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Road Vehicles- Fuel enhancer and emission reducer device performance  
Requirements and Test method

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## **Foreword**

This Ethiopian Standard has been prepared under the direction of the Technical Committee for Road Vehicle (TC 54) and published by the Ethiopian Standards Agency (ESA).

The standard has been developed to address the observed environmental problems caused by vehicle pollutant emission and enhance fuel economy.

Information has been gathered from various relevant sources in developing the technical specifications.

DRAFT STANDARD

## Road Vehicles - Fuel enhancer and emission reducing device performance requirements, installation and test method

### 1. Scope

This Ethiopian standard specifies the requirements for the performance, installation and test methods of the fuel enhancer and emission reducing device designed to reduce fuel consumption and emission of motor vehicles by avoiding incomplete combustion and purifying the inhaled air.

This standard includes fuel molecular enhancer and air refining device

### 2. Normative Reference

The following referenced documents are indispensable for the application 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.

EN 55014-1, Electromagnetic Compatibility – Requirements for household appliance, electric tools and similar apparatus – part 1 emission

ES IEC 61000, Electromagnetic compatibility

EN 55014-2, Electromagnetic Compatibility Requirements for household appliance – part 2 immunity product family.

### Abbreviation

#### EMC - Electromagnetic compatibility

HC – Hydrocarbon

THC – Total Hydrocarbon

NO<sub>x</sub> – Nitrogen oxides

CO – Carbon monoxide

PM – Particulate Matter

SO<sub>x</sub>-Sulfur oxides

### 3. Terms and definitions

For the purposes of this standard the following terms and definitions shall apply:

#### 3.1.

##### Fuel enhancing and emission reducing device

a device which includes molecular enhancer and air refining devices which is used to reduce fuel consumption, reduce emission pollutant gas and increase engine efficiency.

#### 3.2.

##### Molecular enhancer device

a device that can change the aggregation of molecules from larger molecular clusters to smaller ones or even single molecular units (nano - granular fuel) by breaking Vander Waals force resulting in better atomization of the fuel, hence better fuel economy and lower exhaust emissions.

**3.3**

**Air refining device**

a device that can purify the air and increase the oxygen level in the air by neutralizing the pollutant floating in the air such as dust, emission, germs, pollen, smoke, molds and other species possess positive ions.

**3.4.**

**Emission**

Engine exhaust gas containing carbon dioxide, carbon monoxide, lead compounds, nitrogen oxide, UHC (unburned hydro carbon), particulate matters and water vapor among other pollutants.

**3.5.**

**Green House Gas (GHG)**

a gas that contributes to the green house effect by absorbing infrared radiation.

**3.6.**

**Ringelmann scale**

Is a scale for measuring the apparent density or opacity of smoke.

**3.7.**

**Vander Waals force**

Is relatively weak electric force that attracts atoms or molecules to one another in gases, in liquefied and solidified gases, and in almost all organic liquids and solids.

**4. General requirement**

4.1 Fuel enhancer and emission reducing device shall be:-

4.1.1 corrosion resistant.

4.1.2. weather resistant.

4.1.3. EMC compatible.

4.1.4. light in weight.

4.1.5. environmental friendly.

4.1.6. user friendly.

4.1.7. able to purify the air and increasing the oxygen level in the air up to 20%.

4.1.8. compact and robust in design.

4.1.9. fitted into all kinds of vehicle with no need to modify the vehicle and will not affect the vehicle warranty.

4.2. the electromagnetic disturbance generated by the fuel enhancer and emission reducing

device shall not exceed the level above which radio and telecommunications equipment

or other equipment cannot operate as intended;

4.3. Fuel enhancer and emission reducing device shall :-

4.3.1. have a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without un acceptable degradation of its intended use.

4.3.2. operate a minimum of 10 years without any modification.

4.3.3. minimize vehicle exhaust emission.

4.3.4. enhance the engine performance.

4.3.5 change only the physical structure of the fuel (shall not cause any chemical reaction in the fuel inside the tanker as well in the fuel line.

4.4. After the fuel enhancer and emission reducing device is installed in the vehicle the exhaust shall not emit dense blue or clearly visible black smoke.

## 5. Specific Requirement

### 5.1. Functionality

#### 5.1.1. Fuel saving

The device shall have:-

- 5.1.1.1. a minimum capacity of 8 % fuel saving for diesel powered vehicles .
- 5.1.1.2. a minimum capacity of 12 % fuel saving for gasoline powered vehicles .

#### 5.1.2. Emission reduction

The uel enhancer and emission reducing device :-

- 5.1.2.1. shall have a minimum capacity of 80% emission reduction from the existing exhaust emission level of the vehicle.
- 5.1.2.2. shall have a minimum capacity to maintain the emitted smoke level not to exceed 2 units on the Ringlemann Scale during engine acceleration mode.
- 5.1.2.3. for **diesel powered vehicles at natural engine idle speed** shall reduce the emission level of :-
  - 5.1.2.3.1. CO to 4.5 % of the exhaust volume for vehicles manufactured starting
  - 5.1.2.3.2. CO to 6 % by volume for vehicles manufactured before 1992 GC
  - 5.1.2.3.3. HC to 0.12% vol. (1 200 ppm) by volume for all vehicles.
  - 5.1.2.3.4. HC to 0.12% vol. (1 200 ppm) by volume for vehicles manufactured

#### 5.1.3. User friendly

##### 5.1.3.1. Installation

- 5.1.3.1.1. The device shall be installed without any modification on the vehicle
- 5.1.3.1.2. Shall be easy and not require specialized personnel and hand tools
- 5.1.3.1.3. The fuel enhancer and emission reducer shall be placed inside the fuel tank:-
  - a) Simply immerse the fuel enhancer to the fuel tank , if you can see the fuel directly from the tank filler and there is no anti-siphon device.
  - b) Immersing the fuel enhancer to the fuel tank by removing the anti-siphon if any.
  - c) By the sender or fuel pump via access plate usually under the back seat if your vehicle can not be installed by the previous methods.
  - d) The air purifier is fitted in the air line before the air filter

**5.1.4. Temperature and humidity**

- 5.1.4.1. The fuel saving and emission reduction device operating temperature shall be a minimum lower and upper limit of – 10°C and +55° C respectively.
- 5.1.4.2. The fuel saving and emission reduction device shall operate with Humidity range of 5% to 95%.

