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SANS 342:2016

Edition 5 1

# SOUTH AFRICAN NATIONAL STANDARD

Automotive fuels — Requirements and test methods for diesel

# **WARNING**

This document references other documents normatively.

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# Table of changes

Change No.	Date	Scope	
Amdt 1	2016	Amended to update the foreword, definitions	referenced standards and

#### 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 December 2016

This document supersedes SANS 342 2014 (edition 5)

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

I Reference IS made In 3 3 and In the note to 3 3 to the "relevant national legislation" In South Africa this means the Regulations of the Petroleum Products Act, 1977 (Act No 120 of 1977), as published by Government Notice No R 627 (Government Gazette No 28958) of 23 June 2006

- I Reference IS made In the note to 3 3 to "relevant national department" In South Africa this means the Department of Energy Arndt 1
- I Reference IS made In 3 4 and In the note to 34 to the "relevant national legislation" In South Africa this means the Regulations of the Petroleum Products Act, 1977 (Act No 120 of 1977), as published by Government Notice No R 431 (Government Gazette No 35410) of 1 June 2012

I Reference IS made In the note to 34 to "relevant national department" In South Africa this means the Department of Energy Amdt 1

Reference IS made In 44 to the "relevant national legislation" In South Africa, this means the Petroleum Products Act, 1977 (Act No 120 of 1977)

Annex A IS for Information only

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# Automotive fuels — Requirements and test methods for diesel

# 1 Scope

This standard specifies the grades of automotive diesel fuel containing up to a volume fraction of 5 % of automotive biodiesel in accordance With SANS 1935, and sultable for use in compression-lightlon engines, Including high-speed 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 and liquid fuels at atmosphenc pressure

ASTM D93, Standard test methods for flash pont by Pensky-Martens closed cup tester

ASTM DI 30, Standard test method for corrosweness to copper from petroleum products by copper stnp test

ASTM D445, Standard test method for kinematlc viscosity of transparent and opaque liquids (and the calculation of dynamc wscosity)

ASTM D482, Standard test method for ash from petroleum products

ASTM D613a, Standard test method for cetane number of diesel fuel 011

ASTM D976, Standard test methods for calculated cetane Index of distillate fuels

ASTM D1298b, Standard test method for density, relative density, or API gravity of crude petroleum and liquid petro/eum products by hydrometer method

ASTM D2274, Standard test method for oxidation stability of distillate fuel 011 (accelerated method)

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Edition 5.1 ASTM D2425, Standard test method for hydrocarbon types ln middle distillates by mass

ASTM D2500, Standard test method for cloud point of petroleum products

spectrometry

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ASTM D2622, Standard test method for sulfur In petroleum products by wavelength disperswe X-ray fluorescence spectrometry

ASTM [)4052, Standard test method for density, relative density, and API gravity of liquids by digital density meter

ASTM [)4057, 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 D4377, Standard test method for water In crude Olls by potentiometric Karl Fischer titration

ASTM [)4530, Standard test method for determination of carbon residue (mcro method)

ASTM [)4737, Standard test method for calculated cetane Index by four vanable equation

ASTM D5453, Standard test method for determnation of total sulfur In light hydrocarbons, spark ignition engine fuel, diesel engtne fuel, and engine 011 by ultraviolet fluorescence

ASTM [)5772, Standard test method for cloud pont of petroleum products (linear coollng rate method)

ASTM D6304, Standard test method for deterrmnation of water In petroleum products lubncating Olls, and additives by coloumetric Karl Fischer titration

ASTM [)6371, Standard test method for cold filter pluggng point of diesel and heating fuels

ASTM [)6890, Standard test method for determnation of Ignition delay and derwed cetane number (DCN) of diesel fuel ONS by combustion in a constant volume chamber

ASTM [)7042, Standard test method for dynarmc wscoslty and density of liquids by Stabinger wscometer (and the calculation of kinematic wscoslty)

ASTM D7170a, Standard test method for determnation of denved cetane number (DCN) of diesel fuel Olls — Fixed range Injection per10d, constant volume combustion chamber method

