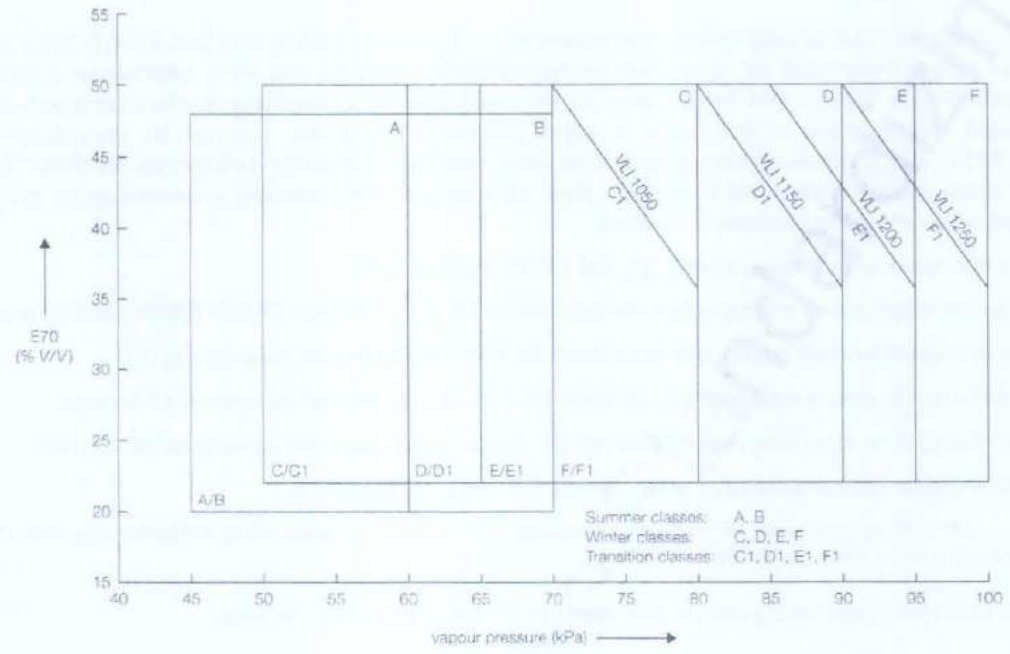

Figure 2 — Relation between VP, E70 and VLI for the ten different volatility classes for unleaded petrol with a maximum oxygen content of 2,7 % (*m/m*)

5.6 Octane reporting

To prevent any misinterpretation in the reported results, the following reporting is recommended:

— *RON*m, being the measured Research Octane Number according to EN ISO 5164,

— *MON*m, being the measured Motor Octane Number according to EN ISO 5163,

— *RON* and *MON* being the Research and Motor Octane properties, respectively, shall be reported after correction of RONm and MONm according to Formulae (1) and (2):

$$RON = RONm - 0,2 \quad (1)$$

$$MON = MONm - 0,2 \quad (2)$$

5.7 Precision and dispute

5.7.1 Resolution of disputes

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

5.7.2 Arbitration test methods

In cases of dispute concerning motor octane number and research octane number, EN ISO 5163 and EN ISO 5164 respectively shall be used. For the determination of MON and RON, alternative methods to those indicated in Table 1 and Table 2 may also be used, provided that these methods originate from a recognised method series, and have a valid precision statement, derived in accordance with EN ISO 4259, 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.

In cases of dispute concerning density, EN ISO 12185 shall be used.

In the case of dispute concerning sulfur content, either EN ISO 20846 or EN ISO 20884 shall be used.

In cases of dispute on hydrocarbon type content, EN ISO 22854 shall be used (see [10]).

In cases of dispute concerning benzene content, EN 238 cannot be used as method of dispute.

In cases of dispute concerning oxygen content, EN 13132 cannot be used as method for dispute.

In cases of dispute concerning methanol content, EN 1601 shall be used.

NOTE EN 1601 is applicable for samples containing > 15 % (*V/V*) of ethers using a dilution step lowering the amount of ethers to a value below 15 % (*V/V*).

In cases of dispute concerning oxygenates content, EN ISO 22854 shall be used.

Annex A
(normative)

Vapour pressure waiver

A.1 Vapour pressure waiver permitted

The permitted vapour pressure waiver for intermediate ethanol content between the values listed in Table A.1 shall be determined by a straight line interpolation between the ethanol content immediately above and that immediately below the intermediate value determined by the methods indicated in Table A.1.

Table A.1 — Vapour pressure waiver permitted for unleaded petrol containing bioethanol

Ethanol content EN 1601- EN 13132 — EN ISO 22854 [a] % (*V/V*)	Vapour Pressure Waiver Permitted EN 13016-1 kPa
0	0
1,0	3,7
2,0	6,0
3,0	7,2
4,0	7,8
5,0	8,0
6,0	8,0
7,0	7,9
8,0	7,9
9,0	7,8
10,0	7,8

[a] See also 5.7.2.

A.2 Guidance for checking compliance with the permitted waiver

To correctly sample for vapour pressure compliance, EN 14275 shall be used

To verify the compliance with the permitted waiver, the following approach shall be followed.

1) Measure the ethanol content according to the test methods listed in Table A.1.

2) Get the rounded waivers corresponding to the measured ethanol content.

3) Apply the waiver to the maximum vapour pressure limit of EN 228 of the Class A volatility class (60,0 kPa) as defined in Table 3 and obtain a new waiver limit.

4) Perform the vapour pressure measurement according to EN 13016-1, using the 1 l container procedure.

5) Compare the results obtained under 3 and 4.

6) The interpretation of results and the verification of the compliance shall be performed according to EN ISO 4259.

Bibliography

[1] Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC

[2] Directive 2003/17/EC of the European Parliament and of the Council of 3 March 2003 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC

[3] 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

[4] Directive 2011/63/EU of the European Parliament and of the Council of 1 June 2011 amending, for the purpose of its adaptation to technical progress, Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels

[5] CEN/TR 16435, *Liquid petroleum products - Oxygenates blending in line with actual EN 228 requirements*

[6] CONCAWE report 08/03, *Guidelines for blending and handling motor gasoline containing up to 10 % V/V ethanol*, available from www.concawe.org.

[7] CEN/TR 15367-2, *Petroleum products - Guide for good housekeeping - Part 2: Automotive petrol fuels*

[8] CEN/TR 15367-3, *Petroleum products - Guide for good housekeeping - Part 3: Prevention of cross contamination*

[9] Method 13, *Determination of ^{14}C content in ethanol, Annex I of Commission Regulation (EC) No. 625/2003, of 2 April 2003, amending Regulation (EC) No 1623/2000 laying down detailed rules for implementing Council Regulation (EC) No 1493/1999 on the common organization of the market in wine with regards to market mechanism.*

[10] CEN/TR 15745, *Liquid petroleum products - Determination of hydrocarbon types and oxygenates via multidimensional gas chromatography method - Round Robin research report*

[11] A1 Commission Directive 2014/77/EU of 10 June 2014 amending Annexes I and II of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels A1

[12] A1 Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure A1

[13] A1 Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC A1

STANDARD SHQIPTAR

SSH UNI 6579:2011

Lëndë djegëse të lëngëta për përdorim termik civil dhe industrial - Klasifikimi dhe karakteristikat

Liquid fuels for industrial and domestic thermal purposes - Classification and characteristics

DPS Drejtoria e Përgjithshme e Standardizimit
Adresa: Rruga "Mine Peza", 143/3,1014 Tiranë – Shqipëri,
Kutia Postare: 98,
Tel: + 355 (0) 4 222 62 55; Fax: + 355 (0) 4 224 71 77
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Hyrje

Drejtoria e Përgjithshme e Standardizimit, DPS, është Organi Kombëtar i Standardizimit në Republikën e Shqipërisë.

DPS harton, miraton dhe publikon standardet puro shqiptare, si dhe adopton dhe publikon standardet evropiane dhe ndërkombëtare, duke iu dhënë atyre statusin e Standardeve Shqiptare (SSH). Të njejtat kompetenca ka edhe për dokumentet e standardizimit.
Miratimi formal i tyre bëhet nga Drejtori i Përgjithshëm i DPS.

Standardet Shqiptare hartohen dhe adoptohen nga Komitetet Teknike (KT). Anëtarët e Komiteteve Teknike janë specialistë të subjekteve shtetërore dhe private nga fusha të ndryshme të ekonomisë që angazhohen vullnetarisht në këtë proces.

Standardi është adoptuar nga KT 19 dhe miratuar nga DPS si standard më 2011-11-24.

Standardi SSH UNI 6579:2011 botohet për herë të parë.

Ky standard është i njejtë me standardin dhe riprodhohet me lejen e:

Institutit Kombëtar Italian të Standardeve - UNI,
Via Sannio, 2
IT-20137 Milano, Italia

Standardet rishikohen kur është e nevojshme, prandaj është e domosdoshme që përdoruesi të marrë botimin e fundit si dhe amendamentet e tij, nëse ka të tilla.

Përmbajtja Faqe

STANDARD SHQIPTAR

Lëndë djegëse të lëngëta për përdorim termik civil dhe industrial – Klasifikimi dhe karakteristikat	S SH UNI 6579:2011 ICS: 75.160.20

Aprovuar në Komitetin Teknik 19
Miratuar më 24.11.2011

Ky standard ka statusin e Standardit Shqiptar.

Ky standard shqiptar ekziston vetëm në gjuhën shqipe.

Parathënie

Standardi S SH UNI 6579:2011 u përshtat nga Komiteti Teknik 19, "Produkte nafte, lubrifikantë dhe produkte që lidhen me to", sekretariatin e të cilit e mban DPS-ja.

Këtij standardi shqiptar duhet t'i jepet statusi i një standardi kombëtar, nëpërmjet një njoftimi, brenda muajit Maj 2012 dhe standardet kombëtare që bien në kundërshtim me të, duhen të shfuqizohen brenda muajit Maj 2012.

1 Fusha e zbatimit

Ky standard përcakton kërkesat dhe jep klasifikimin për një përdorim sa më të mirë të lëndëve djegëse të lëngëta, me origjinë nga nafta për përdorim termik civil dhe industrial.

Shënim: Për qëllimet e këtij standardi shqiptar, termat "% m" dhe "% vol." janë përdorur për të paraqitur përkatësisht përqindjen në masë dhe përqindjen në vëllim.

2 Standardet referuese

Ky standard shqiptar përmban përcaktime nga publikime të tjera, me anë të referencave të datuara ose të padatuara. Këto referenca normative janë cituar në vendet e nevojshme në tekst dhe publikimet janë renditur më poshtë. Referencat e datuara, amendamentet e mëtejshme ose rishikimet e çdo publikimi të tillë, zbatohen për këtë standard shqiptar vetëm kur ato përfshihen në të, me anë të amendamentit ose rishikimit. Për referencat e padatuara, zbatohet botimi më i fundit i publikimit të referuar (përfshirë amendamentet).

