BS EN 16709:2015

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Automotive fuels — High FAME diesel fuel (B20 and B30) — Requirements and test methods

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PTI/2, Liquid Fuels.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2015

ISBN 978 0 580 85146 9

ICS 75.160.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2015.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16709

October 2015

ICS 75.160.20

English Version

Automotive fuels - High FAME diesel fuel (B20 and B30) - Requirements and test methods

Carburants pour automobiles - Carburant diesel à haute teneur en EMAG (B20 et B30) - Exigences et méthodes d'essai

Kraftstoffe für Kraftfahrzeuge - Dieselkraftstoffmischungen mit hohem FAME-Anteil (B20 und B30) - Anforderungen und Prüfverfahren

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EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16709:2015 E

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European foreword

This document (EN 16709:2015) has been prepared by Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2016, and conflicting national standards shall be withdrawn at the latest by April 2016.

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 is related to the European Fuels Directive 98/70/EC including amendments 2003/17/EC, 2009/30/EC and 2011/63/EU [1, 2, 3 and 4] and the requirements therein are connected to requirements in this standard.

This document describes two fuel grades in the range of (14 – 20) % (*V/V*) and (24 – 30) % (*V/V*) of fatty acid methyl ester (FAME) in diesel fuel to be used in captive fleet application for designated vehicles[1)], as it is not suitable for all vehicles.

Information on the development of this fuel specification can be found in CEN/TR 16557 [5].

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

[1)] In the sense that they are compatible with the product.

1 Scope

This European Standard specifies requirements and test methods for marketed and delivered high FAME (B20 and B30) diesel fuel for use in diesel engine vehicles designed or subsequently adapted to run on high FAME (B20 and B30) fuel. High FAME (B20 and B30) diesel fuel is a mixture of up to 20 % (*V/V*) in total and up to 30 % (*V/V*) in total respectively fatty acid methyl esters (commonly known as FAME) complying to EN 14214 and automotive diesel fuel complying to EN 590.

For maintenance and control reasons high FAME (B20 and B30) diesel fuel is to be used in captive fleets that are intended to have an appropriate fuel management (see Clause 3).

NOTE 1 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.

NOTE 2 In this European Standard, A-deviations apply (see Annex A).

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 12916:2006[2], *Petroleum products — Determination of aromatic hydrocarbon types in middle distillates — High performance liquid chromatography method with refractive index detection*

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

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*

2) Under revision.

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

EN ISO 2719:2002[2)], *Determination of flash point — Pensky-Martens closed cup method (ISO 2719:2002)*

EN ISO 3104:1996, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity (ISO 3104:1994)*

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

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

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

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

EN ISO 3924:2010[2)], *Petroleum products — Determination of boiling range distribution — Gas chromatography method (ISO 3924:2010)*

EN ISO 4259:2006[2)], *Petroleum products — Determination and application of precision data in relation to methods of test (ISO 4259:2006)*

EN ISO 5165:1998[2)], *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)*

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

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)*

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 Captive fleet application

This European Standard is intended to cover fuels for use in captive fleet application for designated vehicles. Captive fleet is defined as a group of vehicles that use dedicated facilities and logistics for supply and storage of their fuel only accessible for them. The vehicles shall receive adequate maintenance as part of an organization or group agreement with the vehicle supplier(s).

NOTE 1 The fleet is usually operated by a single organization, but might also be operated by a consortium of professional vehicle owners.

NOTE 2 The fact that they are dedicated implies that fuel facilities are clearly identified as differing from public fuel facilities, by separate placement, and to which accessibility is limited to only captive fleet users.

4 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.

5 Pump marking

Information to be marked on dispensing pumps used for delivering high FAME (B20 and B30) diesel fuel, and the dimensions of the mark shall be in accordance with the requirements of national standards or regulations for the marking of pumps for automotive fuel. Such requirements shall be set out in detail or shall be referred to by reference in a National Annex to this European Standard.

Labelling shall be clearly visible, easily legible and displayed at any point where high FAME (B20 and B30) diesel fuel 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.

Should pump marking for high FAME (B20 and B30) diesel fuel be necessary for distinction to avoid misfuelling, it is recommended to use easily recognized visual symbols that

a) identify that the diesel fuel has a fatty acid methyl ester (FAME) content greater than and including 14 % (*V/V*) and less than and including 20 % (*V/V*), in this case the recommended symbol is “B20”, or

b) identify that the diesel fuel has a fatty acid methyl ester (FAME) content greater than and including 24 % (*V/V*), and less than and including 30 %(*V/V*), in this case the recommended symbol is “B30”.

6 Requirements and test methods

6.1 Dyes and markers

The use of dyes or markers is allowed.

6.2 Additives

6.2.1 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.

