
**Goriva za motorna vozila - Parafinsko dizelsko gorivo iz sinteze ali postopka s
hidrogeniranjem - Zahteve in preskusne metode**

Automotive fuels - Paraffinic diesel fuel from synthesis or hydrotreatment - Requirements
and test methods

Kraftstoffe - Paraffinischer Dieselkraftstoff aus Synthese oder Hydrierungsverfahren —
Anforderungen und Prüfverfahren

Carburants pour automobiles - Gazoles paraffiniques de synthèse ou obtenus par
hydrotraitement - Exigences et méthodes d'essais

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Ta slovenski standard je istoveten z: prEN 15940

ICS:

75.160.20 Tekoča goriva Liquid fuels

oSIST prEN 15940:2021

en

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 15940

December 2021

ICS 75.160.20

Will supersede EN 15940:2016+A1:2018+AC:2019

English Version

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und Prüfverfahren

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 19.

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

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Contents	Page
European foreword.....	3
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	8
4 Sampling.....	8
5 Pump marking.....	8
6 Requirements and test methods.....	8
6.1 Dyes and markers	8
6.2 Additives.....	8
6.2.1 General.....	8
6.2.2 Methylcyclopentadienyl Manganese Tricarbonyl (MMT)	9
6.3 Fatty acid methyl ester (FAME).....	9
6.4 Generally applicable requirements and related test methods.....	9
6.5 Climate dependent requirements and related test methods	11
6.6 Precision and dispute	12
Annex A (normative) Details of interlaboratory test programme	14
Annex B (normative) Measurements and constants for paraffinic fuel products and components.....	15
B.1 General.....	15
B.2 Short abstract of density / temperature conversion formulae and constants	15
B.3 Measurements and constants for paraffinic diesel fuel products and components	16
B.4 Conclusions	18
Bibliography.....	19

European foreword

This document (prEN 15940:2021) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 15940:2016+A1:2018.

Significant technical changes between this document and the previous version are:

- a) Update of the note in the scope explaining the product approval for vehicle purpose.
- b) Removal of the former A-deviation for Belgium due to change of legislation in the meantime.
- c) Update to the normative references towards undated versions where they don't concern requirements originating from European Directives (in line with decisions by CEN/TC 19 in coordination with the European Commission), and updating the effective publication dates where required.
- d) Inclusion of the amended EN 14214 FAME specification.
- e) Addition of micro-distillation (EN 17306) as an alternative test method to distillation by EN ISO 3405 and EN ISO 3924.
- f) Addition of the ICN technique (EN 17155) as alternative methods for cetane number determination by EN ISO 5165; <https://standards.iteh.ai/catalog/standards/sist/320c0f96-c691-4f96-973e-3f0c9d11bc5e/osist-pr-en-15940-2021>
- g) Addition of automated method (EN ISO 22995) as an alternative test method to cloud point by EN ISO 3015.
- h) Addition of the Stabinger viscometer (ISO 23581) as an alternative test method to viscosity by EN ISO 3104.
- i) Addition of EDXRF spectrometry method (EN ISO 13032) as an alternative test method to sulfur determination.
- j) Replacement of the clauses setting requirements for cavitation prevention and seizure control, plus the seizure protection Annex, by adapting the improved lubricity requirement in Table 1, by removal from Table 1 of the reporting requirement for IBP, and by introduction of a shorter cautionary statement under 5.4.6.
- k) Addition of oxidation stability by rapid small scale oxidation method (EN 16091) as an alternative test method to oxidation stability by EN 15751 for diesel fuel containing FAME above 2,0 % (V/V).
- l) Introduction of instructions how to apply bias correction.
- m) Deletion of the allowance for cetane alternative methods in 5.6.2.
- n) Updating of Annex B based on recent test method standard updates.
- o) Considerations around use of this document for heating fuel application have been introduced in the Introduction.

prEN 15940:2021 (E)

In this document, all relevant characteristics, requirements and test methods are specified. These specifications are relevant for the driveability of the vehicles and are currently known to prevent harm to the vehicles and their powertrains. Climate dependent requirements of this document may vary according to national adoptions of EN 590 and EN 14214, and should be indicated by a specific National Annex.

