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**Fuel additives — Requirements**



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## Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 366 was prepared by Technical Committee RSB/TC 045, *Petroleum and Petroleum Products*.

In the preparation of this standard, reference was made to the following standard:

TZS 1247, *Fuel Additive – Specifications*

The assistance derived from the above source is hereby acknowledged with thanks.

### Committee membership

The following organizations were represented on the Technical Committee on Petroleum and Petroleum Products (RSB/TC 045) in the preparation of this standard.

Paragraph of participants

University of Rwanda-College of Science and Technology (UR-CST)

Global Oil Solutions

Integrated Polytechnic Regional Centre-Kigali (IPRC-Kigali)

AGROPY Ltd

AFRICHEM Rwanda Ltd

National Industrial Research and Development Agency (NIRDA)

Star Construction and Consultancy Ltd

Mount Kenya University – Rwanda

NAREM Consult Ltd

University of Kibungo (UNIK)

Rwanda Standards Board (RSB) – Secretariat

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## Introduction

The petroleum additive industry is a research and development intensive industry and its products are marketed almost exclusively to industrial users.

A very wide range of additives has been developed to meet the needs of an industry which converts principally hydrocarbon fuels into heat energy, either to provide transportation or to generate electricity for industrial and domestic consumption. The wide range of products required reflects both the range of fuel types that benefit from additive use and also the range of performance features that can be improved, or operational problems that can be overcome, through the use of additives. These may be encountered at the refinery, in distribution systems and storage tanks or in use, for example, in numerous different transport applications. An additive may be used as a single stand-alone product to resolve a specific issue, for example at the refinery or, frequently, may be combined with other products to create a multi-functional package for use in finished fuels for the automotive industry.

Fuel additive treat levels are generally low, with some additives dosed at single figure mg/kg (ppm) levels. Others are employed at treat levels ranging from 50 – 3500 mg/kg (0.005 – 0.35 %) depending on the extent and range of benefit desired. Additive treat levels employed do not approach those of fuel blending components (such as ethanol for use in gasoline, or fatty acid methyl esters – FAME – in diesel fuel), where use levels are typically 3 – 20% of hydrocarbon base fuel volume.

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## Fuel additives — Requirements

### 1 Scope

This Draft Rwanda Standard gives the requirements for fuel additives produced or sold for use in gasoline and/or diesel 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.

RS ISO 3170, *Petroleum liquids -- Manual sampling*

RS ISO 3171, *Petroleum liquids -- Automatic pipeline sampling*

RS EAS 177, *Automotive gas oil (automotive diesel) – Specification*

RS EAS 158, *Automotive gasoline (Premium motor spirit) – Specification*

ISO 3929, *Road vehicles – Measurement methods for exhaust gas emissions during inspection and maintenance*

RS EAS 751, *Air quality — Specification*

### 3 Terms and definitions

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

#### 3.1

##### **fuel**

any material which is capable of releasing energy or power by combustion or other chemical or physical reaction

### 3.2

#### **fuel additives**

chemical substances that are designed to be added to fuels for the purpose of improving engine performance; reducing fuel consumption and reducing emissions. They also make fuel burn more uniformly and completely. They are normally grouped into cleaners or catalysts

### 3.3

#### **reformulated fuel**

this is a fuel into which those additives have been added.

### 3.4

#### **exhaust emission limit**

the 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 (e.g., dark color of smoke).

### 3.5

#### **emission**

shall mean transfer of pollutants from the source to the atmosphere.

### 3.6

#### **baseline fuel**

fuel that conforms to the requirement of RS EAS 177 or RS EAS 158

### 3.7

#### **diesel engine**

an internal combustion engine in which heat produced by the compression of air in the cylinder is used to ignite the diesel.

### 3.8

#### **gasoline engine**

an internal-combustion engine having its piston driven by explosions of a mixture of air and vapor of gasoline ignited by an electric spark



## 4 Types of fuel additives

### 4.1 Main additives component families

Additive can be sub-divided in terms of their point of application as indicated below:

- a) Refinery products
  - Antioxidant and stability improver additives
  - Octane/cetane enhancing additives
  - Cold flow improver additives
  - Metal deactivator additives
  - Dyes
- b) Distribution system products
  - Corrosion inhibitors
  - Pipeline drag reducing additives
  - Anti-static additives
- c) Automotive performance enhancement products
  - Deposit control additives
  - Cetane improvers
  - Lubricity additives
  - Friction modifiers
  - Antifoam additives

- Corrosion inhibitors
- Demulsifiers/dehazers
- Ant-valve seat recession additives
- Fuel borne catalysts for particulate filters

## 4.2 Multi-functional additives

Combined packages of a number of selected additive components should be assembled to provide a bespoke performance-enhancing additive for use by fuel retailers for their products

Multifunctional gasoline additive packages will often combine a deposit control additive with a corrosion inhibitor and demulsifier additive. Multifunctional diesel additive packages are frequently more complex and may combine deposit control additive with cetane number improver, antifoam additive, corrosion inhibitor and demulsifier (and possibly also cold improver additives depending on seasonality).

## 5 Requirements

### 5.1 General

**5.1.1** The fuel additive shall not have known harmful side-effects to avoid deterioration of driveability and emissions control durability for a baseline fuel.

