BS EN 228:2012

BSI Standards Publication

Automotive fuels — Unleaded petrol — Requirements and test methods

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 228:2012. It supersedes BS EN 228:2008 which is withdrawn.

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

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

This British Standard contains the necessary requirements for high octane (super) unleaded petrol, previously specified in BS 7800:2006 which is withdrawn.

National Annex NA (normative) gives the national sampling requirements for unleaded petrol to comply with Clause 3.

National Annex NB (normative) gives the pump marking requirements for unleaded petrol to comply with Clause 4.

National Annex NC (normative) gives seasonal volatility requirements to comply with Subclause 5.5.2.

National Annex ND (normative) gives requirements for the provision of Super grade of unleaded petrol.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2013

Published by BSI Standards Limited 2013

ISBN 978 0 580 68484 5

ICS 75.160.20

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2013.

Amendments/corrigenda issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 228

October 2012

ICS 75.160.20

Supersedes EN 228:2008

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.

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.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2012 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 228:2012: E

Contents

Page

Foreword

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

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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 EN 228:2008.

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:

— New requirements following amendment 2009/30/EC [3] and 2011/63/EU [4] to the European Fuels Directive 98/70/EC [1], are taken into account. 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], refers to test methods in 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.

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, 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].

NOTE 2 For the purposes of this European Standard, the terms "% (*m/m*)" and "% (*V/V*)" are used to represent respectively the mass fraction, μ, and the volume fraction, φ.

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*

EN 1601:1997[1)], *Liquid petroleum products — Unleaded petrol — Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography (O-FID)*

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

EN 13016-1:2007, *Liquid petroleum products — Vapour pressure — Part 1: Determination of air saturated vapour pressure (ASVP) and calculated dry vapour pressure equivalent (DVPE)*

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*

EN 14275:2003[1)] , *Automotive fuels — Assessment of petrol and diesel fuel quality — Sampling from retail site pumps and commercial site fuel dispensers*

EN 15376:2011, *Automotive fuels — Ethanol as a blending component for petrol — Requirements and test methods*

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

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

1) Under revision.

EN 16136:2011, *Automotive fuels — Determination of manganese content in unleaded petrol — Inductively coupled plasma optical emission spectrometry (ICP OES) method*

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

EN ISO 5163:2005[1)], *Petroleum products — Determination of knock characteristics of motor and aviation fuels — Motor method (ISO 5163:2005)*

EN ISO 5164:2005[1)], *Petroleum products — Determination of knock characteristics of motor fuels — Research method (ISO 5164:2005)*

EN ISO 6246:1997, *Petroleum products — Gum content of light and middle distillate fuels — Jet evaporation method (ISO 6246:1995)*

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

EN ISO 12185:1996, *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 22854:2008[1)], *Liquid petroleum products — Determination of hydrocarbon types and oxygenates in automotive-motor gasoline — Multidimensional gas chromatography method (ISO 22854:2008)*

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

Information to be marked on dispensing pumps used for delivering unleaded petrol, and the dimensions of the label shall be in accordance with the requirements of national standards or regulations for the marking of pumps for unleaded petrol. Such requirements shall be set out in detail or shall be referred to by reference in a national annex to this European Standard.

Labelling shall be clearly visible, easily legible and displayed at any point where 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.

It is also recommended that additional pump marking be applied for dispensing unleaded petrol containing high oxygenates (with a maximum oxygen content of 3,7 % (*m/m*)) and/or low oxygenates (with a maximum oxygen content of 2,7 % (*m/m*)).

For unleaded petrol containing high oxygenates, pump marking shall consist of easily recognised visual symbols that:

a) identify the unleaded petrol as complying with EN 228,

b) specify the RON, and

c) identify that the unleaded petrol contains high oxygenates (in this case the recommended symbol is “E10”).

