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Public Comment*

Draft Zambian Standard

AVIATION TURBINE FUEL (JET A-1) - Specification

This Draft Standard is for Public Comment **ONLY** and should **NOT** therefore be referred to as a Zambian Standard

ZAMBIA BUREAU OF STANDARDS

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CONTENTS

	Page
Technical committee Responsible	i
Foreword	ii
Table of contents	iii
1 Scope	1
2 Normative References	1
3 Definitions	3
4 Requirements	3
5 Packaging and Marking	3
6 Test Methods	4
7 Sampling	4
Table1: Requirements for Aviation Turbine Fuel (Jet A-1)	6

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.

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The preparation 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 in the necessitated the formulation of this standard.

This edition of ZS 394 aims at providing consumers with acceptable quality fuel and to enhance trade within the region. It is equivalent to Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) Joint Fueling System Checklist for Jet A-1, Issue 18 - November 1999 in all respects.

During the preparation of this standard, the following publications were consulted:

- Aviation Fuel Quality Requirements for Jointly Operated Systems for Jet A-1, Issue 17 of October 1998 in all respects.

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ZAMBIA BUREAU OF STANDARDS

Zambian Standard

AVIATION TURBINE FUEL - Specification for Jet A-1

1 SCOPE

This Zambian Standard specifies requirements for Aviation Turbine Fuel, Jet A-1 in particular.

2 NORMATIVE REFERENCES

In this standard, reference has been made to the following methods:

ZS ASTM D 86	Test Method for Distillation of Petroleum Products
ZS ASTM D 130	Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish.
ZS ASTM D 156	Test Method for Saybolt Colour of Petroleum Products (Saybolt Chronometer method)
ZS ASTM D 381	Test Method for Existent Gum in Fuels by Jet Evaporation
ZS ASTM D 445	Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ZS ASTM D 1094	Test Method for Water Reaction of Aviation Fuels
ZS ASTM D 1266	Test Method for Sulphur in Petroleum Products (Lamp Method).
ZS ASTM D 1298	Test Method for Density, Relative Density (Specific Gravity) or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
ZS ASTM D 1319	Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Absorption
ZS ASTM D 1322	Test Method for Smoke Point of Aviation Turbine Fuels
ZS ASTM D 1552	Test Method for Sulphur in Petroleum Products (High Temperature Method)
ZS ASTM D 1740	Test Method for Luminometer Numbers of Aviation Turbine Fuels
ZS ASTM D 2386	Test Method for Freezing Point of Aviation Fuels
ZS ASTM D 2622	Test Method for Sulphur in Petroleum Products by X-Ray Spectrometry
ZS ASTM D 2624	Test Method for Electrical Conductivity of Aviation and Distillate Fuels

ZS ASTM D 3227	Test Method for Mercaptan Sulphur in Gasoline, Kerosene, Aviation Turbine, and Distillate Fuels (Potentiometer Method)
ZS ASTM D 3241	Test for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure)
ZS ASTM D 3242	Test Method for Acidity in Aviation Turbine Fuel
ZS ASTM D 3338	Test Method for Estimation of Net Heat of Combustion for Aviation Turbine Fuels
ZS ASTM D 3828	Test Methods for Flash Point by Small Scale Closed Tester
ZS ASTM D 4052	Test Method for Density and Relative Density of Liquids by Digital Density Meter
ZS ASTM D 4294	Test Method for Sulphur in Petroleum Products by Energy Dispersive X-Ray Fluorescence Spectroscopy
ZS ASTM D 4529	Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
ZS ASTM D 4952	Test Method for Qualitative Analysis for Active Sulphur Species in Fuels and Solvents (Doctor Test)
ZS ASTM D 4809	Test Method Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Intermediate Precision Method)
ZS ASTM D 5453	Test Method for Determination of Total Sulphur in Light Hydrocarbons, Motor Fuels, and Oils by Ultraviolet Fluorescence
ZS ASTM D 5901	Test Method for Freezing Point of Aviation Fuels (Automated Optical Method)
ZS ASTM D 5972	Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)
IP 170	Test Method for Flash Point Abel Apparatus (Kerosene)
IP 57	Test Method for Smoke Point
IP 10	Test Method for Burning
IP 74/82	Test Method for Water Content
IP 156	Test Method for Determination of Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
IP 227	Silver Corrosion in Aviation Turbine Fuels
IP 354	Total Acidity in Aviation Turbine Fuels
IP 432	Particulate contamination
IP 564, 565, & 577	Particulate, cumulative channel particle counts, ISO Code & individual Channel Courts
ZS 396	Sampling Petroleum Products Part 1: Manual Sampling of Liquid Hydrocarbons

