

STANDARD SHQIPTAR

SSH EN 228:2012+A1:2017

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

Automotive fuels - Unleaded petrol -  
Requirements and test methods



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English Version

## Automotive fuels - Unleaded petrol - Requirements and test methods

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

Kraftstoffe für Kraftfahrzeuge - Unverbleite  
Ottokraftstoffe - Anforderungen und Prüfverfahren

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

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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



<b>Contents</b>		Page
European foreword.....		3
1	Scope.....	5
2	Normative references.....	5
3	Sampling.....	7
4	Pump marking.....	7
5	Requirements and test methods.....	7
5.1	<b>A1</b> Bio-components <b>A1</b> .....	7
5.2	Dyes and markers.....	8
5.3	Additives.....	8
5.4	Generally applicable requirements and test methods.....	8
5.5	Climatically dependent requirements and test methods.....	11
5.6	Octane reporting.....	15
5.7	Precision and dispute.....	15
Annex A (normative) Vapour pressure waiver.....		17
A.1	Vapour pressure waiver permitted.....	17
A.2	Guidance for checking compliance with the permitted waiver.....	17
Bibliography.....		19



## European foreword

This document (EN 228:2012+A1:2017) has been prepared by Technical Committee CEN/TC 19 "Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2017, and conflicting national standards shall be withdrawn at the latest by November 2017.

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

This document supersedes  $\text{A}_1$  EN 228:2012  $\text{A}_1$ .

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  $\text{A}_1$   $\text{A}_1$ .

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

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

- $\text{A}_1$  New requirements following amendment 2009/30/EC [3], 2011/63/EU [4] and 2014/77/EU [11] to the European Fuels Quality Directive 98/70/EC [1], are taken into account.  $\text{A}_1$  Tables 1, 2, 3, 4 and A.1 explicitly differentiate between requirements included in the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3] and [4], and other requirements.
- Specific requirements concerning the limitation of use of methylcyclopentadienyl manganese tricarbonyl (MMT) as required by the EC have been incorporated.
- As the introduction of 10 % (V/V) of ethanol in unleaded petrol has an impact on refinery and blending processes, an update of the distillation characteristics has been considered and a new Table 3 with slightly adapted volatility classes (E70, E100 and VLI) has been introduced. Work is still ongoing to generate data that would support the idea that these changes do not affect cold starting and hot weather driveability aspects of the vehicles. These updates have been agreed upon with precaution and might be revised depending on fuel-related issues in the market.
- Further specification is given, by including separate tables on unleaded petrol grade for older vehicles that are not warranted to use unleaded petrol with a high biofuel content. A CEN/TR aiming at giving guidance on oxygenate blending has been prepared in parallel [5].
- Further clarification on how to determine the vapour pressure waiver for unleaded petrol containing ethanol, allowed on the market under exemption circumstances, is given in Annex A. The exact number of decimal points for the waiver has been clarified [4].
- Several new or revised test methods have been introduced. The European Fuels Directive 98/70/EC [1], including its Amendments [2] [3] [4],  $\text{A}_1$  [11]  $\text{A}_1$  refers to test methods in



EN 228:2012+A1:2017 (E)

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

- Removal of the allowance for 50 mg/kg sulfur content.
- Reference to the revised ethanol specification EN 15376.

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

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



## 1 Scope

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

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

NOTE 1 The two types are based on European Directive requirements [3], [4],  $\text{A}_1$  [11]  $\text{A}_1$ .

NOTE 2 For the purposes of this European Standard, the terms “% ( $m/m$ )” and “% ( $V/V$ )” are used to represent respectively the mass fraction,  $\mu$ , and the volume fraction,  $\varphi$ .

## 2 Normative references

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

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

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

$\text{A}_1$  EN 1601:2014<sup>1</sup>, *Liquid petroleum products — Unleaded petrol — Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography (O-FID)*  $\text{A}_1$

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

$\text{A}_1$  EN 13016-1:2007<sup>1</sup>, *Liquid petroleum products — Vapour pressure — Part 1: Determination of air saturated vapour pressure (ASVP) and calculated dry vapour pressure equivalent (DVPE)*  $\text{A}_1$

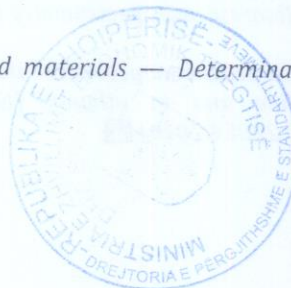
EN 13132:2000, *Liquid petroleum products — Unleaded petrol - Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography using column switching*

$\text{A}_1$  EN 14275:2013, *Automotive fuels — Assessment of petrol and diesel fuel quality — Sampling from retail site pumps and commercial site fuel dispensers*  $\text{A}_1$

$\text{A}_1$  EN 15376:2014, *Automotive fuels — Ethanol as a blending component for petrol — Requirements and test methods*  $\text{A}_1$

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

<sup>1</sup> Under revision.