For unleaded petrol containing low oxygenates, pump marking shall consist of easily recognised visual symbols that

d) identify the unleaded petrol as complying with EN 228,

e) specify the RON, and

f) identify, at the discretion of the Member State and laid down in a National Annex to this document, that the unleaded petrol contains low oxygenates.

The pumps dispensing low or high oxygenates unleaded petrol may also be marked with text in the national language(s) at the discretion of the Member State describing the characteristics of the unleaded petrol and all such requirements shall be set out in detail or referred to in a National Annex to this document.

5 Requirements and test methods

5.1 Ethanol

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.

5.2 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.

CAUTION – Unleaded petrol shall be free from any adulterant or contaminant that may render the fuel unacceptable for use in petrol engine vehicles designed to run on unleaded petrol.

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. The presence of the MMT in unleaded petrol shall be limited to 6 mg of manganese per litre from 1 January 2011. The limit shall be 2 mg of manganese per litre from 1 January 2014.

NOTE These requirements are subject to review following an assessment by the European Commission.

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.

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 [a] (See 2. Normative references)
		Min	Max	
Research octane number, RON		**95,0**	--	EN ISO 5164 [b]
Motor octane number, MON		**85,0**	--	EN ISO 5163 [b]
Lead content	**mg/l**	--	**5,0**	EN 237
Density (at 15 °C) [c]	kg/m^3	720,0	775,0	EN ISO 3675 EN ISO 12185
Sulfur content [c]	**mg/kg**	--	**10,0**	EN ISO 13032 EN ISO 20846 EN ISO20884
Manganese content [d]	**mg/l**			EN 16135 EN 16136
until 2013-12-31		--	**6,0**	
from 2014-01-01		--	**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 [e]		clear and bright		Visual inspection
Hydrocarbon type content [c, f,]	**% *(V/V)***			EN 15553 EN ISO 22854
- olefins		--	**18,0**	
- aromatics		--	**35,0**	
Benzene content [c]	**% *(V/V)***	--	**1,00**	EN 238 EN 12177 EN ISO 22854
Oxygen content [c, k]	**% *(m/m)***	--	**3,7**	EN 1601 EN 13132 EN ISO 22854
Oxygenates content [c]	**% *(V/V)***			EN 1601
- methanol [g]		--	**3,0**	EN 13132
- ethanol [h]		--	**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 [i]		--	**15,0**	

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

[a] See also 5.7.1.

[b] 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] and [4]. See also 5.6 and 5.7.2.

[c] See also 5.7.2.

[d] See also 5.3.3.

[e] Appearance shall be determined at ambient temperature.

[f] A CEN study found EN ISO 22854 applicable for the analysis of samples having an oxygen content of maximum 3,7 % (*m/m*).

[g] Stabilising agents shall be added.

[h] Ethanol when used as a blending component shall conform to EN 15376 (see 5.1). Stabilising agents may be added.

[i] Other mono-alcohols and ethers with a final boiling point no higher than prescribed in Table 3.

[k] The test methods cited do not have a precision statement for an oxygen content above 3 % (*m/m*). 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** [a] (See 2. Normative references)
		Min	**Max**	
Research octane number, RON		**95,0**	--	EN ISO 5164 [b]
Motor octane number, MON		**85,0**	--	EN ISO 5163 [b]
Lead content	**mg/l**	--	**5,0**	EN 237
Density (at 15 °C) [c]	kg/m^3	720,0	775,0	EN ISO 3675 EN ISO 12185
Sulfur content [c]	**mg/kg**	--	**10,0**	EN ISO 13032 EN ISO 20846 EN ISO 20884
Manganese content [d]	**mg/l**			EN 16135 EN 16136
until 2013-12-31		--	**6,0**	
from 2014-01-01		--	**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 [e]		clear and bright		Visual inspection
Hydrocarbon type content [c,]	**% *(V/V)***			EN15553 EN ISO 22854
- olefins		--	**18,0**	
- aromatics		--	**35,0**	
Benzene content [c]	**% *(V/V)***	--	**1,00**	EN 238 EN 12177 EN ISO 22854
Oxygen content [c]	**% *(m/m)***	--	**2,7**	EN 1601 EN 13132 EN ISO 22854
Oxygenates content [c]	**% *(V/V)***			EN 1601 EN 13132 EN ISO 22854
- methanol [f]		--	**3,0**	
- ethanol [g]		--	**5,0**	
- iso-propyl alcohol [h] **- iso-butyl alcohol** [h] **- tert-butyl alcohol** [h] **- ethers (5 or more C atoms)** [h] **- other oxygenates** [h, i]			Volume blending restricted to 2,7 % (*m/m*) maximum oxygen content	

