



SLOVENSKI STANDARD
SIST-TP CEN/TR 15993:2010
01-april-2010

Goriva za motorna vozila - Etanol (E85) gorivo za motorna vozila - Izhodišča zahtevanih parametrov, mejnih vrednosti in določevanja

Automotive fuels - Ethanol (E85) automotive fuel - Background to the parameters required and their respective limits and determination

Kraftstoffe für Kraftfahrzeuge - Ethanol-Kraftstoff (E85) - Hintergrund für die geforderten Parameter und deren jeweiligen Grenzwerte und Bestimmung

Carburants pour automobiles - Ethanol (E85) carburants pour automobiles - Background to the parameters required and their respective limits and determination

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TECHNICAL REPORT
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CEN/TR 15993

February 2010

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English Version

Automotive fuels - Ethanol (E85) automotive fuel - Background to the parameters required and their respective limits and determination

Carburants pour automobiles - Essence pour automobile
Ethanol (E85) - Informations sur les paramètres requis et
leurs limites et détermination respectives

Kraftstoffe für Kraftfahrzeuge - Ethanol-Kraftstoff (E85) -
Hintergrund für die geforderten Parameter und deren
jeweiligen Grenzwerte und Bestimmung

This Technical Report was approved by CEN on 4 January 2010. It has been drawn up by the Technical Committee CEN/TC 19.

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Contents

Page

Foreword.....	3
1 Scope	4
2 Normative references	4
3 Summary of the ethanol fuel (E85) taskforce work	4
4 Record of the work to date	5
4.1 Context.....	5
4.2 The Ethanol (E85) automotive fuel Task Force.....	5
4.3 Planning.....	7
5 The draft ethanol (E85) automotive fuel specification	7
5.1 Parameters included	7
5.2 Considerations on the parameters	8
5.2.1 Denaturants	8
5.2.2 RON MON.....	8
5.2.3 Ethanol content and higher alcohols.....	9
5.2.4 Vapour pressure	10
5.2.5 Density.....	11
5.2.6 Sulfur content.....	11
5.2.7 Oxidation stability.....	12
5.2.8 Existent gum content (solvent washed).....	12
5.2.9 Appearance	12
5.2.10 Higher alcohols (C3-C5) content.....	12
5.2.11 Methanol content	13
5.2.12 Ether (5 or more C atoms) content.....	14
5.2.13 Phosphorus	14
5.2.14 Water content.....	14
5.2.15 Chloride content	15
5.2.16 Copper strip corrosion.....	16
5.2.17 Total acidity	16
5.2.18 Copper content	16
5.2.19 Sulfate content	16
5.2.20 Conductivity	17
5.2.21 pHe	17
5.2.22 High boiling components.....	17
5.2.23 Additives	18
5.2.24 Biologically sourced ethanol.....	18
5.2.25 Guidelines.....	18
5.3 Parameters considered and not included in the draft specification	18
5.3.1 Chlorine as chlorides	18
5.3.2 Lead.....	18
6 Acknowledgement	18
Bibliography.....	19

Foreword

This document (CEN/TR 15993:2010) 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.

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.

The intention of the document was to support in publication of EN 15293, however both that document's and the Technical Report enquiry ballot showed that many technical updates in both documents were needed. This document will thus be updated immediately after its publication.

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CEN/TR 15993:2010 (E)**1 Scope**

This Technical Report explains the requirements and test methods for marketed and delivered ethanol (E85) automotive fuel according to EN 15293. It provides background information to judge the (approval of the) final text of the standard and gives guidance and explanations to the producers, blenders, marketers and users of ethanol (E85) automotive fuel.

NOTE 1 This document is directly related to prEN 15293:2009 and should be updated once further publications take place.

NOTE 2 For the purposes of this document, the terms “% (m/m)” and “% (V/V)” are used to represent the mass fraction, μ , and the volume fraction, φ , respectively.