S SH EN 116 Lëndë djegëse për motorët diesel dhe pajisje ngrohëse shtëpiake – Përcaktimi i pikës së taposjes së filtrit në të ftohtë

S SH EN 12766-2	Produktet e naftës dhe vajrat e përdorur – Përcaktimi i BPK – ve dhe produktet në lidhje me 'to – Llogaritja e përmbajtjes së BPK
S SH EN 12766-3	Produktet e naftës dhe vajrat e përdorur – Përcaktimi i BPK – ve (derivatet e Benzenit të PoliKlorinuar) dhe produktet në lidhje me 'to – Pjesa 3: Përcaktimi dhe kuantifikimi (sasijimi) i përmbajtjes së terfenileve (difenilbenzeneve) të poliklorinuara (TPK) dhe toluen benzileve të poliklorinuara (TBPK) me anë të gazkromatografisë (GK) duke përdorur një dedektor (gjurmues) për kapjen e elektronit (DKE).
S SH EN 13131	Metodat e provës për naftën dhe produktet e saj - Produktet e lëngta të naftës - Përcaktimi i përmbajtjes së nikelit dhe vanadit - Metoda spektrometrike e absorbimit atomik
S SH EN 14078	Produktet e lëngshme të naftës - Përaktimi i metilestereve të acideve lyrore (FAME) në distilatet e mesme - Metoda e spektroskopisë me rreze infra të kuqe
S SH EN 14213	2003 Vajrat ngrohës - Metilesteret e acideve lyrore (FAME) - Kërkesat dhe metodat e provës
S SH EN ISO 2719	Përcaktimi i pikës së flakërimit – Metoda Pensky-Martens me kupë të mbyllur (kroxholl) (ISO 2719:2002)
S SH EN ISO 2592	Përcaktimi i pikës së flakërimit – Metoda Cleveland me kupë të hapur (kroxhol) (ASTM D-92)
S SH EN ISO 3104	Produkte të naftës – Lëngjet transparentë dhe të errët – Përcaktimi i vizkozitetit kinematik dhe llogaritja e viskozitetit dinamik. (ASTM D-445-11a)
ASTM D1665-98	Përcaktimi i viskozitetit specifik Engler në produktet e rënda
S SH EN ISO 3170	Lëngjet e naftës – Marja e mostrës me dorë
S SH EN ISO 3171	Lëngjet e naftës – Marja automatike e mostrës me tubacion (ISO 3171:1988).
S SH EN ISO 3405	Produkte të naftës – Përcaktimi i karakteristikave të distilimit (IS0 3405:2000). (ASTM D-86)
S SH EN ISO 3675	Nafta bruto dhe produktet e lëngëta të naftës – Përcaktimi laboratorik i densitetit –Metoda me hidrometër(ISO 3675:1998).
S SH EN ISO 3735	Naftë bruto dhe mazut - Përcaktimi i mbetjes - Metoda e ekstraktimit

S SH EN ISO 4259	Produkte të naftës – Përcaktimi dhe zbatimi i të dhënave të sakta në lidhje me metodat e provës (ISO 4259:1992, përfshirë Korrigjimin 1:1993)
S SH EN ISO 6245	Produkte të naftës – Përcaktimi i hirit (ISO 6245:2001)
S SH EN ISO 8754	Produkte nafte - Përcaktimi i përmbajtjes së squfurit – Spektrometria fluoreshente e shpërndarjes së energjise me reze x (ASTM D 4294-02)
S SH EN ISO 20884	Produkte nafte - Përcaktimi i përmbajtjes së squfurit në lëndët djegëse të lëngëta për automjete - Spektrometria fluoreshente me rreze X në shpërndarjen e gjatësisë së vales (ASTM D2622)
S SH EN ISO 10370	Produktet e naftës - Përcaktimi i mbetjes së karbonit - Metoda mikro
S SH ISO 3016	Produkte nafte - Përcaktimi i pikës së rrjedhjes
S SH ISO 3733	Produkte nafte dhe materiale bituminoze - Percaktimi ujit - Metoda e distilimit
S SH ISO 3734	Produktet e naftes - Percaktimi i ujit dhe mbeturinave mekanike ne mazutet e naftes – Metoda me centrifuge
ASTM D 974:	Produkte të naftës – Përcaktimi i aciditetit dhe bazicitetit me metodën e titrimit të ngjyrës së indikatorit.

3 Marrja e mostrës

Mostrat duhen të merren siç përshkruhet në standardin S SH EN ISO 3170 ose në standardin S SH EN ISO 3171 dhe/ose në përputhje me kërkesat e standardeve kombëtare ose rregulloret për marrjen e mostrës të lëndës djegëse për ngrohje industriale dhe shtëpiake.

Nga pikëpamja e ndjeshmërisë së disa metodave të provës që referohen në këtë standard shqiptar, vëmendje e veçantë duhet t'i kushtohet përputhshmërisë të çdo udhëzimi për enët e marrjes së mostrës të cilat përfshihen në standardin e metodës së provës.

4 Kërkesat dhe metodat e provës

4.1 Ngjyruesit dhe gjurmuesit

Është i lejueshëm përdorimi i ngjyruesve dhe/ose i gjurmuesve. Duhet të përdoren ngjyrues dhe gjurmues sipas ligjeve dhe akteve nënligjore në fuqi në këtë fushë.

4.2 Shtesat

Lejohet përdorimi i shtesave me qëllim përmirësimin e cilësia së lëndës djegëse.
Rekomandohet përdorimin aditivëve të përshtatshëm, pa efekte anësore të njohur, në sasi të duhur.

4.3.1 Esteret metilik të acideve yndyror

Lejohet përdorimi i estereve metilik i acideve yndyror (FAME) të përzier me gazoil ose me vajra të djegshëm. FAME e përdorur duhet të jetë në përputhje me standardin S SH EN 14213.

4.4 Kërkesa të përgjithshme të zbatueshme dhe metodat e provës në lidhje me to

Kur i nënshtrohen provave sipas metodave të treguara ne tabelen 1, lëndët djegëse dhe përzierjet e mundëshme me FAME (shih pikën 4.3) duhet të kënaqin kufijtë e treguar në tabelën 1.

Në rastin kur përmbajtja e FAME në gazoil ose ne vajin e djegshëm është më e madhe se 105 V/V) për përcaktimin e përmbajtjes së squfurit duhet të përdoret metoda e përcaktuar në standardin S SH EN ISO 14596

Për përcaktimin e përmbajtjes së FAME në gazoil duhet të përdoret metoda e përcaktuar në standardin S SH EN ISO 14078.

4.5 Saktësia dhe dyshimi

Të gjitha metodat e provave të cilave ju referohet ky standard përfshijnë të dhëna të saktësisë në përputhje me standardin S SH EN ISO 4259. Në raste dyshimi, për zgjidhjen e mosmarrëveshjes dhe interpretimin e rezultateve të bazuara në saktësinë e metodës së provës duhen të përdoren procedurat e përshkruara në S SH EN ISO 4259:2006.

Tabela 1 – Klasifikimi i lëndëve djegëse, kërkesat dhe metodat e provave

Lloji i lëngës djegëse	Njësia	Vajguri (kerosinë)	Gazoil ≤0,1	Gazoil >0,1	Lende djegese te lengeta te renda te naftes(heavy fuel oil)		Metodat e provës
					Solar	Mazut	
	Njësia	A	B	C	D	E	
Kartakteristikat							
Pika flakërimit	^{0}C	≥28	>55	>55	>65	>80	S SH EN ISO 2719 ASTM D-92
Indeksi i cetanit			≥42				
Masa vëllimore në 15^{0}C	Kg/m^3	770 deri 830	815 - 875	815 - 875			S SH EN ISO 3675
Viskoziteti							S SH EN ISO 3104
në 40^{0}C	mm^2/s		2,0-7,4	2,0-7,4	-	-	ASTM D-445
në 50^{0}C	mm^2/s		-	-	21-90	>90	ASTM D1665
në 50^{0}C	^{0}E						
në 100^{0}C	mm^2/s				<12	>12	
në 100^{0}C	^{0}E				≤2	>2	
Distilimi							S SH EN ISO3405
në 150^{0}C	%)v/v)	-	≤2[1]	≤2[1]			ASTM D 86
në 210^{0}C	%)v/v)	<90					
në 250^{0}C	%)v/v)	≥65	<65				
në 300^{0}C	%)v/v)			<60			
në 350^{0}C	%)v/v)		≥85	<85			
Uji dhe mbetjet	%)v/v)	≤0,05	≤0,05	≤0,05			S SH ISO 3734
Uji	%)v/v)	shënja	shënja	shënja	≤2	shënja	S SH ISO 3733
Mbetjet	%(m/m)				≤0,5	≤0,5	S SH ISO 3735
Hiri	%(m/m)				≤0,1	≤0,2	S SH EN ISO 6245
korrozioni	vlerësim	1a	1a	1a			S SH EN ISO 2160
Pika e turbullimit	°C		≤ 0	≤ 0			S SH ISO 3016
Squfuri	%(m/m)	≤0,2	≤0,1	≤1	≤5	≤7	S SH EN ISO 20884
Përmbajtja e koksit	%(m/m)				≤15	≤15	S SH EN ISO 10370
Nikel+Vanad	mg/kg	≤15	≤15	≤15	≤180	≤230	S SH EN 13131
PCB	mg/kg	<4	<4	<4	<4	<4	S SH EN 12766-2
PCT	mg/kg	<10	<10	<10	<10	<10	S SH EN 12766-3
Fuqia kalorifike	MJ/kg				≥40	≥40	S SH 3745
Ngjyra(2)		po	po	po			

Shënimi (1) :nuk është i nevojshëm kur pika e flakërimit është më e madhe ose e barabartë me 65^{0}C
Shënimi (2): është i detyrueshëm ngjyrosja,për produktet (A,B,C), sipas ligjeve dhe akteve nënligjore në fuqi

AGJENCIA E BLERJEVE TË PËRQENDRUARA
Nr 58 Prot.
Datë,më 15.01.2020

REPUBLIKA E SHQIPËRISË
MINISTRIA E FINANCAVE DHE EKONOMISË
DREJTORIA E PËRGJITHSHME E STANDARDIZIMIT

Nr. 530/6 prot. Tiranë, më 14.01.2020

Lënda: Kthim përgjigje

ZONJËS EDLIRA NAQELLARI
DREJTOR I PËRGJITHSHËM
AGJENCIA E BLERJEVE TË PËRQËNDRUARA
MINISTRIA E BRENDSHME

Tiranë

Në përgjigje të shkresës Tuaj nr. 2069/2 Prot, datë 31.12.2019, "*Kërkesë për standarde në lidhje me objektin e prokurimit – Blerje karburanti, përveç vajgurit Jet A1*",

Ju bëjmë me dije se Drejtoria e Përgjithshme e Standardizimit (DPS) ka përgatitur standardin e kërkuar nga ju në version letër, të cilën e gjeni bashkëlidhur kësaj shkrese.