Requirements following amendment 2003/17/EC [12], 2009/30/EC [13], 2011/63/EU [14] and 2014/77/EU [15] to the European Fuels Quality Directive 98/70/EC [11], are taken into account. 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 at least the same accuracy and at least the same level of precision (see [13]).

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 [16].

Several assessments of test methods for paraffinic diesel fuel have been executed and the results thereof [9] led to conclusions regarding the applicability of each of the test methods as required in Clause 5. The conclusion of these assessments, partially funded by the European Commission, led to the possibility to upgrade the original Technical Specification into a full European Standard. Although it is its main actual use, the product is now no longer limited to captive fleet usage, but the scope defines the need to check the use of the product with the vehicle manufacturer. There are no EU legislative needs to limit the product to captive fleets. Such restriction is not for the specification but for the market to decide upon. Therefore, and in the light of the defined need to check the use of the product with the vehicle manufacturer, all restrictions towards captive fleet from the CEN/TS text have been deleted

This document is based on current knowledge at the time of publishing, but will require review based on further experiences with the use of paraffinic diesel fuel or when the specification for either regular automotive diesel fuel, EN 590, or FAME, EN 14214, has been determined (revised) by CEN/TC 19 or based on further experiences with the use of paraffinic diesel fuel according to this document. Further background can be found in CEN/TR 16389 [5].

Introduction

This document has been laid down to define a quality specification for diesel fuel on the basis of synthesis gas or of hydrotreated bio-oils or -fats. Paraffinic diesel fuel does not meet the automotive diesel fuel standard, EN 590 [1]. Its density can be outside the limits for automotive diesel fuel, and the described class A type fuel has a higher cetane number. Paraffinic diesel fuel is extensively available and has been increasingly approved for usage in vehicles since the first publication of EN 15940. However it is not released for all vehicles, consult vehicle manufacturer before use.

As some production processes result in a fuel containing cyclo-paraffins, as well as n-paraffins and iso-paraffins, they show different cetane number compared to other paraffinic diesel fuels. Hence, in this document, two classes have been defined, one class showing improved ignition quality compared to automotive diesel fuel meeting EN 590.

Blending of paraffinic diesel fuel with fatty acid methyl ester (FAME) is covered in this document. Against the background of the EU Renewable Energy Directive (RED, 2018/2001/EC [10]) and also the latest developments regarding the European automotive diesel fuel standard, there is now a pressing requirement to allow for FAME blend variations of those paraffinic fuels, which are not already classified as being from renewable resources.

Paraffinic diesel fuel is also used as a blending component in automotive diesel fuel. In that case it does not have to meet EN 15940 requirements since composition and properties of diesel fuel blends are defined in the respective automotive diesel fuel standards, e.g. EN 590 and EN 16734 (see EN 590:2013+A1:2017, 5.4 and EN 16734:2016+A1:2017, 5.4).

The document will be usable on a voluntary basis for engine clearance, fuel acceptance and fuelling station allowance, supporting both local regulations and international trade. See also CEN/TR 16389 [5].

For heating application of paraffinic diesel fuel specific national standards apply.

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1 Scope

This document describes requirements and test methods for paraffinic diesel fuel marketed and delivered as such, containing a level of up to 7,0 % (V/V) fatty acid methyl ester (FAME). It is applicable to fuel for use in diesel engines and vehicles compatible with paraffinic diesel fuel. It defines two classes of paraffinic diesel fuel: high cetane and normal cetane.

Paraffinic diesel fuel originates from synthesis or hydrotreatment processes.

