

SABS/TC 0028/SC 03 "Fuels"

SANS1598 Edition 3.1 Automotive fuels — Requirements and test methods for petrol

Document type: Draft amendment

Date of document: 2018-10-02

Expected action: VOTE

Action due date: 2018-10-24

Background: Dear Member

Please receive SANS 1598 Automotive fuels — Requirements and test methods for petrol (Edition 3.1) Draft Amendment.

At the SABS/TC 028/SC 03 Committee Meeting, members discussed and agreed that an amendment project should be open. The minor amendment is required to update referenced standards (especially to replace SANS 1164 with SANS 465). Both standards cover the same scope.

Upon the approval of this project we will be able to withdraw SANS 1164 as required (and previously agreed by the subcommittee that upon publication of SANS 465, SANS 1164 shall be withdrawn).

Regards
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Committee URL: <https://isolutions.iso.org/ecom/livelink/open/25117272>

PROPOSAL TO AMEND A SOUTH AFRICAN STANDARD

Document number SANS 1598 Edition 3.1

Reference SANS1598ED3.1

Date of circulation 2017-10-02

Committee number: SABS/TC 0028/SC 03

Committee title: PETROLEUM PRODUCTS, BIOFUELS AND LUBRICANTS – FUELS

SOUTH AFRICAN STANDARD TO BE AMENDED

Number, year and title of standard: SANS 1598: 2014, Automotive fuels - Requirements and test methods for petrol

Proposed amendment number: Ed 3.1

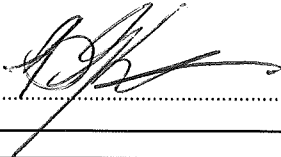
Remarks: Amendment is required in order to update referenced standard (to replace SANS 1164 with SANS 465).

IMPLEMENTATION:

If the amendment is ratified it is proposed that it be implemented

- immediately, i.e. on the date of ratification.
- as from (date).
- within weeks of ratification.
- within months of ratification.

Signature of the chairman:



Date:

02/10/2018

SOUTH AFRICAN NATIONAL STANDARD

Automotive fuels — Requirements and test methods for petrol

WARNING
This document references other documents normatively.

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Table of changes

Change No.	Date	Scope
Amdt 1	2018	Amended to update referenced standard.

Foreword

This South African standard was approved by National Committee SABS/TC 028/SC 03, *Petroleum products, biofuels and lubricants – Fuels*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in xxxx 2018.

This document supersedes SANS 1598:2014 (edition 3).

This document is referenced in the Petroleum Products Act, 1977 (Act No. 120 of 1977).

Reference is made in 3.3 to the "relevant national legislation". In South Africa, this means the Regulations of the Petroleum Product Act, 1977 (Act No. 120 of 1977), as published by Government Notice No. R. 627 (Government Gazette No. 28958) of 23 June 2006.

Reference is made in 3.4 to the "relevant national legislation". In South Africa, this means the Regulations of the Petroleum Product Act, 1977 (Act No. 120 of 1977), as published by Government Notice No. R. 431 (Government Gazette No. 35410) of 1 June 2012.

Annexes A to E are for information only.

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Automotive fuels — Requirements and test methods for petrol

1 Scope

This standard specifies requirements and test methods for marketed and delivered petrol grades suitable for use in spark-ignition internal-combustion engines excluding aviation piston engines.

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. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

ASTM D86, *Standard test method for distillation of petroleum products at atmospheric pressure.*

ASTM D130, *Standard test method for corrosiveness to copper from petroleum products by copper strip test.*

ASTM D323, *Standard test method for vapor pressure of petroleum products (Reid method).*

ASTM D381, *Standard test method for gum content in fuels by jet evaporation.*

ASTM D525, *Standard test method for oxidation stability of gasoline (induction period method).*

ASTM D873, *Standard test method for oxidation stability of aviation fuels (potential residue method).*

ASTM D1298, *Standard test method for density, relative density, or API gravity of crude petroleum and liquid petroleum products by hydrometer method.*

ASTM D1319, *Standard test method for hydrocarbon types in liquid petroleum products by fluorescent indicator adsorption.*

ASTM D2622, *Standard test method for sulfur in petroleum products by wavelength dispersive X-ray fluorescence spectrometry.*

ASTM D2699, *Standard test method for research octane number of spark-ignition engine fuel.*

ASTM D2700, *Standard test method for motor octane number of spark-ignition engine fuel.*

ASTM D3227, *Standard test method for (thiol mercaptan) sulfur in gasoline, kerosine, aviation turbine, and distillate fuels (potentiometric method).*