Duke Ju falenderuar për bashkëpunimin,

DREJTOR I PËRGJITHSHËM

Riza HASANAJ

Rruga "Reshit Çollaku", Godina e ILDKPKI, Kati 6, Tiranë, Shqipëri; Tel.: +355 (0) 4 222 62 55; www.dps.gov.al; info@dps.gov.al

STANDARD SHQIPTAR

SSH EN 589:2018

Lëndë djegëse për automjete, për përdorim shtëpiak dhe industrial - GLN (Mishelë) - Kërkesat dhe metodat e provës

Automotive fuels - LPG - Requirements and test methods

DPS Drejtoria e Përgjithshme e Standardizimit
Adresa: Rruga "Mine Peza", 143/3,1014 Tiranë – Shqipëri,
Kutia Postare: 98,
Tel: + 355 (0) 4 222 62 55; Fax: + 355 (0) 4 224 71 77
E-mail: info@dps.gov.al

Hyrje

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Miratimi formal i tyre bëhet nga Drejtori i Përgjithshëm i DPS.

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Standardi EN 589:2008/FprA1 është hartuar nga KT 19 dhe miratuar nga DPS si standard më 2019-01-23.

Standardi SSH EN 589:2018 botohet për herë të tretë.

Ky standard është i njejtë me standardin EN 589:2008/FprA1 dhe riprodhohet me lejen e:

Komitetit Evropian për Standardizimin – CEN,
Avenue Marnix 17
B-1000 Brussels

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 589

December 2018

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Supersedes EN 589:2008+A1:2012

English Version

Automotive fuels - LPG - Requirements and test methods

Carburants pour automobiles - GPL - Exigences et méthodes d'essai

Kraftstoffe - Flüssiggas - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 19 October 2018.

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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

Ref. No. EN 589:2018 E

Contents

European foreword

This document (EN 589:2018) 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 June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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 589:2008+A1:2012.

This is the 7th edition of EN 589. The main technical changes include:

a) reduction of the sulfur limit value to 30 mg/kg;

b) removal of ASTM D 3246, sulfur determination by oxidative microcoulometry, as being incapable of measuring that level;

c) addition of single limit value for propane in Table 1;

d) addition of a single limit value for 1,3 butadiene in Table 1 due to CLP requirements [5];

e) introduction of a test method for the determination of 1,3 butadiene and hydrocarbon composition, for the determination of low sulfur levels in LPG (prEN 17178) and to determine evaporation residue (EN 16423);

f) addition of Clause 7 "Remarks concerning vehicle application issues like residues in vaporizers or injectors";

g) permission to use alternative odour tests added to sub-clause 6.3. The odour test according to Annex A is not a precise test method with any given precision. Odour is subjectively perceived, not measured. For this reason it is hard to define a referee method;

h) inclusion of reference to EN 16942 regarding pump marking in line with the requirements set by the new Directive 2014/94/EU [1].

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies requirements and test methods for marketed and delivered automotive liquefied petroleum gas (LPG), with LPG defined as low pressure liquefied gas composed of one or more light hydrocarbons which are assigned to UN 1011, 1075, 1965, 1969 or 1978 only and which consists mainly of propane, propene, butane, butane isomers, butenes with traces of other hydrocarbon gases.

This standard is applicable to automotive LPG for use in LPG engine vehicles designed to run on automotive LPG.

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

WARNING — Attention is drawn to the risk of fire and explosion when handling LPG and to the hazard to health arising through inhalation of excessive amounts of LPG.

LPG is a highly volatile hydrocarbon liquid which is normally stored under pressure. If the pressure is released large volumes of gas will be produced which form flammable mixtures with air over the range of approximately 2 % (V/V) to 10 % (V/V). This European Standard involves the sampling, handling and testing of LPG. Naked flames, unprotected electrical equipment electrostatic hazards etc. are sources of ignition for LPG.

LPG in liquid form can cause cold burns to the skin. The national health and safety regulations apply.

LPG is heavier than air and accumulates in cavities. There is a danger of suffocation when inhaling high concentrations of LPG.

CAUTION — One of the tests described in this European Standard involves the operator inhaling a mixture of air and LPG vapour. Particular attention is drawn to the cautionary statement provided in A.1, where this method is referred to.

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 15469, *Petroleum products - Test method for free water in liquefied petroleum gas by visual inspection*

EN 15470, *Liquefied petroleum gases - Determination of dissolved residues - High temperature Gas chromatographic method*

EN 15471, *Liquefied petroleum gases - Determination of dissolved residues - High-temperature gravimetric method*

EN 16423, *Liquefied petroleum gases - Determination of dissolved residue - Gas chromatographic method using liquid, on-column injection*

EN 16942, *Fuels - Identification of vehicle compatibility - Graphical expression for consumer information*

prEN 17178:2017, *Automotive fuels — Sulfur content in liquefied petroleum gas — Determination by ultraviolet fluorescence (UVF)*

EN 27941, *Commercial propane and butane - Analysis by gas chromatography (ISO 7941)*

EN ISO 4256, *Liquefied petroleum gases - Determination of gauge pressure - LPG method (ISO 4256)*

EN ISO 4257, *Liquefied petroleum gases - Method of sampling (ISO 4257)*

EN ISO 4259-2, *Petroleum and related products - Precision of measurement methods and results - Part 2: Interpretation and application of precision data in relation to methods of test (ISO 4259-2)*

EN ISO 6251, *Liquefied petroleum gases - Corrosiveness to copper - Copper strip test (ISO 6251)*

EN ISO 8819, *Liquefied petroleum gases - Detection of hydrogen sulfide - Lead acetate method (ISO 8819)*

EN ISO 8973, *Liquefied petroleum gases - Calculation method for density and vapour pressure (ISO 8973)*

DIN 51619, *Testing of mineral oil hydrocarbons — Determination of the composition of liquid petroleum gases — Gas chromatographic analysis under special consideration of 1,3-butadiene with mass fractions ≤ 0,1 % (m/m)*

ASTM D6667–14, *Standard Test Method for Determination of Total Volatile Sulfur in Gaseous Hydrocarbons and Liquefied Petroleum Gases by Ultraviolet Fluorescence*

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:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
liquefied petroleum gas
LPG
petroleum gas that can be stored and/or handled in the liquid phase under moderate conditions of pressure and at ambient temperature, consisting predominantly of propane and butanes, with small proportions of propene, butenes and pentanes/pentenes

4 Sampling

Samples shall be taken as described in EN ISO 4257 and/or in accordance with the requirements of national standards or regulations for the sampling of automotive LPG. 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.

IMPORTANT — It is important that the sampling procedure is followed in detail in order to avoid evaporation losses.

Before sampling from the dispenser hose, 20 l of product should be pumped or recirculated, in order to obtain a representative sample.

5 Pump marking

Information to be marked on dispensing pumps and nozzles used for delivering automotive LPG, and the dimensions of the label shall be in accordance with EN 16942.

6 Requirements and test methods

6.1 General

When tested by the methods of test given in Table 1, automotive LPG fuel shall comply with the limiting requirements specified in that table.

For the minimum vapour pressure, five grades, A, B, C, D and E are given to allow for seasonal limits to be set nationally for each period of the year. In a national annex to this European Standard, each country shall indicate which grade(s) it adopts to achieve a minimum vapour pressure of 150 kPa (gauge) throughout the entire year and shall detail the date range in which the selected grade applies.

Liquefied petroleum gases for automotive purposes shall be free from any adulterant or contaminant that may render the fuel unacceptable for use in appropriate engines.

6.2 Water content

Liquefied petroleum gases for automotive purposes shall not contain free water at 0 °C and at the saturated vapour pressure on visual inspection.

NOTE For propane rich mixtures with a minimum of 60 % (m/m) of propane, compliance with EN ISO 13758 [2] equally satisfies this requirement.

For operational purposes it is allowed to add up to 2 000 mg/kg methanol. No other antifreeze agents shall be added.

6.3 Odour

When tested in accordance with the procedure described in Annex A, the odour of the gas shall be characteristic (i.e. distinctive and unpleasant), detectable at a concentration in air of 20 % of the lower flammability limit.

NOTE Unpleasant being subjective, the odour is to be a caution and inviting to the user to search for the leak.

For odour testing, alternative test methods may be used if this detection methods demonstrates the ability to measure the odour and/or a correlated parameter at least equal to that of the test method described in Annex A. Such alternative procedures shall be set out in detail or referred to by reference in a national annex to this European Standard.

6.4 Density

If a density report is required, EN ISO 3993 [3] or EN ISO 8973 are recommended.

6.5 Precision and dispute

6.5.1 All test methods referred to in this European Standard include a precision statement. In cases of dispute, the procedures for resolving the dispute and interpretation of the results based on test method precision, described in EN ISO 4259-2, shall be used.

6.5.2 In case of dispute concerning the evaporation residue, EN 15470 or EN 15471 shall be used.

6.5.3 In case of dispute concerning the vapour pressure, EN ISO 4256 shall be used.

6.5.4 In case of dispute concerning the total diene content and the propane content EN 27941 shall be used.

6.5.5 In cases of dispute concerning total sulfur content, prEN 17178 shall be used. See paragraph 14.1 in that document for additional information on precision.

Table 1 — Requirements and test methods

Property	Unit	Limits		Test method[a] (See Clause 2, Normative references)
		Minimum	Maximum	
Motor octane number, MON		89,0		Annex B
Total dienes content [i]	% (*m*/*m*)		0,5	EN 27941 DIN 51619
1,3 Butadiene	% (*m*/*m*)		0,10	DIN 51619
Propane content [g,i] until 2022-04-30 from 2022-05-01	% (*m*/*m*)	 20 30		EN 27941 DIN 51619
Hydrogen sulphide		negative		EN ISO 8819
Total sulfur content (after odorization) [j]	mg/kg		30	prEN 17178 ASTM D6667
Copper strip corrosion (1 h at 40 °C)	rating	class 1		EN ISO 6251
Evaporation residue [b]	mg/kg		60	EN 15470 EN 15471 EN 16423
Vapour pressure, gauge at 40 °C [c]	kPa		1 550	EN ISO 4256 EN ISO 8973 and Annex C
Vapour pressure, gauge, min 150 kPa at a temperature of: [d,e]	°C			EN ISO 8973 and Annex C
- for grade A			- 10	
- for grade B			- 5	
- for grade C			0	
- for grade D			+ 10	
- for grade E			+ 20	
Water content [f]		pass		EN 15469
Odour [h]		unpleasant and distinctive at 20 % LFL		See 6.3 and Annex A

[a] See also 6.5.1.

[b] See also 6.5.2.

[c] See also 6.5.3.

[d] For the purpose of this standard EN ISO 8973 together with Annex C shall be applied at the indicated temperatures. For internal routine quality control purposes, the values as given in the informative Annex D may also be used.

[e] See also 6.1.

[f] See also 6.2.

[g] A test method on MON and/or on the performance of LPG in the engine is under development. As soon as such a test method is available a revision with the aim of withdrawing the minimum propane content requirement will be initiated.

[h] National safety requirements have to be followed in any case and may overwrite this standard.

[i] See also 6.5.4.

[j] See also 6.5.5. ASTM D6667 is intended to be no longer referenced when sufficient data on EN 17178 is available.

7 Remarks concerning vehicle application issues like residues in vaporizers or injectors

The presence of plasticizer additives (e.g. phthalates) in elastomer hoses or other materials which can come into contact with LPG can lead to increased contamination of LPG by high molecular substances. Therefore, great care should be taken by the automotive industry and LPG retailers to avoid such contacts, e.g. by internal coating or introducing materials which do not release those plasticizers.