ASTM D7371, Standard test tethod for deterrmnation of biodiesel (fatty acid methyl esters) content in diesel fuel 011 Sing mid-infrared spectroscopy (FTIR-A TR-PLS method) Amdt 1

ASTM D7668, Standard test method for deterrmnation of derived cetance number (DCN) of diesel fuel Olls — Ignition delay and combustion delay using a constant volume combustion chamber method

ASTM [)7806, Standard test method for determination of the fatty acid methyl ester (FAME) content of a blend of biodiesel and petroleum-based diesel fuel 01/ uslng mld-lnfrared spectroscopy Amdt 1

CEC F-06 A-96, Diesel engines - Diesel fuel - Performance and test method for assessing fuel lubricity

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EN 1 16, Diesel and domestic heating fuels — Determination of cold filter pluggling pont EN 12662, Liquid petroleum products — Determination of contamination In middle distillates

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EN 12916, Petroleum products — Determination of aromatic hydrocarbon types In middle distillates — High performance liquid chromatography method With refractive Index detection

EN 14078, Liquid petroleum products — Deterrmnafion of fatty acid methyl ester (FAME) content In middle distillates — Infrared spectrometry method

EN 15195, Liquid petroleum products — Determination of Ignition delay and denved cetane number (DCN) of middle distillate fuels by combustion In a constant volume chamber

EN 15751, Automotive fuels — Fatty acid methyl ester (FAME) fuel and blends With diesel fuel — Determination of oxidation stability by accelerated oxidation method

EN 23015, Petroleum products — Determination of cloud point

IP 4, Petroleum products — Determination of ash

IP 34, Determinations of flash pont — Pensky-Martens closed cup method

IP 41, Petroleum products — Determination of the Ignition quality of diesel fuels — Cetane engine method

IP 71, Petroleum products — Transparent and opaque liquids — Section 1 Determination of kinematic viscosity and calculation of dynamic viscosity

IP 74, Petroleum products and bituminous materials — Determination of water— Distillation method

IP 123, Petroleum products — Determination of distillation characteristics at atmosphenc pressure

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 219, Petroleum products — Determination of cloud point

IP 309, Diesel and domestic heating fuels — Determination of cold filter plugging point

IP 336, Petroleum products — Determination of sulfur content — Energy-disperswe-)<-ray fluorescence method

IP 356, Crude petroleum — Determination of water — Potentiometric Karl Fischer titration method

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IP 365, Crude petroleum and petroleum products — Determination of density — Oscillating Utube method

IP 388, Petroleum products — Determination of the oxidation stability of middle-distillate fuels

IP 391, Petroleum products — Determination of aromatic hydrocarbon types In middle distillates — High performance liquid chromatography method With refractive Index detection

IP 440, Liquid petroleum products — Determination of contamination In middle distillates

IP 450, Diesel fuel — Assessment of lubricity using the high-frequency reciprocating ng (HFRR) - Part 1 Test method Amdt 1

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IP 498, Determination of Ignition delay and dewed cetane number (DCN) of middle distillate fuels by combustion In a constant volume chamber

IP 574, Automotive fuels — Fatty acid methyl ester (FAME) fuel and blends With diesel fuel — Determination of oxidation stability by accelerated oxidation method

ISO 2160, Petroleum products — Corrosiveness to copper — Copper stnp test ISO 2719,

Determination of flash point - Pensky-Martens closed cup method

ISO 3015, Petroleum products — Determination of cloud pont

ISO 3104, Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity

ISO 3170, Petroleum liquids — Manual sampling

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

ISO 5165, Petroleum products — Determination of the Ignition quality of diesel fuels — Cetane engine method

ISO 6245, Petroleum products — Determination of ash

ISO 10370, Petroleum products — Determination of carbon residue — Micro method

ISO 12185, Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method

ISO 12205, Petroleum products — Determination of the oxidation stability of middle-distillate fuels

ISO 12937, Petroleum products — Determination of water — Coulometric Karl Fischer titration method

ISO 12156-1, Diesel fuel — Assessment of lubricity using the high-frequency reciprocating ng (HFRR) \_ part I Test method

