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Zambian Standard

UNLEADED PETROL (GASOLINE) FOR MOTOR VEHICLES - Specification

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FOREWORD

This National Standard has been prepared by the Petroleum Products Technical Committee (TC 4/14), in accordance with the procedures of ZABS. All users should ensure that they have the latest edition of this publication as standards are revised from time to time.

No liability shall attach to ZABS or its Director, employees, servants or agents including individual experts and members of its Technical Committees for any personal injury, property damage or other damages of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon this ZABS publication or any other ZABS publication.

The revision of this Standard has been undertaken by the Petroleum Products Technical Committee (TC4/14). The need to be abreast with regional and international technological advancements in the petroleum sector necessitated the revision of ZS 395: 2004.

This edition of ZS 395 has incorporated requirements for

- acceptable additives; Manganese Ferrocene and Alcohol;
- Aromatics; and
- Motor Octane number (MON) for blends containing more than 2% (v/v) alcohol.

which were absent in the 2007 version

ACKNOWLEDGEMENT

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ZAMBIA BUREAU OF STANDARDS

Zambian Standard

UNLEADED PETROL (GASOLINE) FOR MOTOR VEHICLES - Specification

1. SCOPE

This Zambian Standard specifies requirements for Unleaded Petrol (gasoline) for Motor Vehicles.

2. TEST AND SAMPLING METHODS

The following Publications contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a publication is deemed to be a reference to the latest edition of that publication, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below.

ZS ASTM D 86	Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure
ZS ASTM D 130	Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
ZS ASTM D 323	Standard Test Method for Vapour Pressure of Petroleum Products (Reid Method).
ZS ASTM D 381	Standard Test Method for Gum Content in Fuels by Jet Evaporation
ZS ASTM D 525	Standard Test Method for Oxidation Stability of Gasoline (Induction Period Method).
ZS ASTM D 873	Standard Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method
ZS ASTM D 1250	Standard Guide for Use of the Petroleum Measurement Tables
ZS ASTM D 1266	Standard Test Method for Sulphur in Petroleum Products (Lamp Method).
ZS ASTM D 1298	Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ZS ASTM D 2699	Standard Test Method for Research Octane Number of Spark-Ignition Engine Fuel

ZS ASTM D 2700	Standard Test Method for Motor Octane Number of Spark-Ignition Engine Fuel
ZS ASTM D 3120	Standard Test Method for Trace Quantities of Sulphur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
ZS ASTM D 3237	Standard Test Method for Lead in Gasoline by Atomic Absorption Spectroscopy.
ZS ASTM D 3242	Standard Test Method for Total Acidity in Aviation Turbine Fuel.
ZS ASTM D 3348	Standard Test Method for Rapid Field Test for Trace Lead In Unleaded Gasoline (Colorimetric Method)
ZS ASTM D 4052	Standard Test Method for Density and Relative Density of Liquids by Digital Density meter.
ZS ASTM D 4057	Standard Practice for Manual Sampling of Petroleum and Petroleum Products
ZS ASTM D 4177	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products
ZS ASTM D 4815	Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C_1 to C_4 Alcohols in Gasoline by Gas Chromatography
ZS ASTM D 4953	Standard Test Method for Vapour Pressure of Gasoline and Gasoline-oxygenate Blends (dry method)
ZS ASTM D 5059	Standard Test Method for Lead in Gasoline by X-ray Spectroscopy
ATSM 1319	Standard Test Method for aromatics contents for Gasoline
IP 243	Determination of Sulphur Content of Petroleum Products - Wickbold Oxyhydrogen Method
IP 336	Petroleum Products - Determination of Sulphur Content - Energy Dispersive X-ray Fluorescence Method
ZS 396	Sampling Petroleum Products - Part 1: Manual Sampling of Liquid Hydrocarbons
ZS ASTM D3831	Standard test method for Manganese in petrol by Atomic Absorption spectrometry
ZS ASTM D 3237	Standard Test Method for Lead in Gasoline by Atomic Absorption Spectroscopy

3. DEFINITIONS

For the purpose of this standard, the following definitions shall apply:

3.1. Acceptable: Acceptable to the parties concluding the purchase contract, but in relation to conforming to this Zambian Standard.

3.2. Additive: A compound added to petrol (gasoline) to improve either the performance of the petrol (gasoline) or its storage stability or both.