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

[a] See also 5.7.1

[b] 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] and [4]. See also 5.6 and 5.7.2.

[c] See also 5.7.2.

[d] See also 5.3.3.

[e] Appearance shall be determined at ambient temperature.

[f] Stabilising agents shall be added.

[g] Ethanol when used as a blending component shall conform to EN 15376 (see 5.1). Stabilising agents may be added.

[h] The oxygen content of the finished unleaded petrol shall not exceed 2,7 % (*m/m*). A CEN/TR on oxygenate blending is under preparation.

[i] 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 [a]
		class A	class B	class C/C1	class D/D1	class E/E1	class F/F1	(See 2. Normative references)
Vapour pressure (VP)	kPa, min	45,0	45,0	50,0	60,0	65,0	70,0	EN 13016-1[b]
	kPa, max	**60,0**	**70,0**	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**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	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**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	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	

NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4]

[a] See also 5.7.1.

[b] Dry Vapour Pressure Equivalent (DVPE) shall be reported.

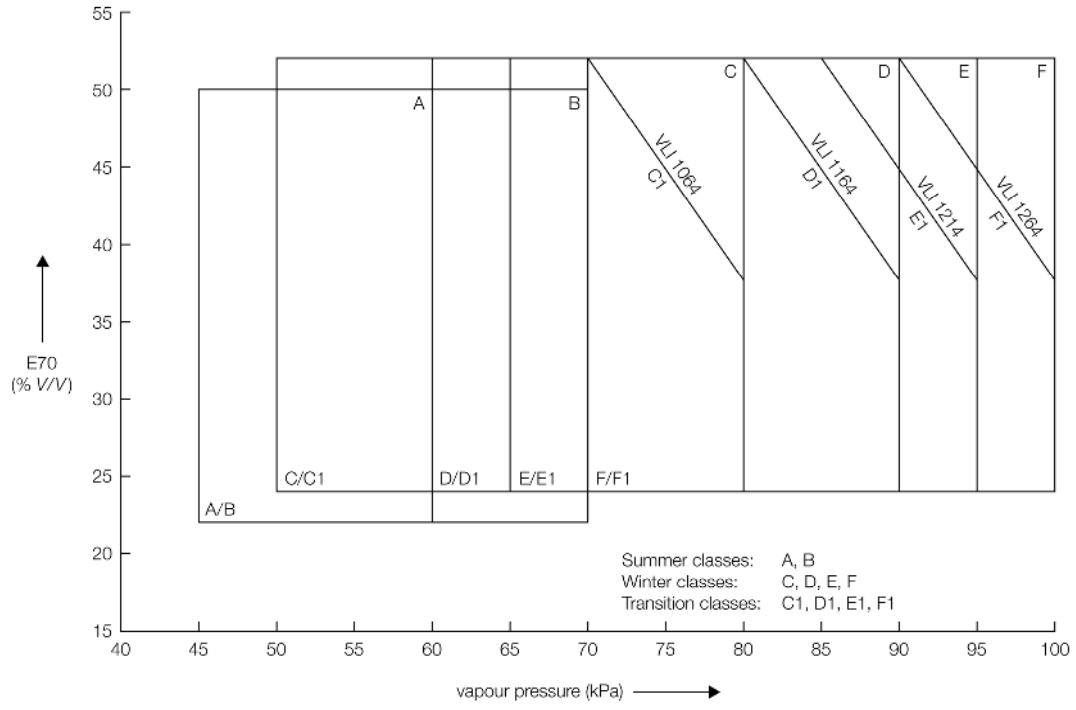

Figure 1 — Relation between VP, E70 and VLI for the ten different volatility classes for unleaded petrol with a maximum oxygen content of 3,7 % (*m/m*)