2 Normative references

The following referenced documents are indispensable for the application 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 228, *Automotive fuels — Unleaded petrol — Requirements and test methods*

prEN 15293:2009, *Automotive fuels — Ethanol (E85) automotive fuel — Requirements and test methods*

EN 15376:2007¹⁾, *Automotive fuels — Ethanol as a blending component for petrol — Requirements and test methods*

CWA 15293, *Automotive fuels — Ethanol E85 — Requirements and test methods*

SIST-TP CEN/TR 15993:2010

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3 Summary of the ethanol fuel (E85) taskforce work

At the 2007 plenary meeting, CEN/TC 19 decided to register the following work item as described in its active programme of work: *Automotive fuels — Ethanol E85 — Requirements and test methods*, under responsibility of WG 21, with the scope to develop a CEN Standard on the basis of CWA 15293 and existing related national standards and to check for the most appropriate wording of the title of the standard.

The work on the specification was developed during a series of Ethanol (E85) automotive fuel Task Force (TF E85) meetings between October 2007 and May 2009, and is presented by means of this Technical Report. The draft standard, now referenced by the identification prEN 15293, comprises a set of properties and limit values to define an adequate quality of the ethanol (E85) automotive fuel and recommendations for precautions to be taken. (See Table 1 in prEN 15293:2009.)

The draft standard was presented to CEN/TC 19/WG 21 in November 2008, together with a request to allow the TF some additional time to finalize discussions and to study data that still needed to be generated from field experience, both of refinery and ethanol production. Following that November meeting a draft enquiry text has been developed and this was presented in January 2009 to WG 21 and thereafter to CEN/CMC.

It should be noted that the draft standard has been considered on the basis of the ethanol blend component specification EN 15376:2007 and the last version of the EN 228 (unleaded petrol) standard. Revision discussion on those documents has been included in the discussions in the last two years. However prEN 15293 still contains some pending issues, which are noted as such in the text.

1) Revision discussions regarding this version have been included in the TF discussions and in this Technical Report.

Many of the test methods proposed by the test methods experts are being examined to determine their applicability to ethanol (E85) fuel and to determine if their precision is sufficient to support the limit values proposed. This activity is being undertaken in several other CEN working groups where the specialists in methods are present.

An automatic link has been established between the gasoline and ethanol (EN 228, respectively EN 15376) standards and the ethanol (E85) automotive fuel (prEN 15293) standard so that modifications to one will be coherent with the other.

4 Record of the work to date

4.1 Context

The European Commission is following a policy of promoting renewable energy use in Europe, and to this end is encouraging the extension of automotive gasoline fuel with a proportion of renewably-sourced ethyl alcohol (referred to in this document as ethanol).

In order to facilitate a transparent and stable market in ethanol, it is necessary to establish an ethanol (E85) automotive fuel standard for Europe that will ensure a uniform high quality fuel for problem-free ethanol use as a gasoline fuel.

To this end, the Comité Européen de Normalisation (CEN) Technical Committee 19, responsible for Automotive Fuels Standards, has accepted the CWA revision as a work item on its programme to be developed in Working Group 21, responsible for Automotive Gasoline management.

The intention of CEN/TC 19 was to redraft the CWA into a CEN standard based on the publication of EN 15376 and EN 228, also taking into account the developments in Sweden, France and Germany. Discussion in WG 21 had given indications that there were still test method questions to solve and thus national initiatives were not halted.

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CEN/TC 19, having considered the proposal for a new work item, as documented in N 1318 and supported by WG 21, noting the request from UPEI in document N 1326R, decides to register the following work item as described in N 1318 in its active programme of work: *Automotive fuels — Ethanol E85 — Requirements and test methods*, under responsibility of WG 21, with the scope to develop a CEN standard on the basis of CWA 15293 and existing related national standards and to check for the most appropriate wording of the title of the standard. The Task Force E85 was created.

The aim of the CWA was to keep the specification simple and straightforward, allowing cars to be introduced in the market. The original idea was to ensure basic car functionality, for which the existing CWA succeeded. However, as flexi-fuel vehicles would fall under the Emission Legislation soon, more stringent fuel requirements were needed. The existing CWA was not able to support EURO V vehicles.

