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TANZANIA STANDARD

Automotive Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), and Liquefied Petroleum Gas (LPG) Engine Oils — Specification

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TANZANIA BUREAU OF STANDARDS

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Tanzania Bureau of Standards
P O Box 9524
16103 Dar es Salaam
Sam Nujoma Road/Morogoro Road,
Tel +255 (22) 2450206/2450949/2450298
Fax +255 22 2450298
Hotline: 0800110827
E-mail: info@tbs.go.tz

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Foreword

This Tanzania Standard was published under the authority of the Board of Director of Tanzania Bureau of Standards.

Tanzania Bureau of Standards (TBS) is the statutory national standards body for Tanzania established by the Standards Act Cap. 130.

Tanzania Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. The Technical Committees work under the supervision of Divisional (sectoral) Committees. The Standards are developed in accordance with the Guide and Procedure for Development of Tanzania Standards and TZS 0, *Guide for presentation of Tanzania Standards*.

Tanzania Standards are subject to review, to keep pace with science and technological advances. Users of the Tanzania Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

This Tanzania Standard was developed under the supervision of the Chemical and Healthcare Divisional Standards Committee, *CHDC*. The Technical Committee responsible for the standard is *CHDC 17, Lubricant and Oils Products*.

The reporting of the results of a test or analysis made in accordance with this Tanzania Standard, if the final value, observed or calculated is to be rounded off, shall be done in accordance with TZS 4.

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Automotive Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), and Liquefied Petroleum Gas (LPG) Engine Oils — Specification

0 Introduction

Automotive engines operating on Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), and Liquefied Petroleum Gas (LPG) experience higher combustion temperatures and increased oxidation/nitration stress compared to conventional diesel or gasoline engines. This standard establishes performance requirements and physical-chemical parameter limits necessary to prevent valve seat recession, control nitroxidation, maintain viscosity integrity, and protect exhaust aftertreatment systems.

1 Scope

This Tanzania Standard specifies performance requirements, physical and chemical parameters, anti-nitration capabilities, sampling, and test methods for automotive-type internal combustion engine oils specifically formulated for dedicated engines operating on Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Liquefied Petroleum Gas (LPG), or purified biomethane.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EAS 159, *Automotive engine oils — Specification*

EAS 1103, *Base oils — Specification*

SAE J300, *Engine Oil Viscosity Classification*

ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*

ASTM D97, *Standard Test Method for Pour Point of Petroleum Products*

ASTM D445, *Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)*

ASTM D874, *Standard Test Method for Sulfated Ash from Lubricating Oils and Additives*

ASTM D2270, *Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 °C and 100 °C*

ASTM D2896, *Standard Test Method for Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration*

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 D4951, *Standard Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)*

ASTM D5185, *Standard Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by ICP-AES*

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ASTM D5293, *Standard Test Method for Apparent Viscosity of Engine Oils and Base Stocks Between -5 °C and -35 °C Using Cold-Cranking Simulator (CCS)*

ASTM D5800, *Standard Test Method for Evaporation Loss of Lubricating Oils by the Noack Method*

ASTM E168, *Standard Practices for General Techniques of Infrared Quantitative Analysis (for FTIR Nitration and Oxidation Analysis)*

TZS 4, *Rounding off numerical values*

TZS 668, *Petroleum industry — Terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in TZS 668 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses: — ISO Online Browsing Platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Compressed Natural Gas (CNG) / Liquefied Natural Gas (LNG) / Liquefied Petroleum Gas (LPG) Engine Oil

An automotive engine lubricant formulated with high-quality base oils, specialized antioxidant systems, and detergent-dispersant additives specifically designed to withstand elevated combustion temperatures, control nitroxidation, and protect against valve seat recession in spark-ignited gas engines

3.2 Nitration (Nitroxidation)

A chemical degradation process resulting from the reaction of engine oil with gaseous nitrogen oxides (NOx) formed during high-temperature in combustion engines, leading to oil thickening, sludge formation, and organic nitrate accumulation.

3.3 Anti-Nitration Technology

An additive and base oil formulation strategy utilizing high-thermal-stability base stocks combined with targeted anti-nitration/antioxidant additives to minimize nitrogen oxidation degradation in stoichiometric and lean-burn gas engines

3.4 Low-SAPS / Optimized Ash

Engine oil formulations containing controlled levels of Sulfated Ash, Phosphorus, and Sulfur to prevent catalyst poisoning in three-way catalysts (TWC) and methane oxidation catalysts while preventing spark plug fouling and valve seat recession.

4 Performance levels

Automotive CNG, LNG, and LPG engine oils shall meet or exceed OEM gas engine performance benchmarks (e.g., Cummins CES 20092, CES 20085, CES 20074, MAN M 3271, MB 228.31, Volvo VDS-4.5). Dual-fuel or mixed-fleet formulations shall meet API service categories CK-4/SN or equivalent

5. Requirements

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5.1 General requirements

5.1.1 The oil shall consist of high-quality base oil complying with TZS 4058/EAS 1103 (preferably Group II, Group III, or synthetic base stocks to resist thermal oxidation) blended with functional performance additives.

5.1.2 The oil shall be homogeneous, free from water, suspended matter, sediment, and other visible impurities when visually inspected.

5.1.3 The lubricant shall incorporate proven Anti-Nitration Technology to prevent Nitration, rapid viscosity increase, sludge, and organic nitrate build-up under severe thermal and combustion stress typical of gas-fuelled engines.

5.1.4 The additive formulation shall adhere to Low-SAPS / Optimized Ash limits (see 3.4) to protect exhaust aftertreatment devices (such as methane oxidation catalysts) and prevent spark plug fouling while providing essential anti-wear protection against valve seat recession.