EN 228:2012+A1:2017 (E)

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

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

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

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

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

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

EN ISO 3405:2011<sup>1</sup>, *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 4259:2006<sup>1</sup>, *Petroleum products — Determination and application of precision data in relation to methods of test (ISO 4259:2006)*

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

EN ISO 5164:2014<sup>1</sup>, *Petroleum products — Determination of knock characteristics of motor fuels — Research method (ISO 5164:2014)*

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

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

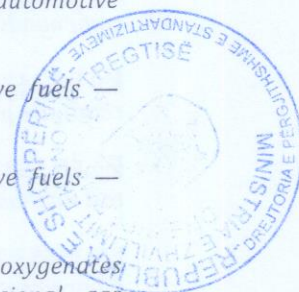
EN ISO 12185:1996<sup>1</sup>, *Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method (ISO 12185:1996)*

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)*

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





### 3 Sampling

Samples shall be taken as described in EN ISO 3170 or EN ISO 3171 and/or in accordance with the requirements of national standards or regulations for the sampling of unleaded petrol. The national requirements shall be set out in detail or shall be referred to by reference in a national annex to this European Standard.

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

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

### 4 Pump marking

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

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

**A1** Deleted text. **A1**

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

### 5 Requirements and test methods

#### 5.1 **A1** Bio-components **A1**

##### 5.1.1 **A1** Ethanol **A1**

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

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

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

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

##### 5.1.2 **A1** Other (bio-)components

Limits for adding ethanol and other oxygenates as listed in Table 1 and Table 2 do not apply to other hydrocarbons, such as synthetic hydrocarbons, and other renewable<sup>2</sup> hydrocarbons, since these components are allowed in any proportions provided that the final blend complies with the

<sup>2</sup> For clarification of renewable, see [13].



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

## 5.2 Dyes and markers

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

## 5.3 Additives

### 5.3.1 General

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

<sup>A1</sup> Deleted text. <sup>A1</sup>

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

### 5.3.2 Phosphorus

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

### 5.3.3 Methylcyclopentadienyl Manganese Tricarbonyl (MMT)

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

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

<sup>A1</sup> Deleted text. <sup>A1</sup>

## 5.4 Generally applicable requirements and test methods

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

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

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

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

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



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

Property	Units	Limits		Test Method <sup>a</sup> (See 2. Normative references)
		Min	Max	
Research octane number, RON		95,0	--	EN ISO 5164 <sup>b</sup>
Motor octane number, MON		85,0	--	EN ISO 5163 <sup>b</sup>
Lead content	mg/l	--	5,0	EN 237
Density (at 15 °C) <sup>c</sup>	kg/m <sup>3</sup>	720,0	775,0	EN ISO 3675 EN ISO 12185
Sulfur content <sup>c</sup>	mg/kg	--	10,0	EN ISO 13032 EN ISO 20846 EN ISO 20884
Manganese content <sup>d</sup>		<del>(A1) Deleted text. (A1)</del>	<del>(A1) Deleted text. (A1)</del>	EN 16135
<del>(A1) Deleted text. (A1)</del>	mg/l	--	2,0	EN 16136
Oxidation stability	minutes	360	--	EN ISO 7536
Existent gum content (solvent washed)	mg/100 ml	--	5	EN ISO 6246
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Appearance <sup>e</sup>		clear and bright		Visual inspection
Hydrocarbon type content <sup>c</sup>	% (V/V)			EN 15553
- olefins		--	18,0	EN ISO 22854
- aromatics		--	35,0	
Benzene content <sup>c</sup>	% (V/V)	--	1,00	EN 238 EN 12177 EN ISO 22854
Oxygen content <sup>c,i</sup>	% (m/m)	--	3,7	EN 1601 EN 13132 EN ISO 22854
Oxygenates content <sup>c</sup>	% (V/V)			EN 1601
- methanol <sup>f</sup>		--	3,0	EN 13132
- ethanol <sup>g</sup>		--	10,0	EN ISO 22854
- iso-propyl alcohol		--	12,0	
- iso-butyl alcohol		--	15,0	
- tert-butyl alcohol		--	15,0	
- ethers (5 or more C atoms)		--	22,0	
- other oxygenates <sup>h</sup>		--	15,0	
<sup>(A1)</sup> NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. <sup>(A1)</sup>				
<sup>a</sup> See also 5.7.1.				
<sup>b</sup> <sup>(A1)</sup> A correction of 0,2 for MON and RON shall be subtracted for the calculation of the final result, before reporting according to the requirement of the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. <sup>(A1)</sup> See also 5.6 and 5.7.2.				
<sup>c</sup> See also 5.7.2.				
<sup>d</sup> See also 5.3.3.				
<sup>e</sup> Appearance shall be determined at ambient temperature.				
<sup>f</sup> Stabilising agents shall be added.				
<sup>g</sup> Ethanol when used as a blending component shall conform to EN 15376 (see 5.1). Stabilising agents may be added.				
<sup>h</sup> Other mono-alcohols and ethers with a final boiling point no higher than prescribed in Table 3.				
<sup>i</sup> <sup>(A1)</sup> EN 13131 contains no precision statement for an oxygen content above 3 % (m/m). <sup>(A1)</sup> Based on the round robin data from the last six years, CEN/TC 19 accepts an average reproducibility value of $R = 0,37$ for all test methods.				