ASTM D3231, *Standard test method for phosphorus in gasoline.*

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- ASTM D3237, *Standard test method for lead in gasoline by atomic absorption spectroscopy.*
- ASTM D3242, *Standard test method for acidity in aviation turbine fuel.*
- ASTM D3341, *Standard test method for lead in gasoline-iodine monochloride method.*
- ASTM D3348, *Standard test method for rapid field test for trace lead in unleaded gasoline (colorimetric method).*
- ASTM D3606, *Standard test method for determination of benzene and toluene in finished motor and aviation gasoline by gas chromatography.*
- ASTM D3831, *Standard test method for manganese in gasoline by atomic absorption spectroscopy.*
- ASTM D4052, *Standard test method for density, relative density, and API gravity of liquids by digital density meter.*
- ASTM D4057, *Standard practice for manual sampling of petroleum and petroleum products.*
- ASTM D4177, *Standard practice for automatic sampling of petroleum and petroleum products.*
- ASTM D4294, *Standard test method for sulfur in petroleum and petroleum products by energy-dispersive x-ray fluorescence spectrometry.*
- ASTM D4815, *Standard test method for determination of MTBE, ETBE, TAME, DIPE, tertiary-amyl alcohol and C₁ to C₄ alcohols in gasoline by gas chromatography.*
- ASTM D4953, *Standard test method for vapor pressure of gasoline and gasoline-oxygenate blends (dry method).*
- ASTM D5059, *Standard test methods for lead in gasoline by X-ray spectroscopy.*
- ASTM D5191, *Standard test method for vapor pressure of petroleum products (mini method).*
- ASTM D5443, *Standard test method for paraffin, naphthene and aromatic hydrocarbon type analysis in petroleum distillates through 200 °C by multidimensional gas chromatography.*
- ASTM D5453, *Standard test method for determination of total sulfur in light hydrocarbons, spark ignition engine fuel, diesel engine fuel, and engine oil by ultraviolet fluorescence.*
- ASTM D5580, *Standard test method for determination of benzene, toluene, ethylbenzene, p/m-xylene, o-xylene, C₉ and heavier aromatics, and total aromatics in finished gasoline by gas chromatography.*
- ASTM D6730, *Standard test method for determination of individual components in spark ignition engine fuels by 100-metre capillary (with precolumn) high-resolution gas chromatography.*
- EN 238, *Liquid petroleum products – Petrol – Determination of the benzene content by infrared spectrometry.*
- EN 1601, *Liquid petroleum products – Unleaded petrol – Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography (O-FID).*
- EN 12177, *Liquid petroleum products – Unleaded petrol – Determination of benzene content by gas chromatography.*

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

IP 30, *Detection of mercaptans, hydrogen sulfide, elemental sulfur and peroxides – Doctor test method.*

IP 40, *Petroleum products – Determination of oxidation stability of gasoline-induction period method.*

IP 69, *Determination of vapour pressure – Reid method.*

IP 123, *Petroleum products – Determination of distillation characteristics at atmospheric pressure.*

IP 131, *Petroleum products – Gum content of light and middle distillates – Jet evaporation method.*

IP 138, *Determination of oxidation stability of aviation fuel – Potential residue method.*

IP 154, *Petroleum products – Corrosiveness to copper – Copper strip test.*

IP 160, *Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method.*

IP 228, *Determination of lead content of gasoline – X-ray spectrometric method.*

IP 236, *Motor and aviation-type fuels – Determination of knock characteristics of motor and aviation fuels – Motor method.*

IP 237, *Petroleum products – Determination of knock characteristics of motor fuels – Research method.*

IP 270, *Petroleum products – Determination of lead content of gasoline – Iodine monochloride method.*

IP 336, *Petroleum products – Determination of sulfur content – Energy-dispersive X-ray fluorescence spectrometry.*

IP 342, *Petroleum products – Determination of thiol (mercaptan) sulfur in light and middle distillate fuels – Potentiometric method.*

IP 352, *Determination of lead content of automotive gasoline – Energy dispersive x-ray fluorescence spectrometry method.*

IP 354, *Total acidity of aviation turbine fuel – Colour indicator titration method.*

IP 365, *Crude petroleum and petroleum products – Determination of density – Oscillating u-tube method.*

IP 362, *Determination of total lead content of gasoline – Atomic absorption spectrophotometry method.*

IP 456, *Determination of potassium in gasoline – Atomic absorption spectrometry (AAS) method.*

ISO 3170, *Petroleum liquids – Manual sampling.*

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ISO 3405, *Petroleum products – Determination of distillation characteristics at atmospheric pressure.*

ISO 3675, *Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method.*

~~ISO 4259, *Petroleum products – Determination and application of precision data in relation to methods of test.*~~ **Amdt 1**

