

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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English Version

Automotive fuels - Diesel - Requirements and test methods

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

Kraftstoffe für Kraftfahrzeuge - Dieselkraftstoff -
Anforderungen und Prüfverfahren

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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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of an identical text or by endorsement, at the latest by November 2017, and conflicting national standards shall be withdrawn at the latest by November 2017.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).

EN 590:2013+A1:2017 (E)

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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* ^{A1}

EN 12662:2014, *Liquid petroleum products - Determination of total contamination in middle distillates, diesel fuels and fatty acid methyl esters* ^{A1}

EN 12916:2016, *Petroleum products - Determination of aromatic hydrocarbon types in middle distillates - High performance liquid chromatography method with refractive index detection* ^{A1}

EN 14078:2014, *Liquid petroleum products - Determination of fatty acid methyl ester (FAME) content in middle distillates - Infrared spectrometry method* ^{A1}

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* ^{A1}

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* ^{A1}

EN 15751:2014, *Automotive fuels - Fatty acid methyl ester (FAME) fuel and blends with diesel fuel - Determination of oxidation stability by accelerated oxidation method* ^{A1}

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* ^{A1}

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* ^{A1}

EN 16942:2016, *Fuels - Identification of vehicle compatibility - Graphical expression for consumer information* ^{A1}

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



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

A1 EN ISO 2719:2016¹, *Determination of flash point - Pensky-Martens closed cup method (ISO 2719:2016)* **A1**

A1 EN ISO 3104:1996¹, *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 3405:2011¹, *Petroleum products - Determination of distillation characteristics at atmospheric pressure (ISO 3405:2011)* **A1**

A1 EN ISO 3675:1998¹, *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 4259:2006¹, *Petroleum products - Determination and application of precision data in relation to methods of test (ISO 4259:2006)* **A1**

EN ISO 4264:2007², *Petroleum products - Calculation of cetane index of middle-distillate fuels by the four-variable equation (ISO 4264:2007)*

EN ISO 5165:1998¹, *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 12185:1996¹, *Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method (ISO 12185:1996)* **A1**

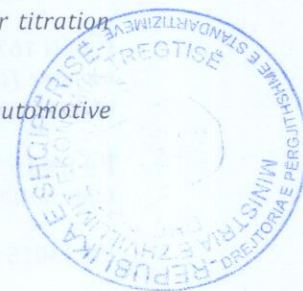
EN ISO 12205:1996, *Petroleum products - Determination of the oxidation stability of middle-distillate fuels (ISO 12205:1995)*

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)*

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.

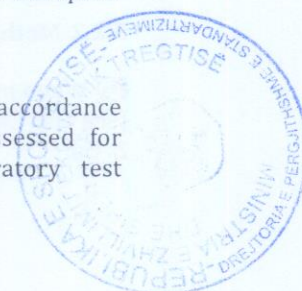
5.4 Other (bio-) components

^{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 renewable³ 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/m ³	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]	[A1] Deleted text. [A1]	[A1] EN 16576 [A1]
[A1] Deleted text. [A1]	mg/l	-	2,0	
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/m ³ 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	mm ² /s	2,000	4,500	EN ISO 3104
Distillation ^{k, l}				EN ISO 3405 ^m EN ISO 3924
% (V/V) recovered at 250 °C	% (V/V)		< 65	
% (V/V) recovered at 350 °C	% (V/V)	85		
95 % (V/V) recovered at	°C		360	

[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].

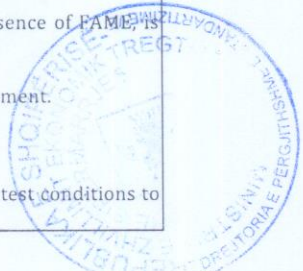
^j When diesel fuel contains more than 2 % (V/V) FAME, oxidation stability as determined by EN 15751 is the requirement.

^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.

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.

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/m ³ , min. kg/m ³ , 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	mm ² /s, min. mm ² /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	% (V/V), max.	10,0	10,0	10,0	10,0	10,0	EN ISO 3405 ⁱ EN ISO 3924
recovered at 340 °C	% (V/V), min.	95,0	95,0	95,0	95,0	95,0	

^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 **[A]** 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. **[A]**
^f **[A]** 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. **[A]**
^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, EN ISO 12185 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 [A1] [9] [A1] and the EI [A1] [10] [A1], 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

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- [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
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