NOTE. Such compounds include alcohols and certain other oxygenated compounds

4. REQUIREMENTS

4.1. GENERAL

4.1.1. The petrol (gasoline) shall be a hydrocarbon fuel to which additives may have been added to improve its performance or its storage stability (or both) and shall be suitable for use in spark ignition internal combustion engines other than aviation piston engines. The petrol (gasoline) may also contain small quantities of harmless colouring materials to give it a distinctive appearance.

4.1.2. The oxygen content of petrol (gasoline) incorporating ethanol and higher Alcohols shall not exceed 3.7% (m/m).

4.1.3. The product when tested in accordance with the methods of test given in Table 1 shall comply with all the limiting requirements given in that table. At 20 ºC or at ambient temperature (whichever is higher), the product 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.

4.2. STORAGE STABILITY

4.2.1. After conventional storage under normal conditions for a period of 6 months after the date of receipt, the petrol (gasoline) shall still comply with all the requirements of this standard (other than the requirements for potential gum content).

4.2.2. In the case of petrol (gasoline) that is to be stored for longer than 6 months, the stability over a period exceeding 6 months shall be as agreed upon between the supplier and purchaser and shall be such that compliance with this standard is maintained.

4.3. Acceptable Additives

For the purposes of this standard, the following are the acceptable octane enhancers:

a. Methylcyclopentadienyl manganese tricarbonyl (MMT)
b. Ferrocene
c. Alcohol

Table 1. Requirements for Unleaded Petrol (Gasoline)

CHARACTERISTIC	REQUIREMENT	TEST METHOD
Octane Rating a) Research Octane number (RON), min	91	ZS ASTM D 2699
b) Motor Octane Number (MON), min	81	ZS ASTM D 2700
c) Motor Octane number (MON) for blends containing more than 2% (v/v) alcohol, min	83	ZS ASTM D 2700
Colour	Orange	Visual
Density at 20 ºC, kg/m^3	710 - 785	ZS ASTM D 1298
		ZS ASTM D 4052
Distillation a) Temperature, ºC for 10% (v/v) evaporated, max 50% (v/v) evaporated 90% (v/v) evaporated, max b) End Boiling Point, ºC, max c) Residue, % (v/v), max d) Evaporated to 70 ºC (E70), % (v/v)	 65 77 – 115 185 215 2.0 Report	ZS ASTM D 86
Reid Vapour Pressure (RVP) at 37.8˚C, kPa	45 - 75	See 6.1
Flexible Volatility Index [FVI = RVP + 0.7 (E70)] a) FVI (hot[1]), max b) FVI (cold[1]), max	 89 94	See 6.2
Residual lead content g Pb/L, max.	0.013	ZS ASTM D 5059, D 3237, D 3348
Induction Period, minutes, min.	360	ZS ASTM D 525
Existent Gum Content, mg/100 mL, max	4	ZS ASTM D 381
Potential Gum (2.5 hr at 100 C), mg/100mL, max	4	ZS ASTM D 873
Sulphur Content, % mass, max.	0.015	ZS ASTM D 1266, D 3120, IP 243
Aromatics, % v/v	42	ATSM 1319, D5580, D5443
Copper Corrosion, 3 hrs at 50 ºC, max.	1	ZS ASTM D 130
Total Acidity[2)] , mg KOH/g, max	0.03	ZS ASTM D 3242
Oxygen Content[3)] , % (m/m) , max	3.7	ZS ASTM D 4815
Manganese content, mg Mn/L, max	25	ZS ASTM D 3831, ZS ASTM D 3237
Iron, mg Fe/L	Report	ZS ASTM D 3831, ZS ASTM D 3237

[1)] Hot = 1st September – 31st March (inclusive)
Cold = 1st April – 31st August (inclusive)

[3)] Any alcohol blended into the fuel shall contain a minimum of 85% (m/m) ethanol with the balance i-propanol and npropanol, and only trace quantities of other alcohols.
3.7 % (m/m) oxygen
= approximately 10% (v/v) ethanol

NOTES
1. For Octane Rating only one of the three parameters needs to be satisfied.
2. The oxygen content of the blend will be determined by method ASTM D 4815 and such other methods that may be developed for other C5 esters.
3. ASTM D 1250 / IP 200 (Standard guide for petroleum measurement tables) should be used for correlation of densities at 15 ºC and 20 ºC respectively.
4.Gasoline should be free of oxygenate and the Use of MTBE as an additive shall not be permitted.