ISO 4259-1, *Petroleum and related products – Precision of measurement methods and results – Part 1: Determination of precision data in relation to methods of test.* **Amdt 1**

ISO 4259-2, *Petroleum and related products – Precision of measurement methods and results – Part 2: Interpretation and application of precision data in relation to methods of test.* **Amdt 1**

ISO 6246, *Petroleum products – Gum content of light and middle distillate fuels – Jet evaporation method.*

ISO 7536, *Petroleum products – Determination of oxidation stability of gasoline – Induction period.*

ISO 12185, *Crude petroleum and petroleum products – Determination of density Oscillating U-tube method.*

ISO 22854, *Liquid petroleum products – Determination of hydrocarbon types and oxygenates in automotive-motor gasoline and in ethanol (E85) automotive fuel – Multidimensional gas chromatography method.* **Amdt 1**

SANS 465, *Automotive fuels – Requirements and specifications for fuel ethanol as a blending component with petrol.* **Amdt 1**

~~SANS 1164, *Automotive fuels – Requirements and specifications for fuel ethanol as a blending component with petrol.*~~ **Amdt 1**

SANS 1518, *Transport of dangerous goods – Design, construction, testing, approval and maintenance of road vehicles and portable tanks.*

SANS 10089-1, *The petroleum industry – Part 1: Storage and distribution of petroleum products in above-ground bulk installations.*

SANS 10089-2, *The petroleum industry – Part 2: Electrical and other installations in the distribution and marketing sector.*

SANS 10089-3, *The petroleum industry – Part 3: The installation, modification, and decommissioning of underground storage tanks, pumps/dispensers and pipework at service stations and consumer installations.*

SANS 10131, *Above-ground storage tanks for petroleum products.*

SANS 10187-1, *Load securement on vehicles – Part 1: General requirements.*

SANS 10187-6, *Load securement on vehicles – Part 6: Containers.*

SANS 10187-8, *Load securement on vehicles – Part 8: Dangerous goods.*

SANS 10228, *The identification and classification of dangerous goods for transport by road and rail modes.*

SANS 10229-1, *Transport of dangerous goods – Packaging and large packaging for road and rail transport – Part 1: Packaging.*

SANS 10229-2, *Transport of dangerous goods – Packaging and large packaging for road and rail transport – Part 2: Large packaging.*

SANS 10231, *Transport of dangerous goods – Operational requirements for road vehicles.*

SANS 10232-1, *Transport of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transport.*

SANS 10232-3, *Transport of dangerous goods – Emergency information systems – Part 3: Emergency response guides.*

SANS 10232-4, *Transport of dangerous goods – Emergency information systems – Part 4: Transport emergency card.*

SANS 10233, *Transport of dangerous goods – Intermediate bulk containers for road and rail transport.*

SANS 10234, *Globally Harmonized System of classification and labelling of chemicals (GHS).*

SANS 10263-0, *The warehousing of dangerous goods – Part 0: General requirements.*

SANS 10405, *Transport of dangerous goods by rail – Operational and design requirements and emergency preparedness.*

3 Definitions

For the purposes of this document, the following definitions apply.

3.1

acceptable

acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant

3.2

additive

substance intentionally added to a petroleum product in trace or small quantities in order to improve one or more of the petroleum product's performance or storage stability, its performance in an engine, or a reduction of the emissions from an engine powered by that petroleum product

3.3

clean fuels 1

CF1

permitted petrol grades introduced as the first phase of the clean fuels in the relevant national legislation (see foreword)

3.4

clean fuels 2

CF2

permitted petrol grades introduced as the second phase of the clean fuels in the relevant national legislation (see foreword)

3.5

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referee method
prescribed test method to be used in the event of a dispute

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4 Requirements

4.1 General

4.1.1 The petrol shall be a fuel composed of hydrocarbons and other organic molecules to which additives might have been added and shall be suitable for use in spark-ignition internal-combustion engines other than aviation piston engines. The petrol can also contain small quantities of harmless colouring materials to give it a distinctive appearance.

NOTE For information on materials compatibility, see annex A.

4.1.2 At 20 °C or at the ambient temperature (whichever is higher), the petrol shall be clear and free from visible water, sediment, suspended matter and any other contaminant that can cause malfunctioning of equipment designed to use this type of fuel.

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

4.1.3 Both CF1 “metal free” unleaded petrol and CF2 unleaded petrol grades can be delivered as either petrol that has fuel ethanol content of not more than 5 % volume fraction of fuel ethanol or petrol that has fuel ethanol content of between 5 % volume fraction and 10 % volume fraction.

4.1.4 Both CF1 “metal containing” unleaded petrol and CF2 lead replacement petrol grades shall not contain more than 5 % volume fraction of fuel ethanol.