6.2.2 Methylcyclopentadienyl manganese tricarbonyl (MMT)

When methylcyclopentadienyl manganese tricarbonyl (MMT) is used, a specific labelling is required (see also Clause 5).

MMT is a metallic additive that can be used in automotive fuels, but whose presence is limited since 1 January 2011[4].

6.3 Fatty acid methyl ester (FAME)

High FAME (B20 and B30) fuel may contain from 14,0 %(*V/V*) up to 20,0 %(*V/V*) or from 24,0 %(*V/V*) up to 30,0 % (*V/V*) of FAME complying with EN 14214, in which case the climate-dependent requirements set out in EN 14214:2012+A1:2014, 5.4.2 do not apply.

Climate dependent requirements for FAME as a blending component for use in high FAME (B20 and B30) fuel according to this document are set out in EN 14214:2012+A1:2014, 5.4.3. 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 high FAME (B20 and B30) fuel shall also comply with the climate dependent requirements set out in 6.6.

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 high FAME (B20 and B30) fuel.

NOTE Cold flow requirements for FAME as a blend component in high FAME (B20 and B30) fuel are set out in Tables 3a and 3b and the National Annex of EN 14214:2012+A1:2014, in order to control maximum content of saturated monoglycerides in the final high FAME (B20 and B30) diesel fuel to ensure trouble-free operation. Work is ongoing to identify a suitable test method for saturated monoglycerides or a performance test to control this aspect of low temperature performance.

6.4 Other (bio-) components

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.

When the percentages of biofuels, blended in mineral oil derivatives, exceed 10 % by volume, this shall be indicated at the sales points in EU Member States (see Directive 2009/28/EC [6]).

NOTE A draft fuel specification for paraffinic diesel fuel has been developed [7].

6.5 Generally applicable requirements and related test methods

6.5.1 When tested by the methods indicated in Table 1 and Table 2, high FAME (B20) diesel fuel shall be in accordance with the limits specified in Table 1 and high FAME (B30) diesel fuel shall be in accordance with the limits specified in Table 2. The test methods listed in Table 1 and Table 2 have been assessed for application to automotive diesel containing FAME.

6.5.2 High FAME (B20 and B30) diesel fuel shall be free from any adulterant or contaminant that may render the fuel unacceptable for use in diesel engine vehicles.

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 [8] or CEN/TR 15367–3 [9] respectively.

Table 1 — Generally applicable requirements and test methods for high FAME (B20) fuel

Property	Unit	Limits		Test method [a]
		minimum	maximum	(See Clause 2)
Fatty acid methyl ester (FAME) content [b]	% (*V/V*)	14,0	20,0	EN 14078
Cetane number		51,0	–	EN ISO 5165 [c] EN 15195 EN 16144
Density at 15 °C	kg/m^3	820,0	860,0 [d]	EN ISO 3675 [e] EN ISO 12185
Flash point	°C	Above 55,0	–	EN ISO 2719
Viscosity at 40 °C	mm^2/s	2,000	4,620	EN ISO 3104
Sulfur content	mg/kg	–	10,0	EN ISO 13032 [f] EN ISO 20846 EN ISO 20884
Manganese content [g]	mg/l	-	2,0	EN 16576
Polycyclic aromatic hydrocarbons [h]	% (*m/m*)	–	8,0	EN 12916
Ash content	% (*m/m*)	–	0,010	EN ISO 6245
Water content	mg/kg	–	260	EN ISO 12937
Total contamination [i]	mg/kg	–	24	EN 12662
Oxidation stability	h	20,0	-	EN 15751
Distillation [j] % (*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 [k] EN ISO 3924

[a] See also 6.7.1.

[b] FAME shall meet the requirements of EN 14214, see 6.3.

[c] See also 6.7.4.

[d] The limit in the Fuels Quality Directive [1, 2, 3 and 4] for diesel type fuels is 845,0 kg/m^3.

[e] See also 6.7.2.

[f] See also 6.7.3.

[g] See also 6.2.2.

[h] 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.

[i] If the sample fails to filter within 30 min the test result shall be reported as a failure to meet specification. Further investigation into the total contamination test method to improve the precision, particularly in the presence of FAME, is being carried out by CEN.

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

[k] EN ISO 3924 gives instructions to convert to ISO 3405-equivalent data. See also 6.7.5.