ISO 13759, Petroleum products — Determination of alkyl nitrate In diesel fuels — Spectrometric method

SANS 833, Biodiesel production - Quality management system - Producer requirements

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

SANS 1935, Automotive biodiesel — Fatty Acid Methyl Esters (FAME) for diesel engines ...Requirements and test methods

SANS 10131, Above-ground storage tanks for petroleum products

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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 decornmsslomng of underground storage tanks, pumps/dlspensers and ppework at service stations and consumer Installations

SANS 10187-1, Load securement on vefficles - Part 1 General requrements

#### SANS 10187-6, Load securement on vefficles — Part 6 Containers

SANS 10187-8, Load securement on vefficles — 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 rafl transport — Part 1 Packaging

SANS 10229-2, Transport of dangerous goods - Packaging and large packaging for road and rafl transport - Part 2. Large packaging

SANS 10231, Transport of dangerous goods — Operational requirements for road vefficles

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, Transportation of dangerous goods — Intermedlate bulk containers for rail and road transport

SANS 10234, Globally Harmonzed System of classification and labelling of chemcals (GHS)

SANS 10263-0, The warehousing of dangerous goods — Part 0 General requrements

# 3 Definitions

For the purposes of thIS document, the following defintlons apply

3.1 additive substance Intentionally added to a petroleum product ln trace or small quantitles ln order to Improve one or more of the petroleum product's performance or storage stability, Its

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performance in an engine, or a reduction of the errmsslons from an engine powered by that petroleum product

3.2 biodiesel renewable fuel or fuel components comprised of methyl esters of long chan fatty acids that comply With SANS 1935, and that are produced ln accordance With SANS 833

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CFI cleaner fuels 1 standard grade diesel With a maximum sulfur content of 500 mg/kg, and low sulfur grade With a maximum sulfur content of 50 mg/kg, where both grades may contan a biodiesel content of not more than 5 % (volume fraction), and which are as referenced In the relevant national legislation (see foreword)

NOTE The validity of the relevant national legislation (see foreword) IS to be determined at a future date by the relevant national department (see foreword)

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3.4 CF2 cleaner fuels 2 low sulfur grade diesel With a maximum sulfur content of 10 mg/kg, which may contan a biodiesel content of not more than 5 % (volume fraction), and which IS referenced In the relevant national legislation (see foreword)

NOTE The validity of the relevant national legislation (see foreword) IS to be determined at a future date by the relevant national department (see foreword)  $\,$  Amdt 1

3.5 lot quantity of diesel fuel In containers bearing the same brand name or trade mark, grade designation and batch Identification, from one manufacturer or a supplier, and submitted at any one time for Inspection and testing

# 4 Requirements

### 4.1 General

- 4.1.1 The diesel fuel shall be of one of the following
- a) CFI standard diesel 500 mg/kg, or
- b) CFI low sulfur diesel 50 mg/kg, or
- c) CF2 low sulfur grade diesel 10 mg/kg
- 4.1.2 The fuel shall comply With the relevant requirements given In table 1, and 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

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NOTE For further Information on preventing contamination by water or sediment that may occur In the supply chan or cross contamination see CENfTR 15367-1 and CEN[TR 15367-3, respectively

#### 4.2 Automotive diesel fuel

The requirements for all automotive diesel fuel are given In table 1

NOTE For further Information on the quality verification of automotive diesel fuel see annex A

#### 4.3 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 driveabllty and emission control durability Other technical means With equivalent effect may also be used

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# 4.4 Biodiesel blending

Where the fuel IS blended With automotive biodiesel, the biodiesel component shall not be more than 5 % (volume fraction) of the total blend (see table 1) The biodiesel component used In such blends shall comply With SANS 1935

For higher biodiesel blends refer to the relevant national legislation (see foreword)

It IS strongly recommended to add oxidation stability enhancing additives In the biodiesel product at the production stage and before storage, providing an action similar to that obtained With 1 000 mg/kg of 3,5-dl-tert-butyl-4-hydroxy-toluol (butylated hydroxyl-toluene, BHT)