5.1.5 All marketed brands shall be licensed, listed, or certified to meet recognized OEM gas engine specifications or relevant API service categories

5.2 Specific requirements

Automotive CNG, LNG, and LPG engine oils shall comply with the technical requirements listed in Table 1 (Multigrade) and Table 2 (Monograde) when tested in accordance with specified methods.

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Table 1 — Specific Technical Requirements for Automotive CNG/LNG/LPG Engine Oils (Multigrade)

S/No.	SAE Grade		5W20	0W30	5W30	5W40	10W30	10W40	15W40	20W40	25W40	20W50	25W50	Test Method
	Characteristic		**Requirement**											
I.	Kinematic viscosity at 100°C, mm2/s	min.	3.8	3.8	3.8	3.8	4.1	4.1	5.6	5.6	9.3	5.6	9.3	ASTM D 445
II.		max.	9.3	12.5	12.5	16.3	12.5	16.3	16.3	16.3	16.3	21.9	21.9	
III.	Viscosity index, min.		120	120	120	120	120	120	120	120	120	120	120	ASTM D2270
IV.	Sulfated Ash (Low-SAPS / Optimized Ash), % wt,		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	ASTM D874
V.	Total Base Number, mgKOH/g, min.		5	5	5	5	5	5	5	5	5	5	5	ASTM D2896
VI.	Pour Point, °C max.		-35	-35	-30	-30	-30	-30	-21	-21	-18	-18	-9	ASTM D97
VII.	Flash Point (Cleveland Open Cup), °C, min.		180	204	204	204	204	204	210	220	220	220	220	ASTM D92
VIII.	Apparent Viscosity (CCS), mPa·s (cP), *max.*		6600 at -30 °C	6200 at -35 °C	6600 at -30 °C	6600 at -30 °C	7000 at -25 °C	7000 at -25 °C	7000 at -25 °C	9500 at -15 °C	13000 at -10 °C	9500 at -15 °C	13000 at -10 °C	ASTM D5293
IX.	Phosphorus Content, % m/m, *max*.		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	ASTM D5185 D4951
X.	Anti-Nitration / Oxidation Stability (FTIR Peak Absorbance)		Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	Pass (Max +20 cm^{-1}	ASTM E168 / FTIR

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		increase)	increase)	increase)	increase)	increase)	increase)	increase)	increase)	increase)	increase)	increase)	
	Note: In the event of a missing viscosity grade classification, please refer to the latest SAE J300.												

Table 2 — Specific Technical Requirements for Automotive CNG/LNG/LPG Monograde Engine Oils

SAE Grade		**0W**	**5W**	**10W**	**15W**	**20W**	**25W**	**5**	**10**	**15**	**20**	**30**	**40**	**50**	**60**	**Test Method**
Characteristic		**Requirements**														
Kinematic viscosity at 100 °C, mm^2/s	Min.	3.8	3.8	4.1	5.6	5.6	9.3	5.6	5.6	5.6	5.6	9.3	12.5	16.3	21.9	ASTM D 445
	max.	-	-	-	-	-	-	9.3	9.3	9.3	9.3	12.5	16.3	21.9	26.1	ASTM D 445
Viscosity index, min.		95	95	95	95	95	95	95	95	95	95	95	95	95	95	ASTM D 2270
Sulfated Ash (Low-SAPS / Optimized Ash), % wt		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	ASTM D 874
Total Base Number, mgKOH/g, min.		5	5	5	5	5	5	5	5	5	5	5	5	5	5	ASTM D 2896
Pour Point, °C, max.		-30	-30	-30	-21	-21	-18	-30	-30	-21	-21	-18	-9	-9	-9	ASTM D 97

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Flash Point (Cleveland Open Cup), °C, *min.*	180	204	204	204	204	204	210	220	220	220	220	220	220	220	
Phosphorus Content, % m/m, *max.*	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Anti-Nitration / Oxidation Stability (FTIR Peak Absorbance)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)	Pass (Max +20 cm-1 increase)
Note: In the event of a missing viscosity grade classification, please refer to the latest SAE J300															

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6 Packaging, marking and labelling

6.1 Packaging

6.1.1 Automotive CNG/LNG/LPG engine oil shall be packaged in clean, sound, and suitable containers that protect the contents from contamination and safeguard quality during handling, transit, and storage.

6.1.2 Only containers of the same capacity filled from the same manufacturing batch shall be packaged together in an outer consignment unit.

6.2 Marking and labelling

Each container shall be legibly and indelibly marked in English and/or Kiswahili with the following minimum information:

a) Product name clearly designated as 'Automotive CNG/LNG Engine Oil', 'Natural Gas Engine Oil', or 'CNG/LPG;

b) Name, physical address, and trademark of the manufacturer, packager, or distributor;

c) Claimed service classifications and OEM approvals (e.g., Cummins CES 20092, CES 20085, API CK-4/SN);

d) SAE Viscosity Grade (e.g., SAE 15W-40, SAE 10W-30);

e) Net content;

f) Batch or lot identification number;

g) Date of manufacture and Best Before / Expiry date;

h) Country of origin.

7 Sampling

Sampling shall be conducted in accordance with ASTM D4057 (manual sampling) or ASTM D4177 (automatic sampling).

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Bibliography

1. EAS 159:2024, Automotive engine oils — Specification
2. Cummins CES 20092, Engine Oil Specification for Natural Gas Engines
3. API 1509, Engine Oil Licensing and Certification System

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