4.1.5 Fuel ethanol used for blending with petrol shall conform to ~~SANS 1164~~ SANS 465. **Amdt 1**

NOTE For water tolerance test, see annex B.

4.1.6 Permitted CF1 petrol grades are metal containing unleaded petrol and metal free unleaded petrol.

4.1.7 Permitted CF2 petrol grades are lead replacement petrol (LRP) and unleaded petrol (ULP).

NOTE 1 For the quality verification of petrol, see annex C.

NOTE 2 CF1 metal-containing and metal-free petrol grades are the same and equivalent to the CF2 LRP and ULP petrol grades respectively.

4.2 Additives

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

Caution 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.

4.3 Other requirements

4.3.1 All grades of CF1 and CF2 petrol that have fuel ethanol content of not more than 5 % volume fraction shall comply with the requirements given in table 1 and table 3.

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4.3.2 The CF1 “metal free” unleaded petrol and the CF2 unleaded petrol grades that have fuel ethanol content of between 5 % (volume fraction) and 10 % (volume fraction) shall comply with the requirements given in table 2.

4.3.3 Metal based additives and phosphorus based additives can be added to CF1 “metal containing” petrol grades and CF2 lead replacement petrol grades.

Caution These grades shall contain sufficient additives to provide adequate exhaust valve seat recession protection.

4.3.4 Metal based additives and phosphorus base additives shall not be added to CF1 “metal free” unleaded petrol and CF2 unleaded petrol.

4.3.5 Addition of silicon or silicon containing component(s) to all grades of petrol is prohibited.

Table 1 — Requirements for all petrol grades with ethanol content of not more than 5 % (volume fraction)

1 Property	2 Units	3 Requirement					4 Test method
		a			b		
		CF1			CF2		
Octane: a) Research octane number, RON, min. b) Motor octane number, MON, min.		95	93	91	95	93	ASTM D2699 ^k or IP 237 ASTM D2700 ^k or IP 236
		85	83	83	85	83	
Density	kg/m ³	710 to 785 at 20 °C			716 to 771 at 20 °C 720 to 775 ^c (Report at 15 °C)		ASTM D1298 or ASTM D4052 ^k or IP 160 or IP 365 or ISO 3675 or ISO 12185
Sulfur content: a) Metal-containing unleaded petrol, max. b) Metal-free unleaded petrol, max. c) Unleaded petrol, max d) Lead replacement petrol, max.	mg/kg	1 500 500 - -			10 10		ASTM D2622 or ASTM D5453 ^k , IP336 ^l or ASTM D4294 ⁱ
Aromatic content, max.	% (volume fraction)	50			35		ASTM D1319 or ASTM D5580 or ASTM D5443 ^k
Benzene content, max.	% (volume fraction)	5			1		EN 12177 or EN 238 or ASTM D5580 or ASTM D5443 ^k , or ASTM D3606 or ASTM D6730
Olefins content, max	% (volume fraction)	-			21		ASTM D1319 ^k , ISO 22854
Manganese content^g, max. a) Metal-containing unleaded petrol, max. b) Metal-free unleaded petrol, max. c) Unleaded petrol, max. d) Lead replacement petrol, max.	mg/L	36 See 4.3 - -			- - See 4.3 36		ASTM D3831 ^k
Potassium content^g, max. a) Metal-containing unleaded petrol, max. b) Metal-free unleaded petrol, max. c) Unleaded petrol, max. d) Lead replacement petrol, max.	mg/L	10 See 4.3 - -			- - See 4.3 10		IP 456 ^k
Phosphorus content^g, max. a) Metal-containing unleaded petrol, max. b) Metal-free unleaded petrol, max. c) Unleaded petrol, max. d) Lead replacement petrol, max.	mg/L	14 See 4.3 - -			- - See 4.3 14		ASTM D3231 ^k
Lead content, max.	mg/L	5					ASTM D5059 or ASTM D3237 ^k or ASTM D3348 or ASTM D3341 or IP 270 or IP 228 or IP 362 or IP 352
Oxidation stability (induction period), min.	min	360					ASTM D525 ^k or IP 40 or ISO 7536
Copper strip corrosion (3 h at 50 °C), max.	rating	Class 1					ASTM D130 ^k or IP 154

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Table 1 (continued)