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

Property	Units	Limits						Test method [a]
		class A	class B	class C/C1	class D/D1	class E/E1	class F/F1	(See 2. Normative references)
Vapour pressure (VP)	kPa, min	45,0	45,0	50,0	60,0	65,0	70,0	EN 13016-1[b]
	kPa, max	**60,0**	**70,0**	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**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	**46,0**	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**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	**75,0**	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	

NOTE Requirements in bold refer to the European Fuels Directive 98/70/EC [1], including subsequent Amendments [2], [3], [4]

[a] See also 5.7.1.

[b] Dry Vapour Pressure Equivalent (DVPE) shall be reported.

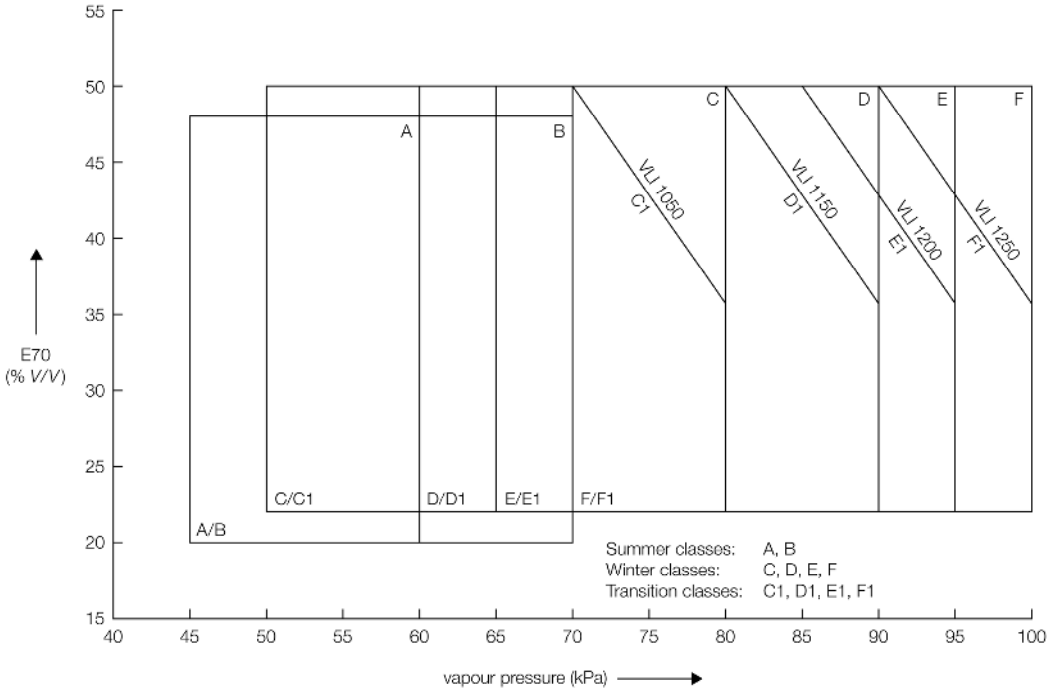

Figure 2 — Relation between VP, E70 and VLI for the ten different volatility classes for unleaded petrol with a maximum oxygen content of 2,7 % (*m/m*)

5.6 Octane reporting

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

— *RON*m, being the measured Research Octane Number according to EN ISO 5164,

— *MON*m, 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 RONm and MONm according to Formulae (1) and (2):

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

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

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 [a] % (*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**
[a] 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.

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.

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.