5. PACKAGING AND LABELLING

5.1 Packaging

The condition of the drums and bulk tankers into which the petrol (gasoline) is filled shall be such as not to be detrimental to the quality of the fuel during normal transportation and storage. Drums and containers shall be acceptably sealed and in addition shall conform to the Petroleum Act, Chapter 435 of the Laws of Zambia.

5.2 Labelling

The following information shall appear in legible and indelible marking on each container or in the case of petrol (gasoline) filled into bulk storage tanks, in the storage and consignment documents of each road tanker or rail wagon:

a) the suppliers' and receivers' name and address

b) the type of fuel, i.e. Unleaded Petrol (Gasoline)

c) the quantity in litres

d) the batch/lot number

6. METHOD OF TEST

For all characteristics, use the applicable method listed in Table 1.

6.1 Reid vapour pressure

6.1.1 When testing fuels containing no alcohol, use test method ZS ASTM D323.

6.1.2 When testing fuel blends containing oxygen in the form of alcohols or alcohol/ether mixtures, use test method ZS ASTM D4953.

NOTE: When alcohol is present in fuel, the water introduced when test method ZS ASTM D 323 or IP 69 is used will extract some of the alcohol, causing low Reid Vapour Pressure values to be obtained.

6.2 Flexible Volatility Index (FVI)

The flexible volatility index is another parameter that characterises the volatility properties of petrol (gasoline), and is calculated using the formula:

$$FVI = RVP + 0.7 (E70)$$

where

RVP is the vapour pressure in kilopascals; and

E70 is the percentage of petrol (gasoline), by volume, evaporated to 70 ºC

7. SAMPLING

7.1 Sampling from storage tanks

For the purpose of this Zambian Standard all sampling shall be carried out in accordance with the relevant procedures of ZS 396 Part 1 and, additionally, as detailed in 7.2.

NOTE: Attention is drawn to the special precautions needed for samples for the determination of Reid Vapour Pressure.

7.2 Sampling from petrol pumps

7.2.1 Sampling cans of 5 litres and 1 litre capacity**.**
The construction of the cans shall comply with the appropriate safety requirements for cans that are to hold highly flammable material. They shall be provided with screw caps incorporating a petroleum resistant washer in good condition. A stock of cans shall be kept solely for the purpose of taking petrol (gasoline) samples.

7.2.2. Preparation of cans**.**
New cans shall be rinsed with petrol (gasoline) before being used, to remove any residual traces of oil left during manufacturing operations, and then allowed to dry. Before use, all cans shall be checked to ensure that they are sound and free from leaks.

7.2.3. Sampling procedure**.**
From the pump nozzle, 5 litres of petrol (gasoline) shall be drawn carefully into a cool 5-litre can using a clean dry funnel. Immediately afterwards, this sample shall be decanted carefully into the requisite number of 1 litre cans, using a funnel, filling the cans within 15 mm of the brim.

If more than 5 litres are needed, the operation shall be repeated immediately and before the pump has been used for any other purpose. The screw caps shall be tightened fully and the cans checked to ensure that there are no leaks.

The sampling procedure shall not be carried out in direct sunlight.

NOTE 1: If carried out in direct sunlight, changes in fuel quality, especially octane level, may occur.

NOTE 2: A quantity of 1 litre is sufficient for the determination of octane number and certain other tests but it is advisable to provide each laboratory with 2 litres of sample in case further work is needed; it is essential that these 2 litres be of identical material.

7.2.4. Storage, labelling and transport.
Samples shall be kept in a cool place although it is not necessary to keep them refrigerated.

NOTE 1: If left in direct sunlight there is a danger that the cans will balloon.

Full and legible information relating to the source of the sample shall be attached to the can in such a manner that it will not easily become detached subsequently.

NOTE 2: If required, the sample may be sealed and labelled to maintain its legal integrity.

NOTE 3: If the sample has to be sent to a laboratory by public transport, it will be necessary to comply with the general regulations covering transportation of flammable materials and with the requirements of the transport authority concerned. Information on the appropriate procedures and the type of packaging required should be obtained from the transport authority involved.

ANNEX A

(Normative)

NOTES TO PURCHASERS

A.1 The following requirement shall be agreed between the supplier and the purchaser:

When the petrol (gasoline) has been stored for a period exceeding 6 months, any additional requirements for storage stability (see 4.2.2) shall be such that compliance with this standard is maintained.