1 Property	2 Units	3		4	5 Test method
		Requirement		CF2 ^b	
		CF1 ^a			
Distillation					
a) Temperature for:					
Initial boiling point,	°C	Report	Report		
10 % (volume fraction) evaporated,	°C	65			
max.					
50 % (volume fraction) evaporated,	°C	77 to 115			
max					
90 % (volume fraction) evaporated,	°C	185			
max.					
b) Final boiling point, °C, max.	% (volume fraction)	215	210		
c) Residue, max.		2,0	2,0		ASTM D86 ^k or IP 123 or ISO 3405
d) Evaporated to 70 °C (E70),					
1) Summer ^e	% (volume fraction)	Report	18 to 48		
2) Winter ^e	% (volume fraction)	Report	20 to 50		
e) Evaporated to 100 °C (E100),	% (volume fraction)		46 to 71		
f) Evaporated to 150 °C (E150), min.	% (volume fraction)		75		
Reid vapour pressure (RVP),					
1) Summer ^e	kPa	45 to 75	47 to 65 ^f		See 6.4
2) Winter		45 to 75	52 to 75		
Vapour lock index, VLI = 10 RVP + (7 x E70)		See table 3			See 6.5 See annex D
Existent gum (washed), max.	mg/100 mL	5			ASTM D381 ^k or IP 131 or ISO 6246
Potential gum (washed) (2,5 h at 100 °C), max.	mg/100 mL	4			ASTM D873 ^k or IP 138
Total acidity^d, max.	mg KOH/g	0,03			ASTM D3242 ^k or IP 354
Doctor test or Mercaptan sulfur, max.	rating	-	Negative		IP 30
	% (mass fraction)	-	0,0015		ASTM D3227 ^k or IP 342
Oxygen content					
a) Inland, max.	% (mass fraction)	3,7	3,7		ASTM D4815 ^k , EN 1601 or EN 13132 or ISO 22854
b) Coastal, max.	% (mass fraction)	2,8	3,7		
Oxygenates content^m, max.					
Methanol ^h		coast / inland	national		
Ethanol ⁱ		3,0 / 3,0	3,0		
Iso-propyl alcohol			5,0		
Iso-butyl alcohol	% (volume fraction)	5,0 / 5,0	12,0		EN 1601 or EN 13132 or ISO 22854 or ASTM D4815 ^k
Tert-butyl alcohol		10,0 / 12,0	15,0		
Ethers (5 or more C atoms)		10,0 / 15,0	15,0		
Other oxygenates		10,0 / 15,0	22,0		
		15,0 / 22,0	15,0		
		10,0 / 15,0			
NOTE ASTM D1250 and IP 200 should be used for correlation of densities at 15 °C and 20 °C respectively.					
^a CF1 = Clean fuels 1.					
^b CF2 = Clean fuels 2.					

Table 1 (concluded)

c	Density to be measured and controlled at 20 °C and reported at 15 °C .
d	Applicable only to fuels containing oxygenates.
e	Summer = 1 October to 31 March (inclusive). Winter = 1 April to 30 September (inclusive).
f	Waiver of additional 5 kPa allowed for petrol that has ethanol content of more than 2 % (volume fraction) during summer.
g	No other metal containing additives are allowed except those listed.
h	Stabilising agents shall be added.
i	Other mono-alcohols and ethers with a final boiling point no higher than prescribed in this table. The n-propanol should not be greater than 0,1 % (volume fraction).
j	Fuel ethanol shall comply with SANS 1164 SANS 465. Amdt 1
k	Referee test method.
l	Methods IP 336 and ASTM D4294 are only applicable for sulfur levels more than 16 mg/kg.
m	Combination of individual oxygenates shall not exceed the total oxygen content by mass.

Table 2 — Requirements for petrol grades with ethanol content between 5 % (volume fraction) and 10 % (volume fraction)

Property	Units	Requirement					Test method
		CF1 ^a			CF2 ^b		
Octane a) Research octane number, RON, min. b) Motor octane number, MON, min.		95	93	91	95	93	ASTM D2699 ^k or IP 237 ASTM D2700 ^k or IP 236
Density	kg/m ³	710 to 785 at 20 °C			716 to 771 at 20 °C 720 to 775 (Report ^c at 15 °C)		ASTM D1298 or ASTM D4052 ^k or IP 160 or IP 365 or ISO 3675 or ISO 12185
Sulfur content: a) Metal-free unleaded petrol, max. b) Unleaded petrol, max.	mg/kg	500			10		ASTM D2622 or ASTM D5453 ^k , IP336 ⁱ or ASTM D4294 ⁱ
Aromatic content, max.	% (volume fraction)	50			35		ASTM D1319 or ASTM D5580 or ASTM D5443
Benzene content, max.	% (volume fraction)	5			1		EN 12177 or EN 238 or ASTM D5580 or ASTM D5443 ^k , or ASTM D3606 or ASTM D6730
Olefins content, max	% (volume fraction)	-			21		ASTM D1319 ^k , ISO 22854
Manganese content^j, max. a) Metal-free unleaded petrol, max. b) Unleaded petrol, max.	mg/L	See 4.3					ASTM D3831 ^k
Potassium content^j, max. a) Metal-free unleaded petrol, max. b) Unleaded petrol, max	mg/L	See 4.3					IP 456 ^k
Phosphorus content^j, max. a) Metal-free unleaded petrol, max. b) Unleaded petrol, max.	mg/L	See 4.3					ASTM D3231 ^k
Lead content, max.	mg/L	5					ASTM D5059 or ASTM D3237 ^k or ASTM D3348 or ASTM D3341 or IP 270 or IP 228 or IP 362 or IP 352
Distillation a) Initial boiling point, °C b) Final boiling point, °C, max. c) Residue, max. d) Evaporated to 70 °C (E70), 1) Summer ^e 2) Winter ^e e) Evaporated to 100 °C (E100), f) Evaporated to 150 °C (E150), min.	°C % (volume fraction) % (volume fraction) % (volume fraction) % (volume fraction)	Report 215 2,0		Report 210 2,0			ASTM D86 ^k or IP 123 or ISO 3405
		22 to 50		22 to 50			
		24 to 52		24 to 52			
		46 to 72		46 to 72			
		75		75			