[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 house keeping — Part 3: Prevention of Cross-Contamination*

[9] Method 13, *Determination of ^{14}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*

National Annex NA
(normative)

Sampling requirements

NA.1 Introduction

This National Annex NA gives the national sampling requirements for unleaded petrol to comply with Clause 3 in BS EN 228:2012. This National Annex has been drafted by Technical Committee PTI/2.

NA.2 Sampling

NA.2.1 Sampling from storage tanks

For the purposes of this British Standard all sampling shall be carried out in accordance with the relevant procedures of BS 2000-475.

NA.2.2 Sampling from retail site pumps and commercial fuel site dispensers

For the purposes of this British Standard all sampling shall be carried out in accordance with the relevant procedures of BS 2000-509.

NA.2.3 Storage, labeling and transport of samples

Samples shall be kept out of direct heat, such as sunlight, although it is not necessary to keep them refrigerated. A sample shall be identified by adequate and appropriate details on a sufficiently robust medium such that its integrity is maintained during subsequent transport and handling.

NOTE 1 If left in direct sunlight there is a danger that the cans will become pressurized through expansion of their contents.

NOTE 2 Attention is drawn to SI 2009 No. 1348: The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 [3], for the transport of samples by road, and to the UK "CHIP" Regulations SI 2002 No. 1689: The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002, as amended [4], for the supply of samples to the recipient.

NA.3 Bibliographic references

[1] BS 2000-475, Petroleum liquids – Manual sampling (EN ISO 3170)

[2] BS 2000-509, Automotive Fuels – Assessment of petrol and diesel fuel quality – sampling from retail site pumps and commercial site fuel dispensers (BS EN 14275)

[3] SI 2009 No. 1348 The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009. London, The Stationery Office

[4] SI 2002 No. 1689 The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (as amended). London, The Stationery Office

National Annex NB
(normative)

Pump marking requirements

NB.1 Introduction

This National Annex NB gives the pump marking requirements for unleaded petrol to comply with Clause 4 in BS EN 228:2012. This National Annex has been drafted by Technical Committee PTI/2.

NB.2 Requirements

NB.2.1 Pump marking

For the purposes of this British Standard the following information shall be marked on each retail dispensing pump or container used for delivering petrol conforming to BS EN 228:2012 into the consuming vehicle:

a) The name or mark of the supplier or vendor of the petrol.

b) The grade designation **"Unleaded Petrol 95"** with a reference to BS EN 228 and displayed as shown in Figure NB.1. The minimum dimensions of this mark shall be as shown in Figure NB.1 (see note 1) and the colour used for the design and lettering shall be in clear contrast to the background (see note 2).

The mark shall be in a position where it can be seen by the person dispensing fuel.

Dimensions are shown to the right, expressed in millimetres

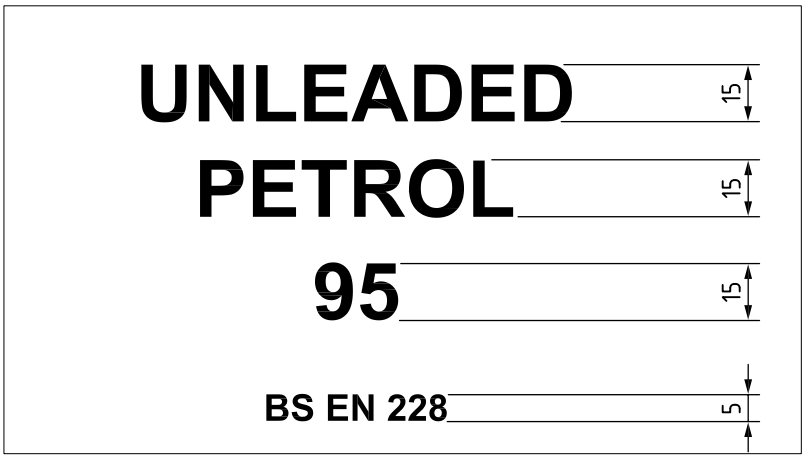

Figure NB.1 – Form of mark for unleaded petrol 95 octane grade containing the oxygen content and compounds in Table 2

NOTE 1 The minimum dimensions of the mark given in Figure NB.1 have been selected to enable its application to pumps of the smallest anticipated dimensions. It is strongly recommended that, in the interests of visibility to the motorist, that larger dimensions be used wherever possible.