Petroleum Act, Chapter 435 of the Laws of Zambia.

3 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

- 3.1 Additive:** A compound added to aviation turbine fuel to improve performance or storage stability.

4 REQUIREMENTS

4.1 General

4.1.1 The aviation turbine fuel shall be hydrocarbon oil derived from petroleum and non-petroleum sources. This does not preclude the incorporation of small amounts of additives intended to improve some aspects of performance. The product shall be free from inorganic acid and from quantities of grit, fibrous material and other foreign matter likely to interfere with the operation of normal equipment.

4.1.2 When tested in accordance with the methods of test given in Table 1, aviation turbine fuel shall be in accordance with the limiting requirements given in the table.

4.1.3 On visual inspection at ambient temperature, the aviation turbine fuel shall be clear, bright, free from solid matter and un-dissolved water.

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 aviation turbine fuel shall still comply with all the requirements of this standard (other than the requirements for potential gum content).

5 PACKAGING AND MARKING

5.1 Packaging

The condition of the containers, rail tankers and road tank vehicles into which the aviation turbine fuel is filled shall be such as not to be detrimental to the quality of the fuel during normal transportation and storage. The 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 aviation turbine fuel filled into bulk storage tanks, with the storage and consignment documents of each road tanker or rail wagon as stipulated in ZS 372 and ZS 673 respectively:

- a) the manufacturer's name and address
- b) the type of fuel as stipulated under UN Code,
- c) the hazards involved in handling and transportation,
- d) the Transport Emergency Card (Tremcard),
- e) the volume in Litres,
- f) the batch/lot number
- g) ZABS Certification Mark

6 TEST METHODS

For all characteristics, the test methods listed in column 4 of Table 1 shall apply.

7 SAMPLING

7.1 Sampling from storage tanks

For the purposes 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.

7.2 Sampling from fuel lines

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 Aviation Turbine Fuel samples.

7.2.2 Preparation of cans.

New cans shall be rinsed with Aviation Turbine Fuel 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 Aviation Turbine Fuel shall be drawn carefully into a 5 Litres can using a clean dry funnel. Immediately afterwards, this sample shall be decanted carefully into the requisite number of 2 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 may occur.

7.2.4 Storage, labeling and transport.

Samples shall be kept in a cool place although it is not necessary to keep them refrigerated.

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 1:

If required, the sample may be sealed and labeled to maintain its integrity,

NOTE 2:

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.

Table 1. Requirements for aviation turbine fuel (Jet A-1)