Table 2 (concluded)

Property	Units	Requirement		Test method
		CF1 ^a	CF2 ^b	
Reid vapour pressure (RVP), 1) Summer ^d 2) Winter	kPa	45 to 75 45 to 75	45 to 70 50 to 75	See 6.4
Oxidation stability (Induction period), min.	min	360		ASTM D525 ^k or IP 40 or ISO 7536
Existent gum (washed), max.	mg/100 mL	5		ASTM D38 ^{k1} or IP 131 or ISO 6246
Potential gum (washed) (2,5 h at 100 °C), max.	mg/100 mL	4		ASTM D873 ^k or IP 138
Copper strip corrosion (3 h at 50 °C), max.	rating	Class 1		ASTM D130 ^k or IP 154
Total acidity, max.	mg KOH/g	0,03		ASTM D3242 ^k or IP 354
Doctor test or Mercaptan sulfur (max.)	rating % (mass fraction)	- -	Negative 0,0015	IP 30 ASTM D3227 ^k or IP 342
Oxygen content ^g , max.	% (mass fraction)	3,7		ASTM D4815 ^k , EN 1601 or EN 13132 or ISO 22854
Oxygenates content ^e , max. Methanol ^f Ethanol ^h , min. Ethanol ^h , max. Iso-propyl alcohol Iso-butyl alcohol Tert-butyl alcohol Ethers (5 or more C atoms). Other oxygenates ^g	% (volume fraction)	3,0 5,0 10,0 12,0 15,0 15,0 22,0 15,0		EN 1601 or EN 13132 or ASTM D4815 ^k , ISO 22854
NOTE ASTM D1250 and IP 200 should be used for correlation of densities at 15 °C and 20 °C respectively.				
<p>^a CF1 = Clean fuels 1.</p> <p>^b CF2 = Clean fuels 2.</p> <p>^c Density to be measured and controlled at 20 °C and reported at 15 °C.</p> <p>^d Summer = 1 October to 31 March (inclusive). Winter = 1 April to 30 September (inclusive).</p> <p>^e Combination of individual oxygenates shall not exceed the total oxygen content by mass.</p> <p>^f Stabilising agents shall be added.</p> <p>^g Other mono-alcohols and ethers with a final boiling point no higher than prescribed in this table. The n-propanol should not be greater than 0,1 % (volume fraction).</p> <p>^h Fuel ethanol shall comply with SANS 4164 SANS 465. Amdt 1</p> <p>ⁱ Methods IP 336 and ASTM D4294 are only applicable for sulfur levels more than 16 mg/kg.</p> <p>^j No other metal containing additives are allowed except those listed.</p> <p>^k Referee test method</p>				

Table 3 — Vapour lock index (VLI) limits effective date progression

1	2	3	4	5	6
Effective date	ULP and LRP (Inland)		ULP and LRP (Coastal)		Test method
	VLI (summer) ^a , max.	VLI (winter) ^b , max.	VLI (summer) ^a , max.	VLI (winter) ^b , max.	
Current	930	980	990	1 040	See 6.5 and annex D
01-Oct-15	950	1 000	1 010	1 050	
01-Oct-16	950	1 000	1 010	1 050	
01-Oct-17	970	1 020	1 030	1 050	
01-Oct-18	990	1 040	1 050	1 050	
01-Oct-19	1 010	1 050	1 050	1 050	
01-Oct-20	1 030	1 050	1 050	1 050	
01-Oct-21	1 050	1 050	1 050	1 050	
NOTE For calculation see 6.5 for vapour lock index.					
^a Summer = 1 October to 31 March (inclusive).					
^b Winter = 1 April to 30 September (inclusive).					