This European Standard specifies requirements and test methods for marketed and delivered Ethanol (E85) automotive fuel. It is applicable to Ethanol (E85) for use in spark ignition engine vehicles designed to run on Ethanol (E85).

Ethanol (E85) is a mixture of nominally 85 % ethanol and 15 % petrol, but also including the possibility of having different "seasonal grades" containing more than 50 % ethanol.

This document is the report on the work to date carried out by this TF E85 towards establishing a European Standard for ethanol (E85) automotive fuel.

4.2 The Ethanol (E85) automotive fuel Task Force

CEN, in anticipation of a mandate from the Commission, requested TC 19/WG 21 to convene a task force and begin work on a draft ethanol (E85) automotive fuel standard. A call was made to the industries concerned by

CEN/TR 15993:2010 (E)

the mandate for experts to participate in the TF E85, and the experts that have contributed to the work are listed in Table 1.

Table 1 — Membership of the taskforce

Name	Organisation	Country
Auger Celine (since meeting 2)	Renault	France
Baldini Luca	ENI	Italy
Bennett John	Afton Chemical	UK
Bernard Joerg	Suedzucker	Germany
Betlejewski Marek (since 2)	PKN Orlen	Poland
Colbert Dane	Ethanol Union	France
Costenoble Ortwin (TF Secretary)	NEN	Netherlands
Crepeau Gerald (Convenor)	PSA Peugeot Citroën	France
Elliott Nigel	Exxon Mobil	UK
Engelen Benoit	Total	Belgium
Feuerhelm Tom	DIN/FAM	Germany
Gameson Thomas	Abengoa Bioenergia	Spain
Gizynski Piotr	PKN Orlen S.A.	Poland
Grand Jean-Gabriel (until 2)	Renault	France
Hermans Pierre	Exxonmobil	Belgium
Jeuland Nicolas (since 5)	IFP	France
King Stan	Afton Chemical	CEFIC-ATC
Kronström Börje	Svenska Shell	Sweden
Lloyd Robin (until 4)	Argent Energy	UK
Leber Edwin	Opel	Germany
Manuelli Pascal	Total	France
Mirabella Walter	Lyondell	Italy
Nilsson Magnus	General Motors Powertrain	Sweden
Olofsson Mathias	SEKAB	Sweden
Pollak Vanda (since 6)	Hungrana	Hungary
Rantanen – Kolehmainen Leena (since 6)	Nesteoil	Finland
Rappange Aly	Royal Nedalco	Netherlands
Schuermans Kurt (since 7)	Chevron	
Sijben Jo (since 4)	Proces Design Center	Netherlands
Skret Iwona (until 6)	Instytut Technologii Nafty	Poland
Spaans Han	AC Analytical Controls	Netherlands
Tittarelli Paolo	SSC	Italy

Following his retirement as TF project leader, due to his change of profession, Mr Bennett handed over the work to Mr Crépeau during the second meeting and his contribution to the work and initiatives of this TF is hereby warmly acknowledged.

The task force has met on eight occasions:

- 1) 30 October 2007 Brussels, 1st meeting;
- 2) 15 January 2008 Brussels, 2nd meeting;
- 3) 5 March 2008 Hamburg, 3rd meeting;
- 4) 18 April 2008 London, 4th meeting;
- 5) 3 July Brussels, 5th meeting;
- 6) 11 September 2008 Brussels, 6th meeting;
- 7) 4/5 December 2008 Paris, 7th meeting;
- 8) 23 April 2009 Paris, 8th meeting.

4.3 Planning

The initial planning was: enquiry text ready in August 2008, the comments known in April 2009 and the final text to be delivered to CEN/CMC in November 2009.

WG 21 had advised to use EN 228 as the blending component and had supported a six month extension allowance for the E85 specification for the necessary updating of test methods and seasonal grades. Next, it agreed that no shortened procedure, such as UAP, should be used. Thus, the renewed planning was pursued and prEN 15239 published for ballot in May 2009.