Annex A
(normative)

Test method for odour of LPG

A.1 Introduction

This annex describes a method for assessing the odour of commercial LPG whatever the odour is due to the presence of unsaturated hydrocarbons and/or sulfur compounds or an odour imparted by the addition of odorants.

WARNING — In order to minimize the exposure of personnel conducting the odour test against toxic impurities, it is strongly recommended that the test should only be performed when it has been ascertained that LPG already meets the other specification limits detailed in Table 1. The test involves the operator inhaling a mixture of LPG vapour and air. There is a risk that the nationally regulated short-term and/or long-term (8 h TWA reference period) occupational exposure limits for substances contained in the LPG may be exceeded. The operator should consult relevant safety and health regulations and ensure that exposure during the sampling, handling and testing of LPG does not exceed the limits set in the respective country.

As a guide, and provided the LPG being tested complies with the quality requirements listed in Table 1, an operator will usually remain within the corresponding national legal occupational exposure limits, provided inhalation of the LPG/air mixture does not exceed three 10 s periods during each test and not more than two tests per hour are performed in the course of an 8 h working day. This shall be confirmed by an individual hazard assessment according to national regulations.

This guidance only takes account of the operator's exposure whilst conducting odour tests. Other potential exposures should be assessed in order to estimate total exposure.

A.2 Principle

A sample of liquid gas is completely vaporized and diluted with purified air so that the mixture contains the gas at a concentration of 20 % of the lower limit of its flammability in air. The odour of the gaseous mixture is assessed by at least three observers.

The lower limits of flammability in air may be considered as:

— butane 1,9 % (V/V);

— propane 2,4 % (V/V).

A.3 Material

Activated charcoal, particle size 1,18 mm to 1,70 mm, for purifying the air stream.

A.4 Apparatus

The apparatus is shown diagrammatically in Figure A.1 and consists of the parts detailed in A.4.1 to A.4.5.

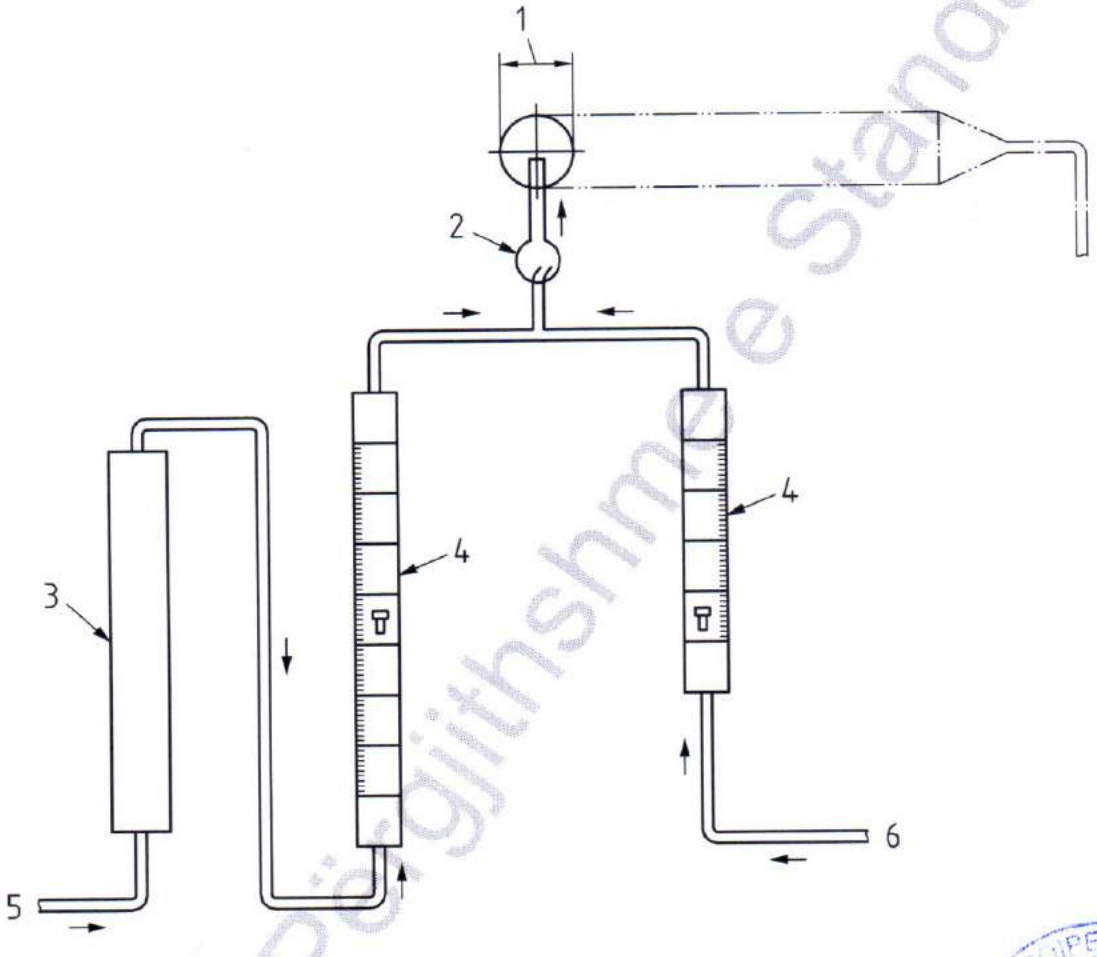
A.4.1 Air purifying column, consisting of a drying tower of approximately 200 ml capacity.

A.4.2 Flowmeter, such as one operating on the floating element principle, for air; range 5 l/min to 15 l/min.

A.4.3 Flowmeter, such as one operating on the floating element principle, for gas; range 5 ml/min to 150 ml/min.

A.4.4 Gas mixing bulb, 30 mm in diameter with a jet 4 mm in diameter.

A.4.5 Glass funnel, diameter 75 mm.



Key

1	Ø 75 glass funnel (A.4.5)	4	flowmeters (A.4.2 or A.4.3)
2	mixing bulb (A.4.4)	5	air
3	air purifying column (A.4.1)	6	stenched gas

Figure A.1 — Apparatus for assessing odour of LPG

A.5 Procedure

Pass air through the air purification column (A.4.1) at the specified rate as measured by the air flowmeter (A.4.2). The air flow rate for propane shall be 8,5 l/min and that for butane shall be 10,5 l/min. For mixtures the flow rate can be calculated by a linear approach based on the share of propane and butane.

Place the nose inside the rim of the funnel (A.4.5) and inhale gently; check that the air is odourless.

Pass the stenched gas through the gas flowmeter (A.4.3) at a rate of 40 ml/min. Assess the odour of the gas-air mixture using at least three observers.

A.6 Expression of results

If the odour is judged to be distinctive and unpleasant by all observers, the batch, which the sample represents, shall be reported as complying with this document.

Annex B
(normative)

Method of calculation of the Motor Octane Number (MON) from compositional analysis of LPG

B.1 Introduction

This annex describes a method for the calculation of the motor octane number from a compositional analysis of LPG, using the method described in EN 27941 or in DIN 51619.

B.2 Principle

The composition of a sample of LPG is obtained using gas chromatography. The motor octane number of the sample is calculated from the partial motor octane factors of the constituents and their concentrations determined from the analysis.

B.3 Determination

Determine the concentration of each constituent present at a concentration in excess of 0,1 % (m/m) in the gas sample, using the method described in EN 27941 or DIN 51619.

B.4 Calculation and expression of results

B.4.1 Calculate the partial motor octane number for each component in the mixture as follows:

$$\text{Partial octane number} = M \cdot C \qquad \text{(B.1)}$$

where

M is the motor octane factor of specific component (see Table B.1), in the same units as used for C;

C is the fraction of specific component in the mixture, either in molar, mass or volume percentage.

NOTE The factors for motor octane number in Table B.1 are empirical values to be used only in the calculation procedures described in this annex.

In case of dispute the molar factors shall be used.

B.4.2 Add the partial motor octane numbers for all of the components determined and round the sum down to the nearest 0,1.

Table B.1 — Factors for determining the Motor Octane Number of LPG

Component	Motor octane number factor, *M*		
	Molar	Mass	Volume
Propane (+ C2)	95,4	95,9	95,6
Propene	83,9	82,9	83,1
Butane (+ C5)	89,0	88,9	88,9
2-Methylpropane (Isobutane)	97,2	97,1	97,1
Butenes	75,8	76,8	75,7

B.5 Reporting

Report the total (B.4.2) as the LPG motor octane number of the sample.

Annex C
(normative)

Absolute vapour pressure blending factors

This annex describes factors for the calculation of the absolute vapour pressure of liquefied petroleum gas. The method of calculation as given in EN ISO 8973 shall be used.[1)]

Table C.1 — Absolute Vapour Pressure Blending Factors

Component	AVP blending factors (kPa) at temperature (°C)					
	-10	-5	0	10	20	40
Methane	21 334	22 742	24 211	27 333	30 707	38 230
Ethane	1 873	2 128	2 407	3 040	3 781	5 613
Ethylene	3 348	3 737	4 159	5 101	6 184	8 805
Propane	346	405	472	630	826	1 353
Propylene	437	510	591	785	1 024	1 661
Butane	71,26	86,64	104,5	149,2	207,6	376,9
Isobutane	109,9	132,3	158,1	221,4	302,7	531
1-Butene	87,91	106,8	128,8	183,4	254,4	457
Isobutene	90,17	109,5	131,9	187,6	259,9	466
Cis-2-Butene	59,63	73,11	88,94	126,7	181,5	336,5
Trans-2-Butene	67,13	81,90	99,16	142,3	199,1	364,8
1,2-Butadiene	43,65	54,08	66,49	98,26	141,3	272,2
1,3-Butadiene	81,55	99,45	120,3	172,2	240,2	436
Pentane	15,23	19,41	24,48	37,85	56,53	115,5
Isopentane	21,98	27,68	34,52	52,25	76,57	151,3
1-Pentene	19,75	25,00	31,33	47,85	70,67	141,5

1) The vapour pressure blending factors of components present in liquefied petroleum gas, as indicated in the table, are primarily calculated using so-called Antoine coefficients as published in [4].

Annex D
(informative)

Seasonal gauge vapour pressure limits

Table D.1 presents the gauge vapour pressure limits at 40 °C that may be used for internal routine quality control purposes.

Table D.1 — Seasonal gauge vapour pressure limits at 40 °C

Grade	Minimum[a] (kPa)	Equivalent to 150 kPa at (°C)
A	950	−10
B	800	−5
C	700	0
D	500	+ 10
E	275	+ 20

[a] These vapour pressures are calculated using the values given in EN ISO 8973 and are for internal routine quality control purposes only.