NOTE 2 It is recommended that the prominent colour should be green. The preferred colour is colour number 216 of BS 381C:1996. [1]

NOTE 3 Attention is drawn to the relevant marking provisions of the Measuring Instruments legislation: SI 2006 No. 1266 and SI 2006 No. 2234 [3]

NOTE 4 Clause 4 of BS EN 228:2012 permits the use of the designation "E5" on a discretionary basis to describe unleaded petrol that complies with Table 2. It is not intended that this mark forms part of this National Annex.

NOTE 5 Marking BS EN 228 on or in relation to a product represents a manufacturers' declaration of conformity, i.e. a claim by the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity.

NB.2.2 Additional pump marking for higher oxygen grade

In accordance with the requirement in Clause 4 of BS EN 228:2012, supplementary information is required for the higher oxygen content blends of petrol in Table 1. This is by means of the normative designation "E10" prescribed in Clause 4, and shall be displayed on the pump as shown in Figure NB.2.

Dimensions are shown to the right, expressed in millimetres

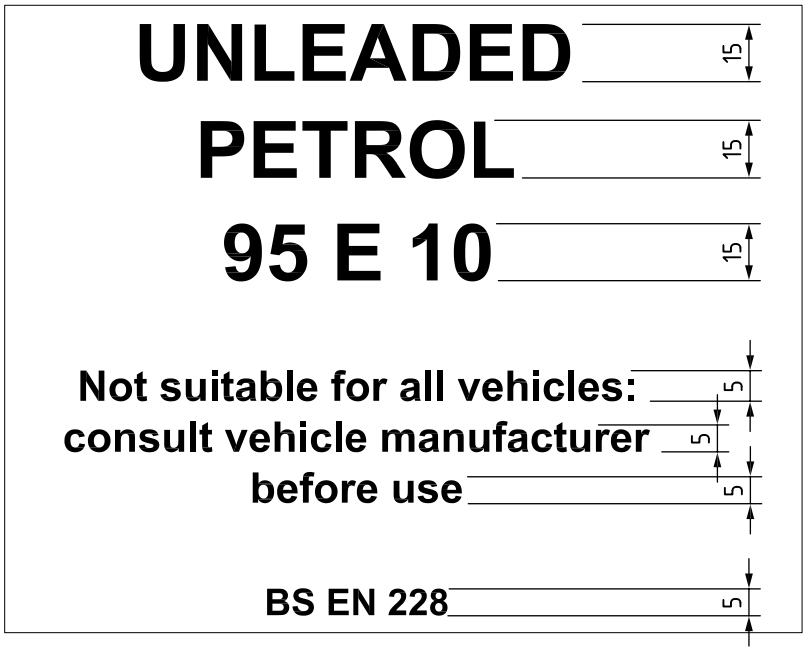

Figure NB.2 – Form of mark for unleaded petrol 95 octane grade containing the higher oxygen content and compounds in Table 1.

NB.2.3 Marking for Bioethanol content

There is no normative requirement in BS EN 228:2012 for pump marking for bioethanol content. However, attention is drawn to the requirement of the Biofuels Labelling Regulations [2] whereby there is currently a requirement to label blends containing more than 5 % bioethanol by volume with the specific wording "**Not suitable for all vehicles: consult vehicle manufacturer before use**"

In the absence of a prescriptive form of labeling for this text in the Statutory Instrument it is recommended that, where it is necessary, this requirement is expressed in a manner compatible with other labeling in this National Annex, in particular with Figure NB.2.