However, the TF encountered several open issues due to the uncertainty of the guarantee of the octane in the future with the integration of Blending Oxygenate Base-stock (BOB) in all European markets and its impact on ethanol (E85) fuels. In addition, the test methods precision for chlorine content at 1 ppm or below and the high-boiler requirement are under evaluation. Also time is required to collect data on the current market, resulting in a better specification proposal. At the end of 2009, the TF still planned to aim at a submission for Formal Vote halfway through 2010 although being revised this CEN Technical Report shall support the ballots.

5 The draft ethanol (E85) automotive fuel specification

5.1 Parameters included

Ethanol (E85) automotive fuel should be based on unleaded petrol complying with EN 228 and ethanol complying with EN 15376.

The parameters chosen by the TF E85 are those presented in Table 1 (general requirements) and Table 2 (seasonal requirements) of prEN 15293:2009. There are different E85 TF positions for different parameters at the moment. Most matters were agreed upon in full consensus. The following issues currently have a majority position halfway 2009:

- a) maximum limit of the inorganic chloride at 6,0 mg/kg at the stage where EN 15376 required the same and a test was not assessed for lower measurements;
- b) the required test method for pHe;

CEN/TR 15993:2010 (E)

c) inclusion of the high boiling components in the seasonal requirements table.

A pending issue which is omitted at this stage is the minimum ethanol content for the summer grade.

NOTE For rejected parameters see 5.3,

5.2 Considerations on the parameters**5.2.1 Denaturants**

The presence of petrol that conforms to EN 228 is generally considered sufficient to render Ethanol (E85) a denatured product. The taskforce considers it is necessary to follow the same line of requirement as set out by the ethanol taskforce and thus their requirement is copied.

5.2.2 RON MON

In Europe, E85 Flex Fuels Vehicles (FFV) are engineered on taking advantage of the higher octane value of 85 % ethanol. Originally, the CWA was drafted on the assumption that EN 228 would be used for blending and the engine ignitions are tuned to these specification limits. The difference between E0 to E85 RON range were analysed and the combustion potentials with higher octane fuels were demonstrated. The impact of energy content loss, the knocking effect and the ignition timing was explained. The car manufacturers calibrate for E0 and E85 fuels based on an oxygen (ethanol) sensor. It is necessary to limit the variation on RON/MON for the E85 fuel because a lower value on RON/MON is not suitable for engine calibration and could potentially damage the engine. Also, it is impossible to test for EN 228 quality at the fuelling station in E85. If future EN 228 at E10 level is used, it will be the finished E10 that meets the EN 228 boundaries. FFVs needed to be able to run on RON 95, but for optimization reasons (OEMs calibrate on the full range of fuels used in the FFV) they would need a minimum of 104/90 for the E85. If the octane is not measured (and EN 228 would not be required for the petroleum part), other elements like paraffin needed to be limited and calorific value needed to be tested. Moreover, it was shown the 104/90 RON/MON proposal was also for optimization of the fuel economy.

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ACEA suggested 104,0 RON and 90,0 MON minimum limits and the ethanol industry agreed to support the auto-industry in their need to use the better octane.

Oil industry mentioned the only available petrol for blending will be BOB, which meets EN 228 after addition of ethanol. They suggested defining an alternative proposal requiring blending with EN 228 minus the octane specification. After a lot of discussions inside the TF E85 covering several meetings, the industry concluded the final RON/MON depended on the quality of the BOB (typical BOB RON could be down to 92), but suspected that in E85 it would be close to 104/88.

This issue warranted a MON/RON limit in the specification to maximise the benefits in the market, besides having sufficient blend stock available at economical conditions to allow the market to grow.