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

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

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

<sup>a</sup> See also 5.7.1

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

<sup>c</sup> See also 5.7.2.

<sup>d</sup> See also 5.3.3.

<sup>e</sup> Appearance shall be determined at ambient temperature.

<sup>f</sup> Stabilising agents shall be added.

<sup>g</sup> Ethanol when used as a blending component shall conform to EN 15376 (see 5.1). Stabilising agents may be added.

<sup>h</sup> The oxygen content of the finished unleaded petrol shall not exceed 2,7 % (m/m). ~~(A1)~~ See CEN/TR 16435 [5] on oxygenate blending for information. ~~(A1)~~

<sup>i</sup> Other mono-alcohols and ethers with a final boiling point no higher than prescribed in Table 4.



## 5.5 Climatically dependent requirements and test methods

### 5.5.1 Water tolerance

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

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

### 5.5.2 Volatility requirements

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

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

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

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

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



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

Property	Units	Limits						Test method <sup>a</sup> (See 2. Normative references)
		class A	class B	class C/C1	class D/D1	class E/E1	class F/F1	
Vapour pressure (VP)	kPa, min	45,0	45,0	50,0	60,0	65,0	70,0	EN 13016-1 <sup>b</sup>
	kPa, max	<b>60,0</b>	<b>70,0</b>	80,0	90,0	95,0	100,0	
% evaporated at 70°C, E70	% (V/V), min	22,0	22,0	24,0	24,0	24,0	24,0	EN ISO 3405
	% (V/V), max	50,0	50,0	52,0	52,0	52,0	52,0	
% evaporated at 100°C, E100	% (V/V), min	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	EN ISO 3405
	% (V/V), max	72,0	72,0	72,0	72,0	72,0	72,0	
% evaporated at 150°C, E150	% (V/V), min	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	EN ISO 3405
Final Boiling Point FBP	°C, max	210	210	210	210	210	210	EN ISO 3405
Distillation residue	% (V/V), max	2	2	2	2	2	2	EN ISO 3405
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max	--	--	C --	D --	E --	F --	
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max			C1 1064	D1 1164	E1 1214	F1 1264	
<p><b>NOTE</b> Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11].</p>								
<p><sup>a</sup> See also 5.7.1.</p>								
<p><sup>b</sup> Dry Vapour Pressure Equivalent (DVPE) shall be reported.</p>								