CHARACTERISTICS	LIMIT	REQUIREMENT	TEST METHOD
APPEARANCE			ZS ASTM D156 or D6045
E			D5452.
Visual appearance	Report	Clear, bright and visually free from solid matter and un-dissolved water at ambient fuel temperature	IP 423 564 or 565 or 577
Colour	1.0		
Particulate contamination mg/L max			
Particulate, cumulative channel particle count	Report		
ISO Code & Individual Channel Counts	Report		
≥ 4 µm(c)	Report		
≥ 6 µm(c)	Report		
≥ 14 µm(c)	Report		
≥ 21 µm(c)	Report		
COMPOSITION			
N Acidity (mg KOH/g)	Max	0.015	ZS ASTM D3242, IP 354
Aromatics (% vol) Doctor Test ¹⁾	Max	22	ZS ASTM D 1319, IP 156
Sulphur, Mercaptan (% m/m)		Negative	ZS ASTM D 4952
Sulphur, Total (% m/m)	Max	0.003	ZS ASTM D 3227
Refinery Components at point of manufacture: Non Hydroprocessed Components, %v/v Mildly Hydroprocessed Components, % v/v Severely Hydroprocessed Components, % v/v Synthetic Components, %v/v	Max	0.30	ZS ASTM D 1266, D 1552, D2622, D 4294 or 5453
		Report (incl. 'nil' or '100%')	
		Report (incl. 'nil' or '100%')	
		Report (incl. 'nil' or '100%')	
		Report (incl. 'nil' or '50%')	
INCIDENTAL MATERIALS			
Fatty Acid Methyl Ester (FAME), mg/kg	Max	50	ZS ASTM D7797, IP 585, 583, 590, & IP 599

VOLATILITY			
Distillation Temperatures			ZS ASTM D 86
10, 50 & 90 % Recovered,	Max	205	ZS ASTM D 86
temperature, C End Boiling	Max	300	ZS ASTM D 86
Point, temperature, C	Max	1.5	ZS ASTM D 86
Distillation Residue, (% vol)	Max	1.5	ZS ASTM D 86
Distillation Loss, (% vol)	Min	38	ZS ASTM D 56, D 3828 or IP170
Flash Point, (C)		775 to 840	ZS ASTM D 1298, D 4052
Density at 15 C, (kg/m ³)			
FLUIDITY			
Freezing Point, (C)	Max	-47	ZS ASTM D 2385, D 2386, D5901, D 5972
Viscosity @ -20 C, (mm ² /s)	Max	8	ZS ASTM D 445
COMBUSTION			
Net Heat of Combustion , (MJ/kg)	Min	42.8	ZS ASTM D 4529, D 3338 or D 4809
One of the following requirements shall be met:			
(1) Specific Energy, net, MJ/kg	Min	42.8	ZS ASTM D 3338 or D 4809
(2) Smoke Point, (mm)	Min	25	ZS ASTM D 1322
(3) Smoke Point, (mm) and	Min	19	ZS ASTM D 1322
Naphthalene's (% vol)	Max	3	ZS ASTM D 1322

CHARACTERISTIC	LIMIT	REQUIREMENT	TEST METHOD
CORROSION			
Copper Strip, 2 hours at 100 C	Max	1	ASTM D 130
STABILITY			
Thermal Stability (JFTOT)			
Control temperature, °C	Min	260	ASTM D 3241
Filter Pressure Differential, mm Hg	Max	25	ASTM D 3241
One of the following requirements shall be met: (1) Annex B VTR (2) Annex C ITR or Annex D ETR, average over area of 2.5mm ² nm	Max	85	
CONTAMINANTS			
Existent Gum, (mg/ 100 ml)	Max	7	ASTM D 381
Microseparator (MSEP),rating			
Fuel with Static Dissipator Additive	Min	70	ASTM D 1094
OR			ASTM D 2550
Fuel without Static Dissipator Additive	Min	85	ASTM D 3948
CONDUCTIVITY			
Electrical Conductivity, (pS/m)		50-600	ASTM D 2624
ADDITIVES			
Antioxidant, mg/l	Max		
Hydroprocessed & synth. fuels (Mandatory)	Min	17	ASTM D 2550
Non-Hydroprocessed fuels (Optional)	Max	24	ASTM D 2550
Metal Deactivator, (mg/l)	Max	24	ASTM D 2550
Static Dissipator (Mandatory)	Max	5.7	ASTM D 2550
First Doping, (mg/l)	Max	3.0	ASTM D 2550
Cumulative Doping, (mg/l)	Max	5.0	ASTM D 2550
LUBRICITY ²⁾	Max	0.85	ASTM D 5001
BOCLE wear scar diameter, mm			

¹⁾ A positive Doctor Test result will not stop a sample from qualifying providing that the Mercaptan Sulphur Result is within specification