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Table 1 — Requirements for all automotive diesel fuel

Table 1 — Requirements for all automotive diesel fuel				
1	2	3	4	5
D (	Units	Requirement		T. 4. 4. 1.
Property		CFI	CF2	Test method
Sulfur content for		500		ASTM 02622,
a) Standard diesel 500 ppm, max		50		ASTM D5453 <sup>a</sup> , IP 336 <sup>b</sup> or
b) Low sulfur diesel 50 ppm, max				ASTM D4294
c) Low sulfur diesel 10 ppm, max	mg/kg mg/kg mg/kg		10	ASTM D5453 <sup>a</sup> or ASTM D2622
Biodiesel content (FAME), max	% (volume fraction)			ASTM D7371 , ASTM D7806 or EN 14078 <sup>a</sup> (see 4 4)
Polyaromattc hydrocarbons, max	% (mass fraction)		8	IP 391, ASTM D2425 or EN 12916
Cetane number , min		45	51	ASTM D613a <sup>a</sup> , IP 41 ISO 5165, EN 15195, ASTM 06890, IP 498, ASTM D7668, or ASTM D7170a
d Density	kg/m3	800,0 min (at 20 ° c)	801 to 847 (at 20 ° c) 805 to 850 (report at 15 ° C)	ASTM D4052 <sup>a</sup> , ASTM D1298b, IP 160 IP 365, ISO 3675, or ISO 12185
Distillation		362		IP 123, or
T90, max T95, max Recovered at 250 °c (E250), max Recovered at 350 °c (E350), mn	% (volume fraction) % (volume fraction)		360 65 85	ASTM D86 ISO 3405
Flash point, min		5	55	<sup>a</sup> IP 34 or ASTM D93 ISO 2719
Copper strip corrosion (3 h at 100 $^{0}$ C), classification, max	Rating	Cla	ss 1	ASTM D130 <sup>a</sup> , IP 154 or ISO 2160

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Cold filter plugging point (CFPP)  1) Summer, max  2) Winter, max (see note)		-3 -4	ASTM D6371 , IP or EN 116
Cloud Pont 1) Summer, max 2) Winter, max		+6	EN 23015, ASTM D5772, ASTM D2500 <sup>a</sup> , IP 219 or ISO 3015
Carbon residue on 10 % (volume fraction) distillation residue , max	% (mass fraction)		ASTM D4530 <sup>a</sup> or ISO 10370

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#### Table 1 (concluded)

1	2	3	4	5
D .	Units	Requirement		m , , , , , ,
Property		CFI	CF2	Test method
Ash content, max	% (mass fraction)	0,01		ASTM D482 <sup>a</sup> , IP 4 or ISO 6245
Water content, max	mg/kg	350	250	ASTM D4377, IP 74, ISO 12937, ASTM D6304 <sup>â</sup> or IP 356
Total contamination, max	mg/kg	24		EN 12662 or IP
Lubricity, corrected wear scar diameter (wsd 1,4) at 60 ° c, max	pm	460		ISO 12156-e, IP 450
Viscosity at 40 ° c	mm2/s	to	2,00 to 4,50	ASTM D445 <sup>a</sup> , ASTM D7042, ISO 3104 71 or
	mg/100 ml-	2,0 max		<sup>a</sup> IP 388 or ASTM D2274 ISO 12205
Oxidation stability	g/m3		25 max	ASTM D2274 <sup>a</sup> , IP 388 or ISO 12205
	hours		20 min g	EN 15751 a or IP 574

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NOTE In the case of a product sold In colder areas (as defined by historic meteorological data), additional CFPP Improver should be Included With the Intention to achieve —7 °C, or better

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a This IS the referee test method and shall be used In the case of a dispute regarding the determination of a specific property (See 5 2 2)

Methods IP 336 and ASTM D4294 are only applicable for sulfur levels > 16 mg/L

Provided a proven correlation between cetane number and cetane Index (ASTM D976 or ASTM [)4737) has been established (for the crude being refined), the cetane number specification may be replaced by a cetane Index specification With a mnrnum value of 48 The cetane Index correlation for synthetic derived diesel has not yet been established The basic need IS that the product shall have a minimum cetane number of 45 for CFI and shall have a mnmum cetane number of 51 for CF2 The reference method used shall be ether ASTM D613a or IP 41