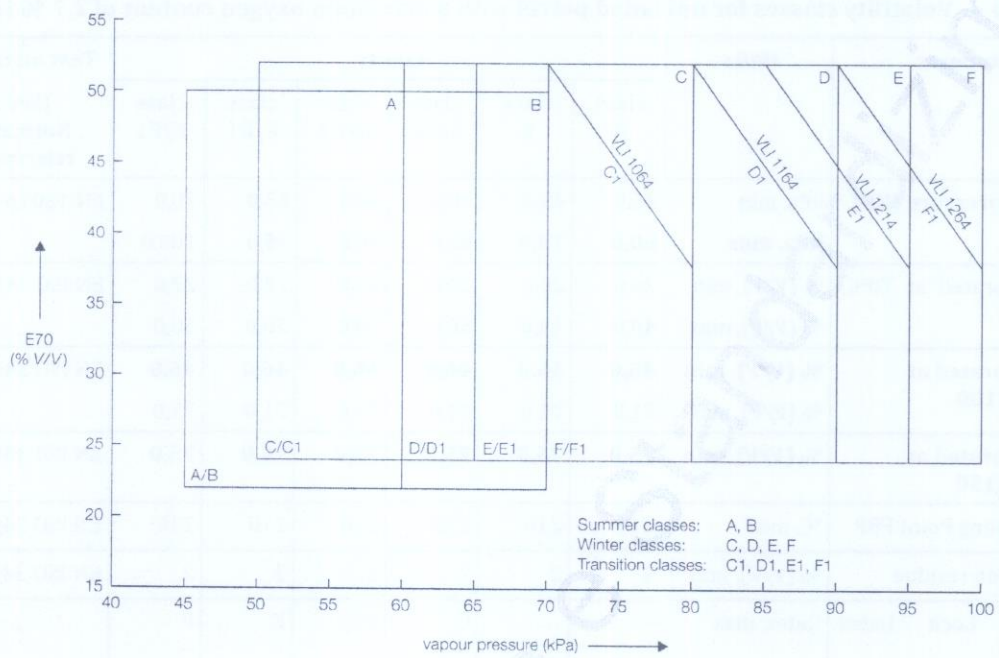


Figure 1 — Relation between VP, E70 and VLI for the ten different volatility classes for unleaded petrol with a maximum oxygen content of 3,7 % (m/m)



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

Property	Units	Limits						Test method <sup>a</sup> (See 2. Normative references)
		class A	class B	class C/C1	class D/D1	class E/E1	class F/F1	
Vapour pressure (VP)	kPa, min	45,0	45,0	50,0	60,0	65,0	70,0	EN 13016-1 <sup>b</sup>
	kPa, max	<b>60,0</b>	<b>70,0</b>	80,0	90,0	95,0	100,0	
% evaporated at 70°C, E70	% (V/V), min	20,0	20,0	22,0	22,0	22,0	22,0	EN ISO 3405
	% (V/V), max	48,0	48,0	50,0	50,0	50,0	50,0	
% evaporated at 100°C, E100	% (V/V), min	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	<b>46,0</b>	EN ISO 3405
	% (V/V), max	71,0	71,0	71,0	71,0	71,0	71,0	
% evaporated at 150°C, E150	% (V/V), min	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	<b>75,0</b>	EN ISO 3405
Final Boiling Point FBP	°C, max	210	210	210	210	210	210	EN ISO 3405
Distillation residue	% (V/V), max	2	2	2	2	2	2	EN ISO 3405
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max	--	--	C --	D --	E --	F --	
Vapour Lock Index (VLI) (10 VP + 7 E70)	index, max			C1 1050	D1 1150	E1 1200	F1 1250	
<p><b>[A]</b> NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4] and [11]. <b>[A]</b></p>								
<p><sup>a</sup> See also 5.7.1.</p>								
<p><sup>b</sup> Dry Vapour Pressure Equivalent (DVPE) shall be reported.</p>								





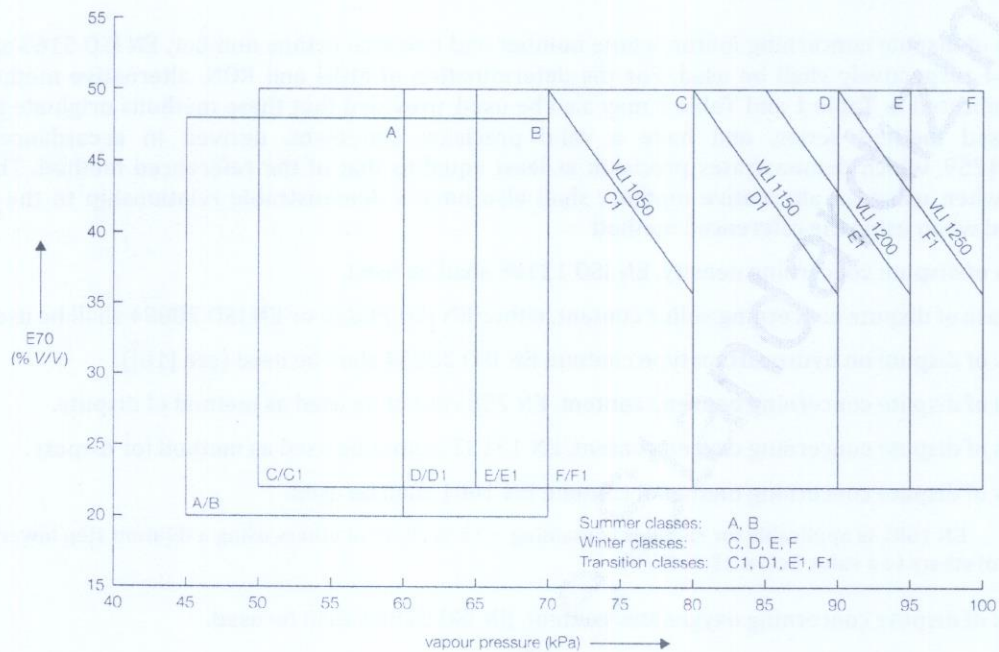


Figure 2 — Relation between VP, E70 and VLI for the ten different volatility classes for unleaded petrol with a maximum oxygen content of 2,7 % (m/m)