The group agreed to consider a higher RON/MON based on the proposal of the engine manufacturers and agreed on setting a MON/RON limit with the actual CFR engine test, include a BOB- ethanol calculation table as an information for the blenders and to do a BOB-ethanol base blend check to further define the E85 limit. After discussions, an E85 based on a fuel with 91 of RON and 83 of MON can reach the 104 and 88 targets, these values are accepted by the group. Tests on two batches of low MON and RON imply that the MON/RON requirement (104/88) was safely set. Oil industry confirmed that and also that sufficient flexibility for the refinery remained.

As the uncertainty of the future value of RON and MON with the introduction of the BOB, a new debate on this subject appeared. After additional information, EU car makers design vehicles in order to exploit higher octane when available in the tank. For example, with a RON of 106 vs. 98, a CO₂ gain of 5 % on mixed cycle. Moreover, if OEMs are sure of the higher RON value, fuel consumption can be reduced by 40 % to 25 % particularly if driven on highway due to a better knocking resistance.

As OEMs and ethanol industry believe this will make E85 fuels more attractive for the customer, it was agreed to leave the 104 as indicative in the table in the first instance. Once there is sufficient confidence with actual field data, the values could become mandatory.

The current ISO 5164 test can measure at the level of 106 of RON. It was suggested to specify 104 based on the precision at that level. However, two steps should be taken notice of: estimation of the octane number and the depicting of the specific nozzle on the CFR engine. As all engines should be certified for their specific nozzle, it was agreed not to clarify the specific r and R in the specification. A correction should not be included in the E85 specification.

5.2.3 Ethanol content and higher alcohols

The ethanol content is specified as a minimum to ensure a correct degree of purity for its use in automobiles, and to qualify for Custom and Excise recognition. As the ethanol coming from the production facility may contain small quantities of higher saturated alcohols C3 – C5 that are not considered harmful to engines, they are included within this parameter. The higher saturated alcohols are also limited by a maximum content as a separate parameter.

TF E85 supported allowing more flexibility on the amount of petrol to achieve the necessary performance. It was suggested to include the French limits and to use different indications of grades to prevent confusion with EN 228 climate classes.

The French Customs required a maximum range of 10 % from a consumer protection viewpoint. But the flexibility in the DVPE would lose if you would limit the range of ethanol to 10 %. It was suggested to first define the volatility grades and see if the ethanol content needed similar or additional grades.

Since the summer period seemed to give the constraints, ethanol industry suggested leaving out the requirement of maximum ethanol percentage and limiting it by the vapour pressure. However in winter a limit of 75 % seemed to give optimum results, as the more gasoline the better.

The group agreed to further address the need for a maximum ethanol limit and the French 10 % range requirement, based on information from the car industry.

The engine needs vapour pressure for a cold start and DVPE is a way to measure it. Once running, the broad distillation characteristics become the more critical and driveability is assisted by high front-end distillates. The usefulness of the Driveability Index was debated. It was feared that we would deviate too much from the original model with such high ethanol quantities.

Referring to the work in CEN/TC 19/WG 9 on three different methods, the GC test should report: oxygenates only or also hydrocarbons. A reliable ethanol determination could be made with only minor updating of the existing test methods.

It was suggested improving the definition of the effective ethanol content, which was a calculation of 100 % minus the rest. The group felt that the ethanol content meant ethanol + higher alcohols. Oil industry, referring to the fact that we needed to measure it in volume, would reckon the fact that ethanol has higher alcohols in it. Ethanol industry indicated that the denaturants should be excluded and administrations referred to the needs of the tax authorities.

The TF E85 agreed to limit the ethanol and higher content, using EN 15721 or another test suggested by WG 9, and not the EN 15376 content, since there was a maximum on the higher alcohols content in the specification table.

Limiting the content of unleaded petrol, the suggestion to delete the petrol content requirement from the table was accepted since Ethanol (E85) is defined as a mixture of ethanol and petrol.

Ethanol industry favoured the original principal of actually blending 85 % and lowering the percentage too much would make the product less commercially attractive. In the US, 70 % was required as a minimum. Regarding E85 volatility in very cold conditions, it could be necessary to use block heaters.