Density to be measured and controlled at 20 <sup>Q</sup>C, and reported at 15 °c

Summer 1 October to 31 March (Inclusive)

Winter 1 April to 30 September (Inclusive)

The limiting value for the carbon residue given In table 1 IS based on product prior to addition of Ignition Improver, If used If a value exceeding the limit IS obtained on the finished fuel In the market, ISO 13759 shall be used as an Indicator of the presence of a nitrate-containing compound If an Ignition Improver IS thus proved present, the limit value for the carbon residue of the product under test cannot be applied The use of additives does not exempt the manufacturer or Importer from meeting the requirements of maxmum % (mass fraction), of carbon residue prior to addition of additives

For diesel fuel containing biodiesel above 2 % (volume fraction), this IS an additional requirement

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# 5 Sampling and methods of test

#### 5.1 Sampling

Use the relevant sampling procedure described in 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

In view of the sensitivity of some of these test methods referred to ln thIS document, particular attention shall be paid to compliance With any guidance on sample containers required by the specIftc test method SpecIfy the sample Size, sample container and method ln accordance With the test method requirements (see table 1)

#### 5.2 Methods of test

521 For all properties, use the applicable method (or, when relevant, one of the applicable methods) IISted In column 5 of table 1

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The test methods IISted In table 1 have been shown to be applicable In an Inter-laboratory test program Preaslon data from thIS program are Incorporated In the relevant test method (see table 1)

- 5.2.2 ln the case of dispute regarding the deterrrunation of a speciftc property, use the referee test methods as given in table I
- 5.2.3 All the test methods referred to ln thIS standard Include a precision statement in accordance With ISO 4259 in cases of dispute, the procedures specified in ISO 4259 for resoMng the dispute and for Interpretation of the resufts based on the test method preasion, shall be used

# 6 Logistic requirements

# 6.1 Packing and transport

The condition of the drums, Intermediate bulk containers, rail and road tank vehides and shipping cargo tanks shall be of sound construction, clean, dry and of sultable material such as not to be detrmental to the quality of the diesel during normal transportation and storage

For the packing and transport of diesel 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, and SANS 10233, shall apply

# 6.2 Classification and labelling

- 6.2.1 The following Information shall appear in prominent, legible and Indelible marking on each drum or, in the case of diesel filled in bulk storage tanks or bulk carriers, in the storage and consignment documents of each bulk carner
- a) the manufacturer's (or the supplier's) name or the brand name of the product or both,
- b) a description of the product,
- c) batch Identification, and
- d) the quantity of the contents

The Information on each drum, bulk storage tank or bulk carrier shall be ln accordance With SANS 10229-1, SANS 10229-2, SANS 10232-1, SANS 10233, SANS 10234, and SANS 10228

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- 6.2.2 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 'DIESEL FUEL".
- c) the substance Identification number UN 1202, and
- d) other Information Including the supplier's brand name or trade mark, the name of the fuel grade (standard or Iow sulfur), the description 'DIESEL FUEL", and the quantity

# 6.3 Storage equipment for diesel

For storage eqwpment for diesel SANS 10089-1, SANS 10089-2, SANS 10089-3, SANS 10263-0, and SANS 10131, shall apply

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# Annex A (Informative) Quality verification of automotive diesel fuel

When a purchaser requires ongoing verification of the quality of diesel fuel, It IS suggested that Instead of concentrating solely on evaluation of the final product, he also direct his attention to the supplier's quality system In this connection It should be noted that SANS 9001 covers the provision of an Integrated quality system

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CEN/TR 15367-1, Petroleum products - Guide for good housekeeping — Part 1 Automotive diesel fuels

CEN/TR 15367-3, Petroleum products - Guide for good housekeeping — Part 3 Prevention of cross contamination

SANS 9001/1SO 9001, Quality management systems - Requirements