Bibliography

[1] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

[2] EN ISO 13758:1996, *Liquefied petroleum gases - Assessment of the dryness of propane - Valve freeze method (ISO 13758:1996)*

[3] EN ISO 3993:1995, *Liquefied petroleum gas and light hydrocarbons - Determination of density or relative density - Pressure hydrometer method (ISO 3993:1984)*

[4] *The Properties of Gases and Liquids*, REID, R.C., PAUSNITZ, J.M. and SHERWOOD,T.K., 3rd ed., 1977

[5] Regulation (EC) No 1272/2008, OJ L 353 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures - amending and repealing Directive 67/548/EEC and 1999/45/EC, and Regulation (EC) No 1907/2006.

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Nr. 1289/1	Prot.	Datë	17	07	2019
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STANDARD SHQIPTAR

SSH ISO 8217:2017

Produkte nafte - Lëndë djegëse (klasa F) - Specifikimet e lëndëve djegëse detare (të marines)

Petroleum products -- Fuels (class F) -- Specifications of marine fuels

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Hyrje

Drejtoria e Përgjithshme e Standardizimit, DPS, është Organi Kombëtar i Standardizimit në Republikën e Shqipërisë.

DPS harton, miraton dhe publikon standardet puro shqiptare, si dhe adopton dhe publikon standardet evropiane dhe ndërkombëtare, duke iu dhënë atyre statusin e Standardeve Shqiptare (SSH). Të njejtat kompetenca ka edhe për dokumentet e standardizimit.
Miratimi formal i tyre bëhet nga Drejtori i Përgjithshëm i DPS.

Standardet Shqiptare hartohen dhe adoptohen nga Komitetet Teknike (KT). Anëtarët e Komiteteve Teknike janë specialistë të subjekteve shtetërore dhe private nga fusha të ndryshme të ekonomisë që angazhohen vullnetarisht në këtë proces.

Standardi ISO 8217:2017 është adoptuar nga KT 19 dhe miratuar nga DPS si standard më 2019-07-12.

Standardi SSH ISO 8217:2017 botohet për herë të katërt.

Ky standard është i njejtë me standardin ISO 8217:2017 dhe riprodhohet me lejen e:

Organizatës Ndërkombëtare për Standardizimin – ISO,
1, ch. de la Voie-Creuse
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CH-1211 Genève 20
Switzerland

Standardet rishikohen kur është e nevojshme, prandaj është e domosdoshme që përdoruesi të marrë botimin e fundit si dhe amendamentet e tij, nëse ka të tilla.

INTERNATIONAL STANDARD

ISO 8217

Sixth edition
2017-03

Petroleum products — Fuels (class F) — Specifications of marine fuels

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 28, *Petroleum products and related products of synthetic or biological origin*, Subcommittee SC 4, *Classifications and specifications.*

This sixth edition cancels and replaces the fifth edition (ISO 8217:2012), which has been technically revised.

Introduction

General

This document was prepared in cooperation with ship owners, ship operators, shipping associations, national standards bodies, classification societies, fuel testing services, engine designers, marine fuel suppliers, fuel additive suppliers and the petroleum industry to meet the requirements for marine fuels supplied on a world-wide basis for consumption on board ships.

The increasing demands of environmental legislation are leading to a transition in the nature of marine fuels supplied from traditional oil products derived from the processing of petroleum crude to the potential inclusion of oil products derived from renewable and/or alternative sources. This document takes into consideration the diverse nature of these fuels and incorporates a number of categories of distillate or residual fuels, even though not all categories may be available in every supply location.

Classification

The categories of fuel in this document have been classified in accordance with ISO 8216-1[1].

At the time of preparation of this document, a number of unconventional fuels have been offered to the market which do not conform exactly to this particular distillate/residual categorization. In these instances, it is recommended that the fuel characteristics or limits should be agreed between the purchaser and supplier and defined by both a category of fuel as given by this document together with any different or additional fuel characteristics or limits necessary to adequately define that fuel.

International statutory requirements

This document specifies allowable minimum flash point limits following the provisions given in the SOLAS Convention[2]. MARPOL Annex VI[3], which controls air pollution from ships, includes a requirement that either the fuel shall not exceed a specified maximum sulfur content or an approved equivalent alternative means be used. During the lifetime of this document, regional and/or national bodies may introduce their own local emission requirements, which can impact the allowable sulfur content, for example, the EU Sulphur Directive[4]. It is the purchaser's and the user's responsibility to establish which statutory requirements are to be met and specify on that basis the corresponding maximum fuel sulfur content to the supplier.

Changes with respect to ISO 8217:2012

This sixth edition reflects important and significant changes. These include substantial amendments to the scope (Clause 1) and to the general requirements (Clause 5).

Changes to the distillate fuels include the following:

— additional grades, DFA, DFZ and DFB have been added with a maximum fatty acid methyl ester(s) (FAME) content of 7,0 volume %;

— the sulfur content of DMA and DMZ has been reduced to a maximum of 1,00 mass %;

— the sulfur content of DMB has been reduced to a maximum of 1,50 mass %;

— requirements for the following characteristics have been added to winter grades of DMA and DMZ: cloud point and cold filter plugging point.

The following annexes, previously included, have been deleted, but the key information is included in the body of this document or is available in referenced industry publications:

— Sulfur content;

— Flash point;

— Catalyst fines;

— Precision and interpretation of test results.

All other annexes have been reviewed and updated.

Petroleum products — Fuels (class F) — Specifications of marine fuels

WARNING — The handling and use of products specified in this document can be hazardous if suitable precautions are not observed. This document does not purport to address all of the safety and health considerations that can be associated with its use. It is the responsibility of the users of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

1 Scope

This document specifies the requirements for fuels for use in marine diesel engines and boilers, prior to conventional onboard treatment (settling, centrifuging, filtration) before use. The specifications for fuels in this document can also be applied to fuels used in stationary diesel engines of the same or similar type as those used for marine purposes.

This document specifies seven categories of distillate fuels, one of which is for diesel engines used for emergency purposes. It also specifies six categories of residual fuels.

For the purposes of this document, the term "fuels" is currently used to include the following:

— hydrocarbons from petroleum crude oil, oil sands and shale;

— hydrocarbons from synthetic or renewable sources, similar in composition to petroleum distillate fuels;

— blends of the above with a fatty acid methyl ester(s) (FAME) component where permitted.

NOTE 1 Appropriate guidance about fuel treatment systems for diesel engines is published by the International Council on Combustion Engines (CIMAC)[5].

NOTE 2 Requirements for gas turbine fuels used in marine applications are specified in ISO 4261[6].

NOTE 3 For the purposes of this document, the terms "mass %" and "volume %" are used to represent the mass and volume fractions respectively.

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.

ISO 2719, *Determination of flash point — Pensky-Martens closed cup method*

ISO 3015, Petroleum products — Determination of cloud point

ISO 3016, *Petroleum products — Determination of pour point*

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

ISO 3675, *Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method*

ISO 3733, *Petroleum products and bituminous materials — Determination of water — Distillation method*

ISO 4259, *Petroleum products — Determination and application of precision data in relation to methods of test*

ISO 4264, *Petroleum products — Calculation of cetane index of middle-distillate fuels by the four-variable equation*

ISO 6245, *Petroleum products — Determination of ash*

ISO 8754, *Petroleum products — Determination of sulfur content — Energy-dispersive X-ray fluorescence spectrometry*

ISO 10307-1, *Petroleum products — Total sediment in residual fuel oils — Part 1: Determination by hot filtration*

ISO 10307-2, *Petroleum products — Total sediment in residual fuel oils — Part 2: Determination using standard procedures for ageing*

ISO 10370, *Petroleum products — Determination of carbon residue — Micro method*

ISO 10478, *Petroleum products — Determination of aluminium and silicon in fuel oils — Inductively coupled plasma emission and atomic absorption spectroscopy methods*

ISO 12156-1, *Diesel fuel — Assessment of lubricity using the high-frequency reciprocating rig (HFRR) — Part 1: Test method*

ISO 12185, *Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method*

ISO 12205, *Petroleum products — Determination of the oxidation stability of middle-distillate fuels*

ISO 12937, *Petroleum products — Determination of water — Coulometric Karl Fischer titration method*

ISO 13739, *Petroleum products — Procedures for transfer of bunkers to vessels*

ISO 14596, *Petroleum products — Determination of sulfur content — Wavelength-dispersive X-ray fluorescence spectrometry*

ISO 14597, *Petroleum products — Determination of vanadium and nickel content — Wavelength-dispersive X-ray fluorescence spectrometry*

ASTM D664, *Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration*

ASTM D4294, *Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry*

ASTM D6751, *Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels*

ASTM D7963, *Standard Test Method for determination of the contamination level of Fatty Acid Methyl Esters in middle distillate and residual fuels using flow analysis by Fourier-Transform Infrared spectroscopy-rapid screening method*

EN 14214, *Liquid petroleum products — Fatty acid methyl esters (FAME) for use in diesel engines and heating applications — Requirements and test methods*

IP 309, *Diesel and domestic heating fuels — Determination of cold filter plugging point*

IP 470, *Determination of aluminium, silicon, vanadium, nickel, iron, calcium, zinc and sodium in residual fuel oil by ashing, fusion and atomic absorption spectrometry*

IP 500, *Determination of the phosphorus content of residual fuels by ultra-violet spectrometry*

IP 501, *Determination of aluminium, silicon, vanadium, nickel, iron, sodium, calcium, zinc and phosphorus in residual fuel oil by ashing, fusion and inductively coupled plasma emission spectrometry*

IP 570, *Determination of hydrogen sulfide in fuel oils — Rapid liquid phase extraction method*

IP 579, *Liquid petroleum products — Determination of fatty acid methyl ester (FAME) content in middle distillates — Infrared spectrometry method*

IP 612,*Diesel and domestic heating fuels — Determination of cold filter plugging point Linear cooling bath method — Linear cooling bath method*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Application and sampling

This document specifies the required properties for fuels at the time and place of custody transfer. Samples for quality verification may be taken in any location agreed between the parties.

The sampling of fuels for analysis shall be carried out in accordance with the procedures given in ISO 13739 or an equivalent national standard. Where specific sampling requirements are documented in the referenced test methods, these shall be adhered to.

5 General requirements

5.1 The fuel as supplied shall be homogeneous and conform to the characteristics and limits given in Table 1 or Table 2, as appropriate, when tested in accordance with the methods specified.

The fuel composition shall consist predominantly of hydrocarbons primarily derived from petroleum sources while it may also contain hydrocarbons from the following:

— synthetic or renewable sources such as Hydrotreated Vegetable Oil (HVO), Gas to Liquid (GTL) or Biomass to Liquid (BTL);

— co-processing of renewable feedstock at refineries with petroleum feedstock.

The DF grades, as defined in ISO 8216, include up to 7,0 volume % FAME (see Table 1), where FAME at the time of blending shall be in accordance with the requirements of EN 14214 or ASTM D6751.

DMX shall be free of FAME.

The DMA, DMZ, DMB and RM grades shall not include FAME other than a "*de minimis*" level. In the context of this document, "*de minimis*" means an amount that does not render the fuel unacceptable for use in marine applications that are not designed or suited to handling fuels containing FAME.

NOTE See Annex A for more details on the level and impacts of FAME.

5.2 The fuel shall be free from any material at a concentration that causes the fuel to be unacceptable for use in accordance with Clause 1 (i.e. material not at a concentration that is harmful to personnel, jeopardizes the safety of the ship, or adversely affects the performance of the machinery).