NB.2.4 Marking for metallic additive content

In accordance with Clause 4 the words **"Contains metallic additives"** shall be displayed at any point where unleaded petrol with metallic additives is made available to consumers. The form and minimum dimensions are shown in Figure NB.3. Where this label is necessary, it is not necessary for this mark to form an integral part of the composite label shown in Figures NB.1 and NB.2.

Dimensions are shown to the right, expressed in millimetres

Figure NB.3 – Form of mark for unleaded petrol containing metallic additives

NB.2.5 Nozzle

For the purposes of this British Standard, where engineering and safety considerations permit, the dispensing nozzle shall be colour coded green forward of the grip (see note 2 to **NB.2.1**).

NB.3 Bibliographic references

[1] BS 381C:1996 Specification for colours for identification, coding and special purposes

[2] Biofuels (Labelling) Regulations SI 2004 No. 3349, (as amended). London, The Stationery Office

[3] SI 2006 No 1266, The Measuring Instruments (Liquid Fuels and Lubricants) Regulations 2006 and SI 2006 No 2234 The Measuring Instruments (Liquid Fuels and Lubricants) (Amendment) Regulations 2006. London, The Stationery Office

National Annex NC
(normative)

Seasonal volatility requirements

NC.1 Introduction

This National Annex NC gives seasonal volatility requirements to comply with Subclause 5.5.2 in BS EN 228:2012. This National Annex has been drafted by Technical Committee PTI/2.

NC.2 Requirements

For the purposes of this British Standard the following volatility specified in Table NC.1 shall apply.

Table NC.1 — Seasonal volatility characteristics

Spring	For sales of petrol to consumers between 16 April to 31 May inclusive.	Class F1 maxima and Class B minima.
Summer	For sales of petrol to consumers between 1 June to 31 August.	Class B maxima and minima.
Autumn	For sales of petrol to consumers between 1 September to 15 October inclusive.	Class F1 maxima and Class B minima.
Winter	For sales of petrol to consumers between 16 October and 15 April inclusive.	Class F maxima and minima.

NOTE With reference to seasonal changeovers, attention is drawn to regulation 5(3) of SI 1999 No. 3107 [1].

NC.3 Bibliographical reference

[1] SI 1999 No. 3107 The Motor Fuel (Composition and Content) Regulations 1999. London, The Stationery Office

National Annex ND
(normative)

Requirements for the provision of Super grade of unleaded petrol

ND.1 General

A requirement exists for some users of BS EN 228:2012 to be able to specify a level of octane value which exceeds the values in Tables 1 and 2. In particular, this octane requirement is referenced under the provisions of the Motor Fuels Regulations (SI 2010 No. 3035) [1] for the supply of unleaded petrol in certain vehicles. This material is restricted to the compositional provisions of Table 2. It is conventionally described as a "Protection Grade" (CONCAWE, 2009) [2] and is a requirement for sales by retail through certain qualifying outlets.

A higher octane performance level was previously described as "High octane or Super unleaded petrol" and was as specified in BS 7800 [3], which is withdrawn. A reference to this National Annex is intended to assure users of BS EN 228:2012 that petrol complies with these specified minimum octane requirements.

ND.2 Octane requirement

With reference to Tables 1 and 2 of BS EN 228:2012, the requirements for the Research Octane Number (RON) and the Motor Octane Number (MON) of the grade of petrol previously described as "High octane (super) unleaded petrol" in BS 7800:2006 [3], and which are now adopted in this standard, are as follows:

RON 97.0 minimum

MON 86.0 minimum

All other requirements are identical with those specified in this edition of BS EN 228.

NOTE 97 RON represents a minimum value for this grade. This does not preclude a vendor from displaying an actual determined minimum RON value on any pump marking, in compliance with this National Annex.