5 Logistic requirements

5.1 Packing and transport

The condition of the drums, intermediate bulk containers, rail and road tank vehicles and shipping cargo tanks shall be of sound construction, clean, dry and of suitable material such as not to be detrimental to the quality of the petrol during normal transportation and storage.

The following standards apply for the packing and transport of petrol: SANS 1518, SANS 10187-1, SANS 10187-6, SANS 10187-8, SANS 10229-1, SANS 10229-2, SANS 10231, SANS 10232-1, SANS 10232-3, SANS 10232-4, SANS 10233 and SANS 10405.

5.2 Classification and labeling

5.2.1 The following information shall appear in prominent, legible and indelible marking on each drum or, in the case of petrol filled in bulk storage tanks or bulk carriers, in the storage and consignment documents of each bulk carrier:

- a) the manufacturer's (or the supplier's) name or the brand name of the product (or both);
- b) a description of the product, i.e.,
 - 1) batch identification, and
 - 2) the quantity of the contents.

5.2.2 The information on each drum, bulk storage tank or bulk carrier shall be in accordance with the following standards: SANS 10228, SANS 10229-1, SANS 10229-2, SANS 10232-1, SANS 10233 and SANS 10234.

5.2.3 For the labelling, placarding and preparation of shipping documents for fuel that complies with the requirements of this standard, the following shall apply:

- a) the hazard-class diamond, as for class 3 dangerous goods;
- b) the proper shipping name: "PETROL";
- c) the substance identification number (S.I.N.): UN1203; and
- d) other information including the supplier's brand name or trade mark, the name of the petrol grade, the description "PETROL" and the quantity.

5.3 Storage equipment for petrol

The following standards apply for storage equipment for petrol SANS 10089-1, SANS 10089-2, SANS 10089-3, SANS 10131 and SANS 10263-0.

6 Methods of test

6.1 General

6.1.1 For all properties, use the applicable method (or, when relevant, one of the applicable methods) listed in the column 8 of tables 1 and 2, and column 6 of table 3.

NOTE The test methods listed in the table 1, table 2 and table 3 have been shown to be applicable in an interlaboratory test program. Precision data from this program are incorporated in the test method.

6.1.2 In the case of dispute regarding the determination of a specific property the test method marked with the superscript "k" shall be used as the referee test method.

6.2 Sampling

6.2.1 Use the relevant sampling procedure described in method ASTM D4057 (referee method) or ASTM D4177 or ISO 3170, as appropriate, to obtain the samples for testing, and deem the samples so taken to represent the lot for the respective properties.

6.2.2 In view of the sensitivity of some of these test methods referred to in this document, particular attention shall be paid to compliance with any guidance on sample containers required by the specific test method. The sample size, sample container and method shall be defined by the test method requirements.

6.3 Precision and dispute

6.3.1 All test methods referred to in this 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 ISO 4259-1 and ISO 4259-2, shall be used.

6.3.2 In cases of dispute concerning results, the applicable referee method should be used.

6.4 Reid vapour pressure (RVP)

6.4.1 When testing petrol containing no alcohol, use test method ASTM D323 or IP 69 or ASTM D5191 or ASTM D4953 (referee method).

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6.4.2 When testing petrol blends containing oxygenates in the form of alcohols or alcohol and ether mixtures, use test method ASTM D4953 (referee method).

NOTE 1 When alcohol is present in the petrol, the water introduced when test method ASTM D323 or IP 69 is used will extract some of the alcohol, causing low Reid vapour pressure values to be obtained.

NOTE 2 See annex E for the alcohol content test.

6.5 Vapour lock index (VLI)

The vapour lock index is an additional parameter which characterizes the volatility properties of petrol, and is calculated using the formula

$$VLI = 10 RVP + 7 E70$$

where

RVP is the Reid vapour pressure, in kilopascals (kPa);

E70 is the percentage volume fraction of petrol, evaporated to 70 °C.

NOTE See annex D for additional information on vapour lock index.

Annex A
(informative)

Materials compatibility

It is recognized and accepted that there can be interactions (in the fuel system) between the materials used in the manufacturing and assembly of motor vehicle fuel systems, and the fuel supplied, such that malfunctioning of motor components can occur. In order to minimize such risks, fuel suppliers and motor manufacturers have agreed that:

- a) the petrol supplied will, as far as is within reason and technically possible, be compatible with the fuel system component materials that have hitherto been used;
- b) the vehicle fuel system component materials will, as far as is within reason and technically possible, be compatible with the fuels that have hitherto been supplied; and
- c) any significant changes to the petrol composition or to the fuel system component materials will be subject to testing before introduction, to prove suitability for the purpose intended.