NOTE See Annex B.

5.3 Subject to the requirements of 5.1 and 5.2, additives that improve some aspects of the fuel's characteristics or performance are permitted.

6 Test methods

6.1 Density

In case of disagreement concerning density, all parties shall agree, prior to additional testing, upon the test method to be used.

6.2 CCAI

Calculated carbon aromaticity index (CCAI) shall be as specified in Table 2.

The CCAI value is calculated in accordance with Lewis, et al.[7], using Formula (1):

$$\mathrm{CCAI} = \rho_{15} - 81 - 141 \cdot \lg\left[\lg\left(v + 0{,}85\right)\right] - 483 \cdot \lg\frac{T + 273}{323} \tag{1}$$

where

ρ_{15} is the density at 15 °C, expressed in kilograms per cubic metre;

lg is the logarithm to base 10;

v is the kinematic viscosity at temperature T, expressed in millimetres squared per second;

T is the temperature, expressed in degrees Celsius, at which the kinematic viscosity is determined.

Density, ρ_{15}, and viscosity, v, shall be determined according to the test methods specified in Table 2.

NOTE 1 CCAI was originally developed as an indicator of ignition performance, but is included in Table 2 in order to avoid fuels with uncharacteristic density-viscosity relationships (see Annex C).

NOTE 2 For engines and/or applications where the ignition quality is known to be particularly critical, Annex C provides a basis for suppliers and purchasers of residual fuels to agree on tighter ignition quality characteristics.

NOTE 3 For RME 180 and RMK 380, when blending at or close to the maximum density, the CCAI limit restricts the combination of density and viscosity.

6.3 Sulfur

Sulfur test precision for fuels containing FAME has not been established for the test methods ISO 8754 and ISO 14596 at the time of preparing this International Standard. The sulfur test precision for distillate fuels containing FAME has been established for test method ASTM D4294.

The reference test method shall be ISO 8754 for DM and RM grades and ASTM D4294 for DF grades.

In case of disagreement concerning sulfur content, all parties shall agree, prior to additional testing, upon the same sulfur certified reference material.

6.4 Flash point

The flash point for all fuels, except for DMX, is set at 60 °C minimum according to the International Convention for Safety of Life at Sea (SOLAS)[2].

Residual fuels have the potential to produce a flammable atmosphere in a tank headspace, even when stored at a temperature below the measured flash point. Appropriate precautions are necessary, therefore, to ensure the safety of the ship and personnel. Further information and advice on precautionary measures are given in References [8] to[11].

The flash point is not a physical constant, but is dependent on the test method, the apparatus and the procedure used.

The flash point for fuels in Table 1 shall be determined in accordance with ISO 2719, Procedure A. The flash point of fuels in Table 2 shall be determined in accordance with ISO 2719, Procedure B.

6.5 Hydrogen sulfide

The reference test method shall be IP 570, Procedure A.

WARNING — Hydrogen sulfide (H_2S) is a highly toxic gas. Exposure to high vapour concentrations is hazardous and, in extreme cases, can be fatal. It is critical that ship owners, operators and other responsible parties continue to maintain appropriate safety practices designed to protect the crew and others who could be exposed to H_2S; see Annex D.

6.6 Acid number

The fuel shall be free of inorganic acids. The fuel shall be tested in accordance with ASTM D664.

NOTE See Annex E.

6.7 Oxidation stability

The oxidation stability shall be as specified in Table 1.

NOTE 1 The oxidation stability limit takes into account that some refinery processes used to manufacture distillate fuels lead to products that have limited oxidation stability and that bio-derived products, e.g. FAME, can impact the oxidation stability of the fuel.

NOTE 2 See Annex A.

6.8 Total sediment by hot filtration

If the appearance of DMB or DFB is assessed as not clear and bright (see 6.12), the total sediment shall be determined by the test method ISO 10307-1, typically called existent total sediment.

6.9 Total sediment — Aged

Either of the standard procedures for ageing in ISO 10307-2 can be used: accelerated total sediment (TSA) or potential total sediment test (TSP).

The reference test method shall be the potential total sediment test in accordance with ISO 10307-2.

6.10 Fatty acid methyl ester(s) (FAME)

Test method IP 579 is not applicable to RM grades at the time of preparation of this document. Test method ASTM D7963 is applicable to all DM, DF and RM grades.

The reference test method shall be IP 579 for DM and DF grades.

NOTE See Annex A.

6.11 Pour point/cloud point/cold filter plugging point

The purchaser should confirm that the cold flow characteristics (pour point, cloud point, cold filter plugging point) are suitable for the ship's design and intended voyage.

Issues with low temperature operability (i.e. deposition of solidified wax in fuel tanks, fuel lines, centrifuges and filters) can occur with distillate fuels. The pour point requirement as defined in Table 1

cannot guarantee operability for all ships in all climates. Therefore, for winter grades of DMA, DFA, DMZ and DFZ, the cloud point and cold filter plugging point shall be reported.

NOTE More information can be found in the CIMAC guideline for managing cold flow properties of marine fuels[12].

6.12 Appearance/water

For distillate fuels, the appearance of a sample shall be assessed by visual inspection in good light, free from glare and shadow, at a sample temperature between 20 °C and 25 °C.

DMX, DMA, DFA, DMZ and DFZ shall appear clear and bright. It has been reported that in some countries, these grades of fuel are dyed (e.g. black) and not transparent. This affects the compliance with the requirement for clear and bright appearance and, in such circumstances, the water content shall not exceed 200 mg/kg (0,020 mass %), as determined by the Coulometric Karl Fischer titration method in accordance with ISO 12937.

If the appearance of DMB and DFB affords visual inspection and appears clear and bright, then testing for total sediment by hot filtration and for water is not required. If the appearance is not clear and bright, the water content shall be determined by ISO 3733.

6.13 Lubricity

The lubricity shall be as specified in Table 1.

NOTE The lubricity limit is based on the existing requirements for high-speed automotive and heavy-duty industrial diesel engines.

6.14 Vanadium

The reference test method shall be IP 501.

NOTE See Annex F.

6.15 Sodium

The reference test method shall be IP 501.

NOTE See Annex F.

6.16 Aluminium plus silicon

The aluminium plus silicon limits in Table 2 restrict the catalyst fines to levels at which fuel treatment plants onboard (settling tanks, centrifuges and filters), when operated in accordance with both good practice and the manufacturers' operating procedures, are expected to reduce the catalyst fines to an acceptable level at the engine inlet[5][13].

The reference test method shall be IP 501.

6.17 Used lubricating oil (ULO)

The fuel shall be free of ULO. In the context of this document, a fuel shall be considered to contain ULO when combinations of calcium and zinc or calcium and phosphorus are above the specified levels; see Table 2.

The reference test method shall be IP 501.

NOTE See Annex G.

7 Specific energy

The specific energy of marine fuels can be calculated as given in Annex H.

8 Precision and interpretation of test results

The test methods specified in Table 1 and Table 2 all contain a statement of precision (repeatability and reproducibility). The determination of reproducibility for CCAI shall be in accordance with Annex C.

ISO 4259, which covers the use of precision data in the interpretation of test results, shall be used in cases of dispute.

The precision data for the test methods ISO 6245 (ash) and ISO 12205 (oxidation stability) for diesel fuels containing 5,0 volume % FAME were determined by the experts of CEN/TC 19 to be the same as the reported precision data[14].

However, at the time of publication of this document, the precision data determined by the experts of CEN/TC 19 for diesel fuels containing 5,0 volume % FAME for the test method ISO 3104 were as follows:

Property	Test method	Unit	Precision for 5,0 volume % FAME blend
Viscosity at 40 °C	ISO 3104	mm^2/s	$r = 0{,}001\ 1\ X$; $R = 0{,}018\ X$

where r is repeatability and R is reproducibility (see ISO 4259), X is the mean of two results being compared.

It is the technical opinion of the experts of ISO/TC 28/SC 4 that the same precision data for 5,0 volume % FAME can be applied to distillate marine fuels containing up to 7,0 volume % FAME.

NOTE Since all fuel testing is subject to inherent variations, the assessment of fuels as supplied is governed by the provisions of ISO 4259. More information is provided in the CIMAC guideline on the interpretation of marine fuel oil analysis test results[15].

Table 1 — Distillate marine fuels

Characteristics		Unit	Limit	Category ISO-F-							Test method(s) and references
				DMX	DMA	DFA	DMZ	DFZ	DMB	DFB	
Kinematic viscosity at 40 °C		mm^2/s[a]	Max	5,500	6,000		6,000		11,00		ISO 3104
			Min	1,400	2,000		3,000		2,000		
Density at 15 °C		kg/m^3	Max	—	890,0		890,0		900,0		ISO 3675 or ISO 12185; see 6.1
Cetane index			Min	45	40		40		35		ISO 4264
Sulfur[b]		mass %	Max	1,00	1,00		1,00		1,50		ISO 8754 or ISO 14596, ASTM D4294; see 6.3
Flash point		°C	Min	43,0	60,0		60,0		60,0		ISO 2719; see 6.4
Hydrogen sulfide		mg/kg	Max	2,00	2,00		2,00		2,00		IP 570; see 6.5
Acid number		mg KOH/g	Max	0,5	0,5		0,5		0,5		ASTM D664; see 6.6
Total sediment by hot filtration		mass %	Max	—	—		—		0,10[c]		ISO 10307-1; see 6.8
Oxidation stability		g/m^3	Max	25	25		25		25[d]		ISO 12205
Fatty acid methyl ester (FAME)[e]		volume %	Max	—	—	7,0	—	7,0	—	7,0	ASTM D7963 or IP 579; see 6.10
Carbon residue – Micro method on the 10 % volume distillation residue		mass %	Max	0,30	0,30		0,30		—		ISO 10370
Carbon residue – Micro method		mass %	Max	—	—		—		0,30		ISO 10370
Cloud point[f]	winter	°C	Max	-16	report		report		—		ISO 3015; see 6.11
	summer	°C	Max	-16	—		—		—		
Cold filter plugging point[f]	winter	°C	Max	—	report		report		—		IP 309 or IP 612; see 6.11
	summer	°C	Max	—	—		—		—		

[a] mm^2/s = 1 cSt.

[b] Notwithstanding the limits given, the purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See Introduction.

[c] If the sample is not clear and bright, the total sediment by hot filtration and water tests shall be required. See 6.8 and 6.12.

[d] If the sample is not clear and bright, the test cannot be undertaken and therefore, compliance with this limit cannot be shown.

[e] See 5.1 and Annex A.

[f] Pour point cannot guarantee operability for all ships in all climates. The purchaser should confirm that the cold flow characteristics (pour point, cloud point, cold filter plugging point) are suitable for the ship's design and intended voyage. See 6.11.

[g] If the sample is dyed and not transparent, then the water limit and test method as given in 6.12 shall apply.

[h] This requirement is applicable to fuels with a sulfur content below 500 mg/kg (0,050 mass %).