## 5.6 Octane reporting

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

- RON<sub>m</sub>, being the measured Research Octane Number according to EN ISO 5164,
- MON<sub>m</sub>, being the measured Motor Octane Number according to EN ISO 5163,
- RON and MON being the Research and Motor Octane properties, respectively, shall be reported after correction of RON<sub>m</sub> and MON<sub>m</sub> according to Formulae (1) and (2):

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

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

## 5.7 Precision and dispute

### 5.7.1 Resolution of disputes

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

### 5.7.2 Arbitration test methods

In cases of dispute concerning motor octane number and research octane number, EN ISO 5163 and EN ISO 5164 respectively shall be used. For the determination of MON and RON, alternative methods to those indicated in Table 1 and Table 2 may also be used, provided that these methods originate from a recognised method series, and have a valid precision statement, derived in accordance with EN ISO 4259, which demonstrates precision at least equal to that of the referenced method. The test result, when using an alternative method, shall also have a demonstrable relationship to the result obtained when using the referenced method.

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

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

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

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

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

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

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

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





## Annex A (normative)

### Vapour pressure waiver

#### A.1 Vapour pressure waiver permitted

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

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

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

<sup>a</sup> See also 5.7.2.

#### A.2 Guidance for checking compliance with the permitted waiver

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

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

- 1) Measure the ethanol content according to the test methods listed in Table A.1.
- 2) Get the rounded waivers corresponding to the measured ethanol content.
- 3) Apply the waiver to the maximum vapour pressure limit of EN 228 of the Class A volatility class (60,0 kPa) as defined in Table 3 and obtain a new waiver limit.

EN 228:2012+A1:2017 (E)

- 4) Perform the vapour pressure measurement according to EN 13016-1, using the 1 l container procedure.
- 5) Compare the results obtained under 3 and 4.
- 6) The interpretation of results and the verification of the compliance shall be performed according to EN ISO 4259.






Table 1 - Test procedure for the laboratory determination of vapour pressure

Step	EN 13016-1	EN 13016-2
1	...	...
2	...	...
3	...	...
4	...	...
5	...	...
6	...	...
7	...	...
8	...	...
9	...	...
10	...	...
11	...	...
12	...	...
13	...	...
14	...	...
15	...	...
16	...	...
17	...	...
18	...	...
19	...	...
20	...	...
21	...	...
22	...	...
23	...	...
24	...	...
25	...	...
26	...	...
27	...	...
28	...	...
29	...	...
30	...	...





## Bibliography

- [1] Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC
- [2] Directive 2003/17/EC of the European Parliament and of the Council of 3 March 2003 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC
- [3] Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC
- [4] Directive 2011/63/EU of the European Parliament and of the Council of 1 June 2011 amending, for the purpose of its adaptation to technical progress, Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels
- [5] CEN/TR 16435, *Liquid petroleum products - Oxygenates blending in line with actual EN 228 requirements*
- [6] CONCAWE report 08/03, *Guidelines for blending and handling motor gasoline containing up to 10 % V/V ethanol*, available from [www.concawe.org](http://www.concawe.org).
- [7] CEN/TR 15367-2, *Petroleum products - Guide for good housekeeping - Part 2: Automotive petrol fuels*
- [8] CEN/TR 15367-3, *Petroleum products - Guide for good housekeeping - Part 3: Prevention of cross contamination*
- [9] Method 13, *Determination of <sup>14</sup>C content in ethanol, Annex I of Commission Regulation (EC) No. 625/2003, of 2 April 2003, amending Regulation (EC) No 1623/2000 laying down detailed rules for implementing Council Regulation (EC) No 1493/1999 on the common organization of the market in wine with regards to market mechanism.*
- [10] CEN/TR 15745, *Liquid petroleum products - Determination of hydrocarbon types and oxygenates via multidimensional gas chromatography method - Round Robin research report*
- [11]  Commission Directive 2014/77/EU of 10 June 2014 amending Annexes I and II of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels 
- [12]  Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure 
- [13]  Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC 