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DRAFT EAST AFRICAN STANDARD

Fuel additives — Specification

EAST AFRICAN COMMUNITY

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Contents

Page

Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Requirements	2
4.1 General requirements	Error! Bookmark not defined.
4.2 Materials	Error! Bookmark not defined.
4.3 Total amount of inorganic material	Error! Bookmark not defined.
4.4 Fillers and pigments	Error! Bookmark not defined.
4.5 Wall thickness	Error! Bookmark not defined.
4.6 Dimensions and tolerances	Error! Bookmark not defined.
4.6.1 General	Error! Bookmark not defined.
4.6.2 Outside diameter	Error! Bookmark not defined.
4.6.3 Shell wall and head thickness	Error! Bookmark not defined.
4.6.4 Placement of fittings	Error! Bookmark not defined.
4.7 Mechanical properties	Error! Bookmark not defined.
4.7.1 Flexural modulus	Error! Bookmark not defined.
4.7.2 Deformation	Error! Bookmark not defined.
4.7.3 Low temperature impact	Error! Bookmark not defined.
5 Fittings	Error! Bookmark not defined.
6 Vents	Error! Bookmark not defined.
7 Tank openings	Error! Bookmark not defined.
7.1 Manhole or inspection opening	Error! Bookmark not defined.
7.2 Opening for filling	Error! Bookmark not defined.
7.3 Opening for suction	Error! Bookmark not defined.
8 Finish	Error! Bookmark not defined.
9 Leakage	Error! Bookmark not defined.
10 Per cent gel (O-xylene insoluble fraction) level	Error! Bookmark not defined.
11 Marking and labelling	Error! Bookmark not defined.
11.1 Marking	Error! Bookmark not defined.
11.2 Labelling	Error! Bookmark not defined.
12 Sampling	Error! Bookmark not defined.
Annex A (normative) Determination of carbon black content	5
A.1 Apparatus	Error! Bookmark not defined.
A.2 Reagents	Error! Bookmark not defined.
A.3 Procedure	Error! Bookmark not defined.
A.4 Calculation	Error! Bookmark not defined.
Annex B (normative) Determination of total amount of inorganic material	Error! Bookmark not defined.
B.1 Test specimen	Error! Bookmark not defined.
B.2 Method of extraction	Error! Bookmark not defined.
B.3 Method of analysis	Error! Bookmark not defined.
Annex C (normative) Determination of resistance to deformation	Error! Bookmark not defined.
Annex D (normative) Determination of per cent gel (O-xylene insoluble fraction) level	Error! Bookmark not defined.
D.1 Principle	Error! Bookmark not defined.

D.2	Apparatus	Error! Bookmark not defined.
D.3	Reagents	Error! Bookmark not defined.
D.4	Procedure	Error! Bookmark not defined.
D.5	Calculation.....	Error! Bookmark not defined.
Annex E (normative)	Determination of elongation	Error! Bookmark not defined.
E.1	Purpose of the test	Error! Bookmark not defined.
E.2	Apparatus	Error! Bookmark not defined.
E.3	Pre-test.....	Error! Bookmark not defined.
E.4	Procedure	Error! Bookmark not defined.

PUBLIC REVIEW DRAFT

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the principles and procedures for development of East African Standards.

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

The committee responsible for this document is Technical Committee EASC/TC 068, Petroleum and petroleum products.

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

Fuel additives — Specification

1 Scope

This Draft East African Standard specifies requirements, sampling, and test methods for fuel additives used in baseline fuel (Automotive gasoline or Automotive Gas Oil) engines.

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.

ASTM E29 *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*.

EAS 158, *Automotive gasoline (Premium Motor Spirit) — Specification*

EAS 177, *Automotive Gas Oil (Automotive diesel) — Specification*

EAS 1047, *Air quality — Vehicular exhaust emission limits*

ISO 1998-1, *Petroleum industry — Terminology — Part 1: Raw materials and products*

ISO 3170, *Petroleum liquids — Manual sampling*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

ISO 3929 *Road vehicles — Measurement methods for exhaust gas emissions during inspection or maintenance*

TZS 986, *Instruments for measuring vehicle exhaust emissions — Metrological and technical requirements; Metrological control and performance tests. ISO 3930.*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

fuel

substance/material capable of releasing energy by combustion or other chemical or physical reaction

3.2 fuel additives
chemical compound added to fuel, usually in small amounts, to impart or enhance desirable properties or to suppress undesirable properties

3.3 baseline fuel
fuel that complies with the requirements of EAS 177 and EAS 158

3.4 additized fuel
baseline fuel into which additives have been added

3.5 exhaust emission limit
highest permissible quantity of pollutants released into the atmosphere from a vehicle, expressed as the concentration of pollutants in relation to one unit of production or to the degree of air pollution caused by these sources

3.6 emission
discharge of gases, particulate matter and/or smoke from a road vehicle into the atmosphere

4 Types of fuel additives

4.1 Main additives component families

Additives can be sub-divided in terms of their point of application as follows:

- a) Distribution and storage system additives,
 - i) corrosion inhibitors;
 - ii) pipeline drag-reducing additives; and
 - iii) anti-static additives.
- b) Performance enhancement additive
 - i) deposit control additives;
 - ii) cetane/Octane improvers
 - iii) lubricity additives;
 - iv) friction modifiers;
 - v) antifoam additives;
 - vi) corrosion inhibitors;
 - vii) demulsifiers/dehazers;
 - viii) ant-valve seat recession additives; and
 - ix) fuel-borne catalysts for particulate filters.

5 Requirements

5.1 General requirements

5.1.1 The fuel additive shall not have harmful side effects that may cause deterioration in the performance of baseline fuel.

5.1.2 The additive shall be soluble and form a homogeneous mixture in the baseline fuel with no evidence of phase separation.

5.1.3 Additive packages may be formulated by combining a selection of compatible additive components to deliver the required performance-enhancing solutions for specific petrol or diesel fuels.

5.1.4 Petrol additive packages may incorporate but not limited to, deposit control additives, corrosion inhibitors, friction modifiers and demulsifiers to address injector and valve deposits and water separation.

5.1.5 Diesel additive packages may comprise but not limited to, deposit control additives, cetane number improvers, antifoam additives, corrosion inhibitors, demulsifiers and cold flow improvers where required.

5.1.6 Additized fuel shall remain stable under storage.

5.2 Specific requirements

5.2.1 Additized fuel shall be prepared using the additive manufacturer's specified ratios and dosing instructions.

5.2.2 Additized fuel shall comply with the requirements as specified in EAS 177 and EAS 158.

5.2.3 The additized fuel shall remain within the specified limits for impurities, including but not limited to sulphur, manganese, lead and benzene.

5.2.4 A supplier shall declare chemical composition of fuel additive (name and % by weight of each element and compound).

5.2.5 The manufacturer/distributor shall substantiate all performance claims made for the fuel additive with verifiable, documented technical evidence based on recognized test methods or validated laboratory analysis.

5.2.6 Fuel additives formulator shall specify a range of composition and properties to minimize the variability of performance of reformulated fuels.

5.2.7 Emission data

The exhaust gas emission test shall be performed to evaluate the effect of additive used in fuel and test shall be performed according to ISO 3929 and shall comply with the requirements of EAS 1047

5.2.8 Engine performance

5.2.8.1 The questionnaire for evaluation of fuel additives (Annex A) should be filled in before any approval by the relevant authority.

5.2.8.2 When the engine performance test is done in accordance with ISO 3930 (see Clause 2), there shall be no significant differences. Alternatively, the method stated in Annex B can be used for engine performance tests.

5.3 Approval and registration

5.3.1 Each fuel additive shall be approved by the relevant authority prior to its introduction into the market.

5.3.2 For the approval of fuel additive, the showing of compliance shall address the following.

- a) the fuel additive does not have any adverse effects on the engine performance, fuel system and after treatment components or the materials of construction.
- b) that the additive does not have any adverse effects on the performance of the baseline fuel that is intended for use with;
- c) that the additive is compatible with all other additives typically used in the baseline fuel.
- d) that the additive is compatible with all other additives typically used in the baseline fuel that the additive does not have harmful side effects on the environment and human health

6 Packaging and labelling

6.1 Packaging

6.1.1 The condition of the containers shall not be detrimental to the quality of the additive during transportation and storage. The containers shall be acceptably sealed or leak-proof, corrosion-resistant, heat-resistant, clean, and free from materials soluble in the product.

6.1.2 The product shall be accompanied by the Material Safety Data (MSD) sheet.

6.2 Labelling

Each container and bulk package shall bear (in prominent legible and indelible marking) the following information:

- a) manufacturer's name and physical address
- b) trademark (if any);
- c) wording to indicate the fuel additive type/components;
- d) area of application, whether in petrol or diesel;
- e) instructions for storage, use, and disposal;
- f) batch identification;
- g) dates of manufacture and expiry;
- h) net contents in metric units; and
- i) safety precautions as applicable.

7 Sampling

Sampling shall be done in accordance with ISO 3170.

Annex A (normative)

Fuel additive questionnaire for evaluation procedure (petrol and diesel)

Complete and send the questionnaire, along with existing data pertinent to the additive's effects, to CERTIFICATION or REGISTRATION AUTHORITY.

The testing laboratory needs to be competent in conducting the appropriate tests.

1 Company name or patent name:

.....

2 Address & Phone No:

.....
.....

3 Contact person (Name & Phone No):

.....
.....

4 Additive name or code:

.....

5 Additive description and category (cleaner, catalyst, etc.):

.....
.....

5.1 What are the additive's effects on the following engine characteristics, and how long does it take to observe these effects? Performance (fuel consumption, exhaust temperature, etc.)

.....
.....
.....

5.2 Exhaust emissions (including smoke and particulate emissions)

.....

5.3 Combustion deposits (including sparking)

.....
.....

5.4 Lube oil

.....
.....
.....

5.5 Wear

.....
.....
.....

6 Fuel system (6.1 parameters for diesel fuel and 6.2 parameters for petrol fuel)

6.1 What are the effects of the additive on the following diesel fuel properties?

- 6.1.1 Cetane number:
- 6.1.2 Viscosity.....
- 6.1.3 API gravity.....
- 6.1.4 Distillation range.....
- 6.1.5 Sulphur content.....
- 6.1.6 Carbon residue.....
- 6.1.7 Flash point.....
- 6.1.8 Cloud point.....
- 6.1.9 Pour point.....
- 6.1.10 Ash content.....
- 6.1.11 Corrosiveness.....
- 6.1.12 Aromatics.....
- 6.1.13 Filterability.....
- 6.1.14 Water absorption.....
- 6.1.15 Stability.....
- 6.1.16 Foaming.....
- 6.1.17 Bacterial resistance.....
- 6.1.18 Vapour pressure.....
- 6.1.19 Miscibility limits.....
- 6.2 What are the effects of the additive on the following petrol fuel properties?
 - 6.2.1 Research Octane Number (RON).....
 - 6.2.2 Motor Octane Number (MON).....
 - 6.2.3 Reid Vapour Pressure (RVP), bar at 37.8 °C.....
 - 6.2.4 Density at 20 °C kg/m³
 - 6.2.5 Distillation point, temperature °C:
 - 10 % (v/v) evaporated.....
 - 50 % (v/v) evaporated at.....
 - 90 % (v/v) evaporated at.....
 - Final boiling point °C.....
 - Residual % (v/v)

- 6.2.6 Flexible Volatility Index (FVI) = $RVP + 0.7E70$
- 6.2.7 Oxidation stability (minutes).....
- 6.2.8 Copper strip corrosion (3 h at 50 °C)
- 6.2.9 Existence gum content solvent washed mg/100 ml.....
- 6.2.10 Sulphur content % m/m.....
- 6.2.11 Colour.....
- 6.2.12 Oxygen content % (m/m)
- 6.2.13 Total aromatics, % by volume.....
- 6.2.14 Total acidity, mg KOH/g.....
- 6.2.15 Mercaptan sulphur % by mass.....