Table 1 *(continued)*

Characteristics		Unit	Limit	Category ISO-F-							Test method(s) and references
				DMX	DMA	DFA	DMZ	DFZ	DMB	DFB	
Pour point (upper)[f]	winter	°C	Max	—	−6		−6		0		ISO 3016; see 6.11
	summer	°C	Max	—	0		0		6		
Appearance				Clear & Bright[g]					[c]		see 6.12
Water		volume %	Max	—	—		—		0,30[c]		ISO 3733
Ash		mass %	Max	0,010	0,010		0,010		0,010		ISO 6245
Lubricity, corrected wear scar diameter (WSD) at 60 °C[h]		µm	Max	520	520		520		520[d]		ISO 12156-1

a $mm^2/s = 1$ cSt.

b Notwithstanding the limits given, the purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See Introduction.

c If the sample is not clear and bright, the total sediment by hot filtration and water tests shall be required. See 6.8 and 6.12.

d If the sample is not clear and bright, the test cannot be undertaken and therefore, compliance with this limit cannot be shown.

e See 5.1 and Annex A.

f Pour point cannot guarantee operability for all ships in all climates. The purchaser should confirm that the cold flow characteristics (pour point, cloud point, cold filter plugging point) are suitable for the ship's design and intended voyage. See 6.11.

g If the sample is dyed and not transparent, then the water limit and test method as given in 6.12 shall apply.

h This requirement is applicable to fuels with a sulfur content below 500 mg/kg (0,050 mass %).

Table 2 — Residual marine fuels

Characteristics		Unit	Limit	Category ISO-F-											Test method(s) and references
				RMA	RMB	RMD	RME	RMG				RMK			
				10	30	80	180	180	380	500	700	380	500	700	
Kinematic viscosity at 50 °C		mm^2/s[a]	Max	10,00	30,00	80,00	180,0	180,0	380,0	500,0	700,0	380,0	500,0	700,0	ISO 3104
Density at 15 °C		kg/m^3	Max	920,0	960,0	975,0	991,0	991,0				1010,0			ISO 3675 or ISO 12185; see 6.1
CCAI			Max	850	860	860	860	870				870			See 6.2
Sulfur[b]		mass %	Max	Statutory requirements											ISO 8754 or ISO 14596 or ASTM D4294; see 6.3
Flash point		°C	Min	60,0	60,0	60,0	60,0	60,0				60,0			ISO 2719; see 6.4
Hydrogen sulfide		mg/kg	Max	2,00	2,00	2,00	2,00	2,00				2,00			IP 570; see 6.5
Acid number[c]		mg KOH/g	Max	2,5	2,5	2,5	2,5	2,5				2,5			ASTM D664; see 6.6
Total sediment – Aged		mass %	Max	0,10	0,10	0,10	0,10	0,10				0,10			ISO 10307-2; see 6.9
Carbon residue – Micro method		mass %	Max	2,50	10,00	14,00	15,00	18,00				20,00			ISO 10370
Pour point (upper)[d]	winter	°C	Max	0	0	30	30	30				30			ISO 3016
	summer	°C	Max	6	6	30	30	30				30			
Water		volume %	Max	0,30	0,50	0,50	0,50	0,50				0,50			ISO 3733
Ash		mass %	Max	0,040	0,070	0,070	0,070	0,100				0,150			ISO 6245
Vanadium		mg/kg	Max	50	150	150	150	350				450			IP 501, IP 470 or ISO 14597; see 6.14

[a] $1\ mm^2/s = 1$ cSt.

[b] The purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See Introduction.

[c] See Annex E.

[d] The purchaser should confirm that this pour point is suitable for the ship's intended area of operation.

Table 2 *(continued)*

Characteristics	Unit	Limit	Category ISO-F-											Test method(s) and references
			RMA	RMB	RMD	RME	RMG				RMK			
			10	30	80	180	180	380	500	700	380	500	700	
Sodium	mg/kg	Max	50	100	100	50	100				100			IP 501, IP 470; see 6.15
Aluminium plus silicon	mg/kg	Max	25	40	40	50	60				60			IP 501, IP 470 or ISO 10478; see 6.16
Used lubricating oil (ULO): Calcium and zinc or Calcium and phosphorus	mg/kg		Calcium >30 and zinc >15 or Calcium >30 and phosphorus >15											IP 501 or IP 470, IP 500; see 6.17

[a] 1 mm^2/s = 1 cSt.

[b] The purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See Introduction.

[c] See Annex E.

[d] The purchaser should confirm that this pour point is suitable for the ship's intended area of operation.

Annex A
(informative)

Bio-derived products including fatty acid methyl esters

A.1 Bio-fuels and blends

Bio-derived fuels and blends of bio-derived fuels with petroleum products are included within the range of potential alternative energy sources being considered by some sections of marine industry since they are renewable and can result in reduced greenhouse gases (GHGs) and sulphur emissions (SO_x).

The bulk of bio-derived fuels currently available are the products of a transesterification process that removes the glyceride fraction to produce fatty acid methyl ester(s) (FAME), also referred to as bio-diesel. Bio-diesels can also contain fatty acid ethyl ester(s) (FAEE), for which, at the time of preparing this document, test methods and specifications are being developed.

In 2010, due to limited experience with the use of FAME blends in the marine sector, ISO 8217 was modified to require marine fuels to contain no more than a "*de minimis*" level, which for distillate fuel was indicated at that time as approximately 0,1 volume % FAME. The practice of blending FAME into conventional diesel and heating oils makes it almost inevitable, under current supply logistics, that some distillate fuels supplied in the marine market can contain FAME. Even some residual fuels can contain FAME as a result of cross contamination or blending with a distillate cutter stock containing FAME.

Since 2010, additional information has become available on the use of biodiesel in conventional automotive diesel fuel as well as on the use of distillate fuels containing biodiesel on-board ships. In the light of this experience, this edition of this document retains the general "*de minimis*" level requirement, but with a wider tolerance as given below and also includes additional specifications (DF grades) for distillate marine fuels containing up to 7,0 volume % FAME. The FAME used for blending shall meet specification requirements of EN 14214 or ASTM D6751.

The increase in demand for marine fuels with sulfur content limited to no more than 0,10 mass % as a result of regulatory requirements, may partially be met by supplying distillate fuel which may contain up to 7,0 volume % FAME.

NOTE In some countries, legislation mandates that distillate fuels shall contain bio-derived products, which may result in FAME levels exceeding 7,0 volume %.

For the purpose of this document, DMX shall be free of FAME and, with exception of DF grades, fuel producers and suppliers should ensure that

— there is no deliberate blending of FAME into the fuel,

— adequate controls are in place so that the resultant fuel, as delivered, does not exceed the "*de minimis*" which is now taken to be a level of approximately 0,5 volume % FAME, and

— the fuel is compliant with the requirements of Clause 5.

To determine the FAME content of DM grades, test methods IP 579 or ASTM D7963 can be used, except IP 579 cannot be used for DMB when it is not clear and bright. For DMB (not clear and bright) and RM grades test method, ASTM D7963 should be used.

A.2 Storage and handling of DF grade marine fuels

The International Council on Combustion Engines (CIMAC) has developed guidelines on managing distillate marine fuels containing up to 7,0 volume % FAME[16].

Notwithstanding that FAME has good ignition and lubricity properties together with perceived environmental benefits, there are potentially specific complications with respect to the storage and handling of distillates with a FAME component in a marine environment, such as

— a tendency to oxidation and long-term storage issues,

— an affinity to water and risk of microbial growth,

— degraded low-temperature flow properties, and

— FAME material deposition on exposed surfaces, including filter elements.

Additionally, there is a variety of differently sourced FAME products, each with its own particular characteristics suitable for the climate of the supply location. This may have implications with respect to storage, handling, treatment and engine operations.

In those instances where the use of fuels containing FAME is being contemplated, it should be ensured that the ship's storage, handling, treatment, service and machinery systems, together with any other machinery components (such as oily-water separator systems), are in terms of materials and operational performance compatible with such a product. Contact of materials such as bronze, brass, copper, lead, tin and zinc with FAME should be avoided as these may oxidize FAME thereby creating sediments.

Annex B
(informative)

Deleterious materials

This document precludes the incorporation of any material at a concentration that causes the fuel to be unacceptable for use as stipulated in Clause 5.

Identifying and determining the concentration of a material that causes the fuel to be unacceptable for use can be difficult given that

a) each fuel is a unique, complex blend of hydrocarbon species,

b) a wide range of materials from different sources can enter the marine supply chain from the production, handling and transport systems,

c) various analytical techniques are used to detect specific chemical species with no standardized approach, and

d) in most cases, sufficient data are not available with respect to the effects of any one specific material, or combinations thereof, on the variety of marine machinery systems in service, on personnel or on the environment.

It is therefore not practical to require detailed chemical analysis for each delivery of fuels beyond the requirements listed in Table 1 or Table 2. Instead, a refinery, fuel terminal or any other supply facility, including supply barges and truck deliveries, should have in place adequate quality assurance and management of change procedures to ensure that the resultant fuel is compliant with the requirements of Clause 5.

NOTE The marine industry continues to build on its understanding of the impact of specific chemical species and the respective critical concentrations at which detrimental effects are observed on the operational characteristics of marine fuels in use.

Annex C
(informative)

Ignition characteristics of residual marine fuels

C.1 Application

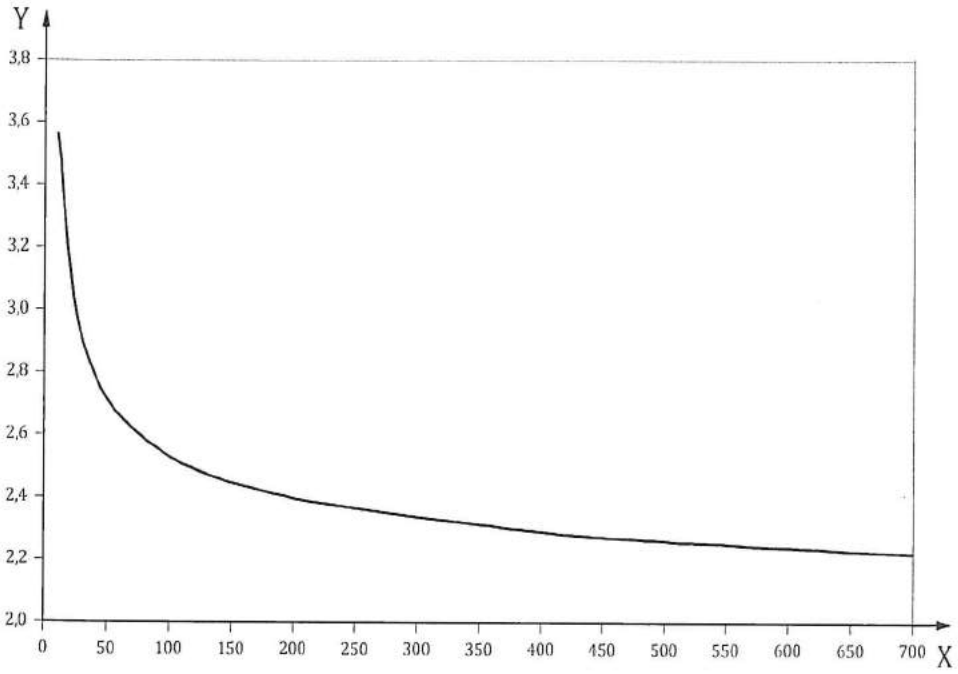
A diesel engine's sensitivity to a fuel's ignition characteristics depends not only on the fuel's chemical composition but also the particular engine type and design together with its maintenance and operating conditions. Where the same fuel is to be used for both main and auxiliary engines, the requirements of those engines with the least tolerance towards poor ignition characteristics should be considered when ordering residual fuels.