Table 2 — Generally applicable requirements and test methods for high FAME (B30) fuel

Property	Unit	Limits		Test method [a]
		minimum	maximum	(See Clause 2)
Fatty acid methyl ester (FAME) content [b]	% (*V/V*)	24,0	30,0	EN 14078
Cetane number		51,0	–	EN ISO 5165 [c] EN 15195 EN 16144
Density at 15 °C	kg/m^3	825,0	865,0 [d]	EN ISO 3675 [e] EN ISO 12185
Flash point	°C	Above 55,0	–	EN ISO 2719
Viscosity at 40 °C	mm^2/s	2,000	4,650	EN ISO 3104
Sulfur content	mg/kg	–	10,0	EN ISO 13032 [f] EN ISO 20846 EN ISO 20884
Manganese content [g]	mg/l	-	2,0	EN 16576
Polycyclic aromatic hydrocarbons [h]	% (*m/m*)	–	8,0	EN 12916
Ash content	% (*m/m*)	–	0,010	EN ISO 6245
Water content	mg/kg	–	290	EN ISO 12937
Total contamination [i]	mg/kg	–	24	EN 12662
Oxidation stability	h	20,0	-	EN 15751
Distillation [j] % (*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 [k] EN ISO 3924

[a] See also 6.7.1.

[b] FAME shall meet the requirements of EN 14214, see 6.3.

[c] See also 6.7.4.

[d] The limit in the Fuels Quality Directive [1, 2, 3 and 4] for diesel type fuels is 845,0 kg/m^3.

[e] See also 6.7.2.

[f] See also 6.7.3.

[g] See also 6.2.2.

[h] 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.

[i] If the sample fails to filter within 30 min the test result shall be reported as a failure to meet specification. Further investigation into the total contamination test method to improve the precision, particularly in the presence of FAME, is being carried out by CEN.

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

[k] EN ISO 3924 gives instructions to convert to ISO 3405-equivalent data. See also 6.7.5.

6.6 Climate dependent requirements and related test methods

6.6.1 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 3 (temperate climates) and Table 4 (arctic or severe winter climates). When tested by the methods given in Table 3 and Table 4, high FAME (B20 and B30) diesel fuel shall be in accordance with the limits specified in these tables.

NOTE For more detail on cold operability testing and fuel performance correlation in the European market see CEN/TR 16884 [10].

6.6.2 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.

Table 3 — Climate-related requirements and test methods - Temperate climates

Property	**Unit**	**Limits**						**Test method** [a]
		Grade A	**Grade B**	**Grade C**	**Grade D**	**Grade E**	**Grade F**	(See Clause 2)
CFPP	°C, max.	+5	0	−5	−10	−15	−20	EN 116 [b] EN 16329
[a] See also 6.7.1. [b] See 6.7.6.								

6.7 Precision and dispute

6.7.1 All test methods referred to in this European Standard have been found applicable to high FAME (B20 and B30) diesel fuel. In case the scope of the test method does not mention this, the precision statement given in the test method normally applies. 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.

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

6.7.3 In cases of dispute concerning sulfur content, EN ISO 20846 shall be used.

6.7.4 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, Table 2 and Table 4 may also be used, provided that these methods originate from a recognized 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.

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

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

Table 4 — 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.	805,0 850,0	805,0 850,0	805,0 845,0	805,0 845,0	805,0 845,0	EN ISO 3675 [c] EN ISO 12185
Viscosity at 40 °C	mm²/s, min. mm²/s, max.	1,780 4,000	1,780 4,000	1,780 4,000	1,690 4,000	1,520 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
Distillation [g, h]							EN ISO 3405 [i]
recovered at 180 °C	% (*V*/*V*), max.	10,0	10,0	10,0	10,0	10,0	EN ISO 3924
recovered at 340 °C	% (*V*/*V*), min.	95,0	95,0	95,0	95,0	95,0	

[a] See also 6.6.1.

[b] See also 6.7.6.

[c] See also 6.7.2.

[d] See also 6.7.4.

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

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

[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] EN ISO 3924 gives instructions to convert to ISO 3405-equivalent data. See also 6.7.5.

Annex A
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC national member.

Notwithstanding that under Directive 2009/30, EU Member States may permit the placing on the market of diesel with a fatty acid methyl ester (FAME) content greater than 7 %, national legislation may prohibit bringing on the regular market of diesel fuel other than specified in EN 590 'Automotive fuels-Diesel-Requirements and test methods' or diesel with a FAME percentage above 7 %.

This European Standard describes a diesel fuel containing up to 20,0 % (*V/V*) or 30 % (*V/V*) FAME. This European Standard is intended to cover fuels for use in captive fleet application for designated vehicles.

ln the relevant CEN-CENELEC countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Country	**Deviation**
Sweden	Drivmedelslag (2011:319), FAME blending in diesel fuel marketed and delivered in Sweden is limited to 7 % (*V/V*).

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] CEN/TR 16557:2013, *Automotive fuels — High FAME diesel fuel blends (B11 - B30) — Background to the parameters required and their respective limits and determination*

[6] Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[7] CEN/TS 15940, *Automotive fuels — Paraffinic diesel fuel from synthesis or hydrotreatment — Requirements and test methods*

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

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

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

[11] EN 590, *Automotive fuels — Diesel — Requirements and test methods*

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