**5.1.2** The fuel additive shall contain carbon, hydrogen, and any one or all of the following elements: oxygen, nitrogen, and/or sulfur.

NOTE Impurities which produce gaseous combustion products may be present in the fuel additive at trace levels.

**5.1.3** The fuel additive shall be at a concentration of not more than 0.35 % by weight and it shall contribute not more than 15 mg/kg sulfur by weight to the fuel.

**5.1.4** Fuel additives permitted for use in fuels identified by independent specifications shall be sufficiently specified to limit the variability of additive chemical composition. The independent specification shall provide a means for detecting the presence of any additive permitted for use in the fuel defined by the specification.

### 5.2 Approval and Registration

**5.2.1** Each fuel additive shall be approved and registered by competent authority prior to its introduction into market. The manufacturer and/or importer of designated fuel additive shall not sell, offer for sale, or introduce into commerce the product without a registration proof.

**5.2.2** For the approval of fuel additive, the showing of compliance shall address the following:

- a) that the additive does not have any adverse effects on the operation, performance, durability, or materials of the products intended for use;
- 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, or combination of all other additives, permitted for use in the baseline fuel that the additive is intended for use with; and
- d) that the additive does not have known harmful side-effects on environment and human health and safety.

### **5.3 Physical and chemical properties**

**5.3.1** When the fuel is reformulated using the ratios specified by manufacturer of fuel additives, the physical and chemical properties shall conform to requirements of RS EAS 158 in case of reformulated gasoline and RS EAS 177 in case of reformulated diesel or both as the claim of the additive may be.

**5.3.2** Fuel additives formulator shall specify a very narrow range of composition and properties to minimize the variability of performance of reformulated fuels.

**5.3.3** Criteria to limit trace materials, such as trace organics, non-metals, and metals, shall be established based on the feedstock and process characteristics. Test methods shall be specified to measure trace materials.

**5.3.4** In case of any significant degradation by candidate products as compared by both requirement of respective fuel specification and baseline fuel data, the additive shall not be allowed on the market.

### **5.4 Emission data**

**5.4.1** 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 conform to the requirements of RS EAS 751.

**5.4.2** The manufacturer and/or importer of designated fuel additives shall provide the exhaust gas emission test report before placing its product on the market.

### **5.5 Engine performance**

**5.5.1** Fuel consumption for baseline and reformulated fuel shall be plotted as a function of engine operating time to show benefit claim and consistency of fuel additive.

**5.5.2** The fuel additive shall maintain original engine performance. The engine performance for fuel additive shall be tested and manufacturer/importer shall avail records to facilitate the inspection exercise.

**5.5.3** The questionnaire for evaluation of fuel additives on engine performance (annex B) should be filled in and be presented to the Inspector.

## **6 Packaging and labelling**

### **6.1 Packaging**

**6.1.1** The condition of the containers shall be such as not to be detrimental to the quality of the additive during normal 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) The manufacturer's name or trade mark or both;
- b) Word indicating that the product is a fuel additive;
- c) General instructions for use and handling that are suitable for the purpose;
- d) The batch identification;
- e) Manufacture and expiry dates
- f) The volume of the contents in metric units
- g) storage conditions

## **7 Sampling**

**7.1** Representative samples for test should be drawn from the market, factory or anywhere else following the procedure of random numbers. Samples should not be stored in direct sunlight. The containers should only be opened during testing.

**7.2** Samples should be taken as described in RS ISO 3170 or RS ISO 3171.

**Annex A**  
(Informative)

**Fuel additive questionnaire for evaluation procedure (diesel and petrol)**

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.

Company name or Patent name: .....

Address & Phone No: .....

Contact person (Name & Phone No): .....

Additive name or code: .....

Additive description and category (Cleaner, catalyst, etc.): .....

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)

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

Exhaust emissions (including smoke and particulate emissions)

.....

Combustion deposits (including sparking)

.....  
.....

Lube oil

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

Wear

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

Fuel system (6.1 parameters for diesel fuel and 6.2 parameters for gasoline fuel )

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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 Vapor 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 100 °C (37.8 °C).....
- 6.2.4 Density at 20 °C kg/m<sup>3</sup> .....
- 5.2.5 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 (3hrs at 50 °C).....
- 6.2.9 Existence gum content solvent washed mg/100ml.....
- 6.2.10 Sulphur content % m/m.....
- 6.2.11 Color.....
- 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.....

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

.....  
.....

How is this additive used?

.....  
.....

8.1 How is it mixed with fuel?

.....  
.....

8.2 In what proportions?

.....  
.....

8.3 How stable is the mixture?

.....  
.....

8.4 How long is the mixture storable?

.....  
.....

8.5 MSDS for safe handling

.....

How stable is the additive itself?

.....

Does the additive contain any zinc?

.....

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.

## Bibliography

- [1] MIL-HDBK-510A (USAF), Department of Defence handbook aerospace fuels certification, 4 August 2014.
- [2] BS EN 16709, Automotive fuels – High FAME diesel fuel (B20 and B30) – Requirements and test methods
- [3] BS EN 14214, *Liquid petroleum products – Fatty acid methyl esters (FAME) for use in diesel engines and heating applications – Requirements and test methods*

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