C.2 Calculated carbon aromaticity index

The calculated carbon aromaticity index (CCAI) was developed as an indicator of the ignition performance of residual fuels and is determined from the density and viscosity values. CCAI is primarily included in Table 2 to avoid residual fuels with uncharacteristic density-viscosity relationships.

The reproducibility of the CCAI value of a particular residual fuel is dependent on the reproducibility, R, of the density and viscosity values from which that CCAI value has been calculated. The interaction of these CCAI factors is such that the highest positive CCAI reproducibility is achieved when the reproducibility for density is added to the density value and the reproducibility for viscosity is subtracted from the viscosity value.

The curve of CCAI reproducibility plotted against viscosity is given in Figure C.1. The reproducibility of density is a constant (independent of the density value) and, therefore, the CCAI reproducibility varies only with the viscosity of the fuel.



Key

X viscosity at 50 °C, expressed in millimetres squared per second

Y CCAI reproducibility

Figure C.1 — Plot of CCAI reproducibility against viscosity

C.3 IP 541 ignition and combustion test method

It has been recognized that fuels with similar densities and viscosities (i.e. similar CCAIs) can have significantly different ignition and combustion properties. Consequently, in order to address both ignition and combustion characteristics of a residual fuel, a standard test method, commonly known as FIA-100FCA, has been established using a constant volume combustion chamber (CVCC); see IP 541[17]. The International Council on Combustion Engines (CIMAC) has developed a guideline regarding fuel ignition and combustion quality for diesel engines[18].

Annex D
(informative)

Hydrogen sulfide

Hydrogen sulfide (H_2S) is a highly toxic gas. Exposure to high vapour concentrations is hazardous and in extreme cases, can be fatal. At very low concentrations, the gas has the characteristic smell of rotten eggs. However, at higher concentrations, it causes a loss of smell, headaches and dizziness and at very high concentrations, is immediately fatal.

H_2S can be formed during the refining process and may evolve from the fuels in storage tanks, in product barges and customer tanks. H_2S can be present in both liquid and vapour phase and the degree and speed of partitioning between the liquid and vapour phase depends on several factors, e.g. the fuel chemistry, temperature, viscosity, level of agitation, storage time, heating applied, ambient conditions, tank shape, ullage and venting.

Contact with H_2S vapours can occur when personnel are exposed to fuel vapours, such as when dipping tanks, when opening tank hatch covers, when entering empty tanks, from vent pipes when tanks are being filled and/or heated, in purifier rooms, when opening up fuel lines and during filter changing operations.

The risks are highlighted in material safety data sheets (MSDSs) and the dangers presented to health and exposure guidelines are documented. A useful reference guidance is provided in ISGOTT, section 2.3.6[8]. There are many other sources of information regarding H_2S, but few are marine specific.

The liquid-phase limit, introduced in the fourth edition of this document, of 2,00 mg/kg, was included to provide an improved margin of safety over the previous edition and reduces the risk of H_2S vapour exposure. This limit alone does not constitute a safe level or eliminate the operational risk of concentrations of H_2S being present in enclosed spaces and it is critical that ship owners and operators continue to maintain appropriate safety processes and procedures designed to protect the crew and others (e.g. surveyors), who could be exposed to H_2S vapour.

NOTE More information on issues associated with H_2S in marine fuels can be found in the CONCAWE report no. 8/13[19].

Annex E
(informative)

Acidity

Fuels with high acid number test results arising from acidic compounds occasionally cause accelerated damage to marine diesel engines. Such damage is found primarily within the fuel injection equipment.

Testing fuels for acid number (AN; formerly known as total acid number or TAN) by ASTM D664 can give indications as to the likely presence of acidic compounds. Although all fuels have a naturally occurring, measurable acid number, these are generally (but not always) less than 0,5 mg KOH/g for distillate fuels and generally (but not always) less than 2,5 mg KOH/g for residual fuels.

However, fuels manufactured from naphthenic crudes can have an acid number that, while greater than those stated in Table 1 or Table 2, is acceptable for use. Confirmation that a fuel was manufactured from naphthenic crudes can be established by non-standard, specialized detailed analysis. In such circumstances, it is the responsibility of the supplier and the purchaser to agree on an acceptable acid number.

Acid number levels significantly higher than those stated above can indicate significant amounts of acidic compounds and, possibly, other contaminants. However, acid numbers below the values stated above do not guarantee that the fuel is free from problems associated with the presence of acidic compounds. There is no currently recognized correlation between an acid number test result and the corrosive activity of a fuel.

Notwithstanding that an acid number limit is given, the fuel shall be free from inorganic acids (strong acids). A fuel in which a strong acid species [strong acid number (SAN)] is present, even at a low level below the reporting limit of ASTM D664 test method, is not compliant with this document as there is a correlation between the presence of a strong acid and the corrosive activity of a fuel.

Annex F
(informative)

Ash

All residual fuels contain some metallic species, either those that are naturally present from the crude oil feedstock used such as vanadium, sodium, calcium and nickel, or those introduced primarily from external sources such as sodium, aluminium, silicon, potassium and iron. When a fuel is combusted, some of these metals are converted into solid particles of oxides, sulfates or more complex compounds, collectively known as ash. At certain temperatures, these solid ash particles become partly fluid and, in this state, can adhere to components in a combustion system if the component surface temperatures are high enough. These adhering ash deposits can cause damage to components (piston crowns, exhaust valves, turbocharger blade surfaces in diesel engines and the waterwall, superheater and reheater tube surfaces of boilers), either by a process termed "hot corrosion" or by other mechanisms. The temperature at which the ash particles start to become fluid and to stick to surfaces, often referred to as the "stiction" temperature, is lowest for ashes that are rich in vanadium and/or sodium. It is for this reason that particular attention is paid to the amounts of these metals in fuels.

A sodium/vanadium ratio of 1:3 is generally claimed to yield the lowest ash-melting temperature. The 1:3 sodium/vanadium ratio assumes increasing importance as the vanadium content of the fuel rises (typically above 150 mg/kg) because the ash becomes increasingly vanadium-rich. While vanadium levels in some residual fuels can extend up to 450 mg/kg, other metals do not usually reach such levels and, therefore, their influence on "stiction" temperatures is limited. Also, at high vanadium levels, the total ash burden is greater, thus exacerbating any problems that can arise due to ash deposition. The International Council on Combustion Engines (CIMAC) has produced a detailed document "recommendations regarding fuel quality for diesel engines (21/2003)"[20], Annex 7 of which provides an in-depth review of this subject.

Annex G
(informative)

Used lubricating oil

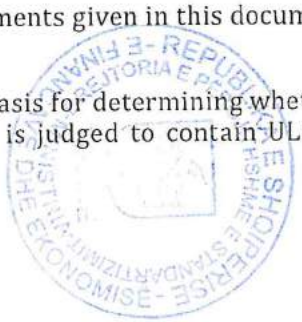
The addition of used lubricating oil (ULO) as a fuel blend component collected from inland sources (e.g. spent motor vehicle crankcase oils), with no or inadequate environmental regulations and controls, can provide a route for waste materials to enter the residual fuel pool.

Potentially, ULO is quite a variable material, but it is comprised predominantly of used vehicle crankcase oils which contain significant amounts of detergent and anti-wear additives. Detergent additives are based mainly on calcium. While the anti-wear additives are usually zinc-phosphorus compounds, some are zinc-free. Therefore, the principle used in setting limits for this document is that the residual fuel is considered to contain ULO if either of the two groups of elements, calcium and zinc or calcium and phosphorus, are above the limits specified in Table 2.

Limits for the selected elements of zinc, phosphorus and calcium have been set at levels that are as low as possible, taking into account both the background levels of these elements in residual fuel free from ULO and the reproducibility of the test methods. It is, therefore, not possible to set a zero upper limit on these "fingerprint" elements.

On the basis of extensive statistical reports, the combination of these elements given in this document would not trigger the incorrect identification of ULO.

The limits on zinc, phosphorus and calcium given in Table 2 serve as the basis for determining whether or not a fuel meets the specification, but do not imply that a fuel that is judged to contain ULO is necessarily unsuitable for use.



Annex H
(informative)

Specific energy

Specific energy is not controlled in the manufacture of fuel except in a secondary manner by the specification of other properties.

For residual fuels, net specific energy, Q_{Rnp}, and gross specific energy, Q_{Rgv}, both expressed in megajoules per kilogram, can be calculated with a degree of accuracy acceptable for normal purposes from Formulae (H.1) and (H.2)[21], respectively:

$$Q_{Rnp} = \left(46{,}704 - 8{,}802\rho_{15}{}^{2} \cdot 10^{-6} + 3{,}167\rho_{15} \cdot 10^{-3}\right) \cdot \left[1 - 0{,}01\left(w_w + w_a + w_s\right)\right] + 0{,}094\ 2w_s - 0{,}024\ 49w_w \quad \text{(H.1)}$$

$$Q_{Rgv} = \left(52{,}190 - 8{,}802\rho_{15}{}^{2} \cdot 10^{-6}\right) \cdot \left[1 - 0{,}01\left(w_w + w_a + w_s\right)\right] + 0{,}094\ 2w_s \quad \text{(H.2)}$$

where

ρ_{15} is the density at 15 °C, expressed in kilograms per cubic metre;

w_w is the water content, expressed as a mass percentage;

w_a is the ash content, expressed as a mass percentage;

w_s is the sulfur content, expressed as a mass percentage.

For distillate fuels, net specific energy, Q_{Dnp}, and gross specific energy, Q_{Dgv}, both expressed in megajoules per kilogram, can be calculated with a degree of accuracy acceptable for normal purposes from Formulae (H.3) and (H.4), respectively:

$$Q_{Dnp} = \left(46{,}423 - 8{,}792\rho_{15}{}^{2} \cdot 10^{-6} + 3{,}170\rho_{15} \cdot 10^{-3}\right) \cdot \left[1 - 0{,}01\left(w_w + w_a + w_s\right)\right] + 0{,}094\ 2w_s - 0{,}024\ 49w_w \quad \text{(H.3)}$$

$$Q_{Dgv} = \left(51{,}916 - 8{,}792\rho_{15}{}^{2} \cdot 10^{-6}\right) \cdot \left[1 - 0{,}01\left(w_w + w_a + w_s\right)\right] + 0{,}094\ 2w_s \quad \text{(H.4)}$$

where

ρ_{15} is the density at 15 °C, expressed in kilograms per cubic metre;

w_w is the water content, expressed as a mass percentage;

w_a is the ash content, expressed as a mass percentage;

w_s is the sulfur content, expressed as a mass percentage.

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