7 What are the effects of the additive on polymers, filter media, and other fuel system components?
.....
.....

8 How is this additive used?
.....
.....

8.1 How is it mixed with fuel?
.....
.....

8.2 What proportions?
.....
.....

8.3 How stable is the mixture?
.....
.....

8.4 How long is the mixture storable?
.....
.....

8.5 MSDS for safe handling
.....
.....

9 How stable is the additive itself?
.....
.....

10 Does the additive contain any zinc?
.....
.....

11 Are there any chemicals, elements, or physical conditions that can neutralize or otherwise influence the effectiveness of the additive? If so, describe in detail on a separate sheet. What are the claimed effects of the additive? (Attach any pertinent material)
.....
.....

11.1 What tests have been conducted to substantiate these claims? (attach any pertinent material)

.....
.....

11.2 What were the results of these tests? (Include formal report issued)

.....
.....

11.3 Where were these tests performed?

.....
.....

Depending on the information supplied above, the testing laboratory needs to be competent in conducting the appropriate tests.

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Annex B (normative)

Engine performance test

B.1 Tests are conducted on a Single Cylinder Research Engine (SCRE) with new engine power components such as piston, rings, cylinder liner, intake and exhaust valves, and injector.

B.2 The tests are conducted in a “baseline-preconditioning-product-baseline” manner. The preconditioning test is necessary for stabilizing engine performance with additive reformulated fuel. After the product test, a check-up baseline test follows to verify the test results.

B.3 Engine power is measured either by dynamometer or by an engine-driven generator with load bank.

B.4 The instruments are calibrated to an accuracy of ± 2 .

B.5 Engine fuel consumption is measured either by weighting scale or flow meter, and instruments are calibrated to ± 1 % of full scale.

B.6 Emissions analyzers meeting the requirements of TZS 983 (see Clause 2) are used for emissions measurements. The analyzers are calibrated before a test according to the procedure recommended by the manufacturer.

B.7 The test is conducted at engine full load (250 hp). Testing at additional engine operating modes is recommended and optional to customers. The test is conducted under the following engine conditions:

- a) Engine intake air temperature shall be controlled within ± 5 °F between the baseline and reformulated fuel tests at the same engine test modes. Engine oil sump temperature shall be controlled within ± 5 °F between the baseline and reformulated fuel tests at the same engine test modes.
- b) Engine coolant water outlet temperature shall be maintained within ± 5 °F between the baseline and reformulated fuel tests at the same engine test modes. Engine fuel temperature shall be maintained at 90 °F ± 10 °F, measured at the fuel supply line (or fuel filters) before the fuel pump. Engine intake air pressure shall be maintained within ± 0.1 psi between the baseline and reformulated fuel tests at the same engine test modes.
- c) The baseline test and the product test are conducted for minimum of 20 h (at least three days). The preconditioning test is performed until stable engine conditions are obtained. 35 h preconditioning period (engine is operated at full load) is recommended; however, more preconditioning hours may be required due to the nature of the product. A baseline check-up test is performed to validate the evaluation test results.

B.8 During the baseline and the product test, engine performance data are taken at every half-hour, and emissions (smoke, gaseous, and particulate matter) and combustion pressure data are recorded at least once midway or at the end of the tests. Brake-Specific Fuel Consumption (BSFC) data obtained for baseline and product (after preconditioning) should be plotted as a function of engine operating time to show any discernible trends and consistency of the data.

B.9 Data analysis

B.9.1 The two sets of BSFC data should be statistically analyzed to determine whether there is a statistically significant difference in the mean values of the two sets of data. The difference should be evaluated at a 90 % confidence level.

B.9.2 Engine emissions data is statistically analyzed to determine any change due to the product. To investigate the effects of a product on the engine combustion process, the apparent net heat release rates are

calculated from the recorded cylinder pressure data by applying the first law of thermodynamics to the content of the combustion chamber. The combustion temperatures are calculated from the cylinder pressure data by assuming a uniform temperature distribution and ideal gas within the cylinder.

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Bibliography

- [1] RS 366: 2018, *Fuel additives — Specification*
- [2] TZS 1247: 2012, *Fuel additives — Specification*

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