NOTE 1 For general diesel engine warranty, the vehicle manufacturer needs to be consulted before use. Paraffinic automotive diesel fuel may need a validation step to confirm the compatibility of the fuel with the vehicle, which for some existing engines may still need to be done (see also the Introduction to this document). However, it is noted that paraffinic diesel fuel is extensively available and has been increasingly approved for usage in vehicles since the first publication of this document

NOTE 2 For the purposes of this document, 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 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 116, *Diesel and domestic heating fuels - Determination of cold filter plugging point - Stepwise cooling bath method*

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

EN 12916:2019, *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+A2:2019, *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, *Automotive fuels - Fatty acid methyl ester (FAME) fuel and blends with diesel fuel - Determination of oxidation stability by accelerated oxidation method*

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

EN 16906:2017¹, *Liquid petroleum products — Determination of the ignition quality of diesel fuels — BASF engine method*

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

EN 17155:2018, *Liquid petroleum products - Determination of indicated cetane number (ICN) of middle distillate fuels - Primary reference fuels calibration method using a constant volume combustion chamber*

EN 17306:2019, *Liquid petroleum products - Determination of distillation characteristics at atmospheric pressure - Micro-distillation*

EN ISO 3015, *Petroleum and related products from natural or synthetic sources - Determination of cloud point (ISO 3015)*

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

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

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

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

EN ISO 3171, *Petroleum liquids - Automatic pipeline sampling (ISO 3171)*

EN ISO 3405:2019, *Petroleum and related products from natural or synthetic sources - Determination of distillation characteristics at atmospheric pressure (ISO 3405:2019)*

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

EN ISO 3924:2019, *Petroleum products - Determination of boiling range distribution - Gas chromatography method (ISO 3924:2019)*

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 5165:2020, *Petroleum products - Determination of the ignition quality of diesel fuels - Cetane engine method (ISO 5165:2020)*

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

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

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

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

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

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

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

EN ISO 20846:2019, *Petroleum products - Determination of sulfur content of automotive fuels - Ultraviolet fluorescence method (ISO 20846:2019)*

prEN 15940:2021 (E)

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

EN ISO 22995, *Petroleum products - Determination of cloud point - Automated step-wise cooling method (ISO 22995)*

ISO 23581, *Petroleum products and related products — Determination of kinematic viscosity — Method by Stabinger type viscometer*

3 Terms and definitions

No terms and definitions are listed in this document.

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 document, should it be adopted on a national level.

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

5 Pump marking

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

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

Further indication on dispensing pumps in the national language of "Not suitable for all vehicles; consult vehicle manufacturer or manual before use" is also recommended.

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 4). The presence of the MMT is limited via a manganese content limit as in Table 1.

6.3 Fatty acid methyl ester (FAME)

Paraffinic diesel fuel may contain up to 7,0 % (V/V) of FAME complying with EN 14214:2013+A2:2019, in which case the climate-dependent requirements set out in EN 14214:2013+A2:2019, 5.4.2 do not apply.

NOTE 1 A suitable method for the separation and identification of FAME is given in EN 14331 [2].

Climate-dependent requirements for FAME as a blending component for use in paraffinic diesel according to this document are set out in 5.4.3 of EN 14214:2013+A2:2019. 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 paraffinic diesel fuel shall also comply with the climate-related requirements set out in 6.7 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.

NOTE 2 Cold flow requirements for FAME as a blend component in paraffinic diesel fuel are set out in Tables 3a and 3b and the National Annex of EN 14214:2013+A2:2019, in order to control maximum content of saturated monoglycerides in the final paraffinic diesel fuel 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 paraffinic diesel fuel. Caution should therefore be taken in the choice of oxidation stability enhancing additives to FAME.

6.4 Generally applicable requirements and related test methods

6.4.1 When tested by the methods indicated in Table 1, paraffinic diesel fuel shall be in accordance with the limits specified in Table 1 for either Class A (high cetane paraffinic diesel fuel) or Class B (normal cetane paraffinic diesel fuel).

NOTE 1 All values in Table 1 meet the requirements of the European Fuels Directive 98/70/EC [5], including Amendments 2003/17/EC [6], 2009/30/EC [7] and 2014/77/EU [8].

NOTE 2 For further clarification of the Classes, see CEN/TR 16389 [5].

6.4.2 The limiting value for the cetane number given in Table 1 is based on product prior to addition of cetane improver.