Annex B
(informative)

Water tolerance test

B.1 Scope

Blends of petrol and alcohol and oxygenates can, from time to time, cause problems with wet or dry corrosion (or both). The water tolerance test determines the ability of such blends to retain water in solution or in a stable suspension at the specified temperature to which they are likely to be exposed in use.

B.2 Apparatus and materials

B.2.1 Glass measuring cylinder, of capacity 100 mL and fitted with a ground-glass stopper.

B.2.2 Micropipette (complete with disposable tip), capable of accurately dispensing a volume of 200 μL .

B.2.3 Water, distilled or de-ionized.

B.3 Procedure

NOTE Conduct the test at a temperature of $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

B.3.1 Rinse the measuring cylinder (including its stopper) with the test sample and allow to drain.

B.3.2 Fill the measuring cylinder up to the 100 mL graduation mark with the test sample and, using the micropipette, add 200 μL of the water.

B.3.3 Stopper the measuring cylinder, shake vigorously for 1 min, and then inspect the test specimen for signs of phase separation or persistent haze.

B.3.4 Report the sample as having passed the test if no sign of phase separation or persistent haze is visible.

Annex C

(informative)

Quality verification of petrol

When a purchaser requires ongoing verification of the quality of petrol, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection it should be noted that SANS 9001 covers the provision of an integrated quality system.

Annex D

(informative)

Vapour lock index (VLI)

Petrol should be sufficiently volatile to ensure ease of starting and acceptable cold weather driveability while excessive volatility can lead to hot weather driveability or hot fuel handling issues. Ambient conditions, both temperature and altitude, have a strong influence on the fuel vaporisation process. The volatility requirements, both to ensure sufficient volatility and limit excessive volatility, are therefore carefully controlled by season and differ for regions at different altitudes. Cold weather operability is ensured through control of the minimum vapour pressure and distillation limits (either maximum T10, T50 and T90 for CF1 petrols or minimum E70, E100 and E150 for CF2 petrols). Hot weather driveability is similarly controlled by the maximum vapour pressure and maximum E70 limits. Experience has however shown, that some fuels which meet both the maximum RVP and maximum E70 limits, but are relatively high in both and are therefore excessively volatile, still have poor hot weather driveability. The vapour lock index (VLI), which is a composite index combining both RVP and E70, has been used successfully to provide sufficient protection against hot weather driveability and are thus incorporated into fuel specifications.

Annex E
(informative)

Alcohol content test

E.1 General

There may be a need from time to time in the field to establish whether or not a sample of petrol contains alcohol. The alcohol content test is simple and quick and does not require sophisticated equipment or specialist operator skills.

E.2 Apparatus and materials

NOTE Ensure that all glassware used is clean (for example, cleaned by flushing twice with acetone) and dry.

E.2.1 Glass mixing cylinder, graduated in millilitres and fitted with a ground-glass stopper. The cylinder is capable of accepting a total volume of at least 125 mL with the stopper in place.

E.2.2 Glass measuring cylinder, of capacity 100 mL.

E.2.3 Ethylene glycol, analytical reagent grade, and that can contain, if so desired, a suitable concentration of a water-soluble dye (for example 0,02 g of methyl violet per litre).

E.3 Procedure

E.3.1 Fill the mixing cylinder to exactly the 25 mL graduation mark with the ethylene glycol (taking care not to wet the wall of the cylinder with the ethylene glycol) and, using the measuring cylinder, add 100 mL of the petrol under test.

E.3.2 Stopper the mixing cylinder, invert it and shake it back and forth 25 times in 15 s, using strokes each of length approximately 25 cm.

E.3.3 Immediately thereafter, place the mixing cylinder on a vibration-free surface, allow the contents to settle undisturbed for 5 min, and then record, to the nearest 0,2 mL, the volume of the layer of ethylene glycol and alcohol in the bottom of the cylinder.

E.3.4 Calculate the difference between the volume of the layer of ethylene glycol and alcohol and the volume of the ethylene glycol used for the extraction (i.e. 25 mL), and report it as the percentage, by volume, of alcohol in the petrol.

Bibliography

ASTM D1250, *Standard guide for use of the petroleum measurement tables*. (Description only; tables published separately in 12 volumes.)

CEN/TR 15367-2, *Petroleum products – Guide for good housekeeping – Part 2: Automotive petrol fuels*.

CEN/TR 15367-3, *Petroleum products – Guide for good housekeeping – Part 3: Prevention of cross contamination*.

IP 200, *Standard guide for use of the petroleum measurement tables*.

SANS 1020, *Power-operated dispensing devices for flammable liquid fuels*.

SANS 9001/ISO 9001, *Quality management systems – Requirements*.