ND.3 Marking

ND.3.1 Pumps and containers

On each retail dispensing pump or container used for delivering petrol, conforming with BS EN 228:2012 and this National Annex, into the consuming vehicle, the following information shall be marked:

a) The name or mark of the supplier or vendor of the petrol.

b) The grade designation "Super Unleaded Petrol 97", with a reference to BS EN 228. The minimum dimensions of this mark are shown in Figure ND.1.

The mark shall be in a position where it can be seen by the person dispensing fuel.

Where super grade is marketed without the restrictions at [1] the form of mark is as illustrated below in Figure ND.2

NOTE 1 The minimum dimensions of the mark given in Figure NB.1 have been selected to enable its application to pumps of the smallest anticipated dimensions. It is strongly recommended that, in the interests of visibility to the motorist, the larger dimensions be used wherever possible.

NOTE 2 It is recommended that the prominent colour should be green. The preferred colour is colour number 216 of BS 381C:1996. [4]

NOTE 3 Marking BS EN 228 on or in relation to a product represents a manufacturers' declaration of conformity, i.e. a claim by the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity.

Dimensions are shown to the right, expressed in millimetres

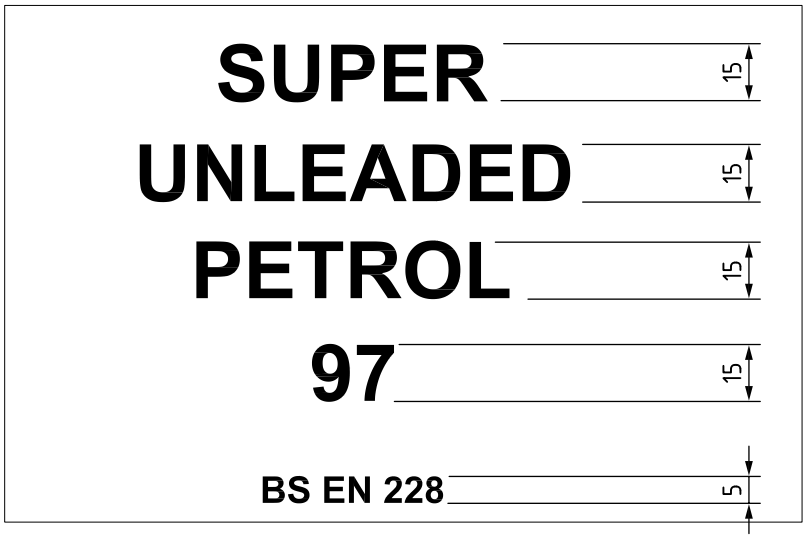

Figure ND.1 – Form of mark for super unleaded petrol

Dimensions are shown to the right, expressed in millimetres

Figure ND.2 – Form of mark for Super unleaded petrol 97 octane grade containing the higher oxygen content and compounds in Table 1

ND.3.2 Marking for metallic additive content

In accordance with Clause 4 of BS EN 228:2012 the words **"Contains metallic additives"** shall be displayed at any point where unleaded petrol with metallic additives is made available to consumers. The form and minimum dimensions are shown in Figure ND.3. Where this label is necessary, it is not necessary for this mark to form an integral part of the composite label shown in Figures ND.1 and ND.2

Dimensions are shown to the right, expressed in millimetres

Figure ND.3 – Form of mark for unleaded petrol containing metallic additives

ND.3.3 Nozzle

For the purposes of this National Annex, where engineering and safety considerations permit, the dispensing nozzle shall be colour coded green forward of the grip (see Note 2 to **ND.3.1**).

ND.4 Bibliographic references

[1] SI 2010 No. 3035 The Motor Fuel (Composition and content) and Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2010. The Stationery Office, London

[2] Overview of European Legislation Impacting Vehicles and Fuels (2009) CONCAWE Boulevarde du Sovereign 165, B-1160 Brussels, Belgium

[3] BS 7800:2006 Automotive fuel – High octane (super) unleaded petrol – Specification

[4] BS 381C:1996 Specification for colours for identification, coding and special Purposes.

This page deliberately left blank

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™