**5.1.5. Safety requirement**

**5.1.5.1. Electromagnetic Compatibility**

- 5.1.5.1.1. The fuel saving and emission reduction device EMC shall comply with ES xxxx

**5.1.5.2. Conducted Electromagnetic Interference**

- 5.1.5.2.1. The device shall not create any electromagnetic interference (EMI) on the vehicle alternator, vehicle ignition, air conditioner/heater motor, *windshield wiper motor and typical police and citizens band transceivers and* any other electric appliances when tested

**5.1.5.3. Radiated disturbance**

- 5.1.5.3.1. The device shall recover its normal performance, without operator intervention after temporary loss of function or degradation of performance which ceases after the disturbance ceases (if any) and shall pass the test EN 55022: 2006+A1:2007 and EN, 55014-1:2006+A1:.
- 5.1.5.3.2. The normal function of the device shall not be disturbed with Continuous radiated Radio- frequency and shall pass the test ES IEC61000-4-3:).

**5.1.5.4. Electrostatic discharge (ESD)**

- 5.1.5.4.1. The device shall recover its normal performance caused by electrostatic discharge without operator intervention after temporary loss of function or degradation of performance and shall pass the test ES IEC 61000-4-2:.

**5.1.6. Environmental**

- 5.1.6.1. The fuel saving and emission reduction device shall be environmental friendly that comply with ES ISO 14001.

## 5.2. The Manufacturer shall provide the following Information.

### 5.2.1. Complete Operating Instructions.

This includes test procedures, required maintenance, and any operating characteristics that are indicative or symptomatic of possible malfunction of the fuel saving device.

### 5.2.2. Installation instructions

Complete instructions for installing the device and verifying their operation, including test procedures, required maintenance, and operating conditions indicative or symptomatic of a possible malfunction of the device system.

## 5.3. Truth-in-advertising

5.3.1.1. Any description of the product that appears on the packaging or inside the package shall be truthful and accurate.

5.3.1.2. No statements should mislead buyers or end users about the features or utility of the product. Included appliances are subject to truth-in-advertising requirements for performance claims.

## 5.4 Test condition

5.4.1. The fuel saving and emission reduction device shall be tested at ambient temperature of 24 °C and humidity 56%

### 5.4.2. Environmental Test

#### 5.4.2.1. Environmental conditions

- a) During the test the environmental conditions shall be within the range of temperature 15 – 35 °C
- b) Humidity 25-75 %
- c) Atmospheric pressure 86- 106 KPa

## 6. Sample size

Two test samples shall be drawn for a type of product.

## 7. Test methods:

### 7.1. Over the road test

1. There are two ways to perform an over the road test. It is possible to perform a short term test, which is a baseline test run over a clean route and data recorded.
2. After the device is fitted, run the engine at 3/4 of maximum RPM for at least 5 minutes to use up the fuel between the fuel tank and the engine and then top up the tank at the same pump, wait another 30 minutes and repeat the run.
3. Top up again at the same pump and compare the results. Depending on the type of vehicle and the installation method for the fuel saver you may not be able to do both runs on the same day. AS you will have filled up at the end of the baseline run you will have a full fuel tank. It is not advisable to install it when you have a full tank as you may spill fuel.
4. You can also do an average test by collecting mileage data over at least six fuel tanks prior to fitting the Fuel Saver and collecting data on an ongoing basis after fitting it. With older vehicles you may notice your economy improving more and more over time as you engine is cleaned of carbon build up.

### 7.2. Idle test /Gas analyzer test

1. For best results testing should be conducted at idle rpm with a warmed up engine.  
IMPORTANT ! Remember to get all of the baseline readings that you require in the “before” tests, as once you have installed it to the engine, you cannot go back to the pre-installation condition.
2. If you are performing gas analysis in conjunction with either, over the road or chassis dynamometer test, collect your gas results at idle before you do your “before” test runs.
3. If using a dynamometer, you can also collect data for under cruising load as well. Once you have completed all of your baseline tests and recorded your results, you can then install it to your vehicle.
4. As per the fitting instructions, once installed wait 30 minutes for the fuel on board to become treated, and then run the engine at 3/4 of full RPM for 5 to 10 minutes to run out the untreated fuel in the fuel line, and allow the engine ECU to become familiar with the new fuel properties.
5. Then repeat the same test procedure as per you baseline tests. Take your new gas readings and compare the results to those that you have recorded prior to installation.

The changes you will see are:

- a. Hydrocarbons: Should DECREASE (-)
- b. Carbon Dioxide: Should INCREASE (+)
- c. Carbon Monoxide: Should DECREASE (-)
- d. Oxygen: Should DECREASE (-)
- e. NOx: Should DECREASE (-)
- f. SOx: Should DECREASE (-)

#### SPECIAL NOTE:

- When conducting gas analysis on an older, or high mileage engine, it is likely that your tests immediately after fitting the device may show an increase, rather than a decrease in hydrocarbon output. This is because the engine has significant carbon buildup on the engine itself, which it will immediately begin to burn off causing higher HC readings.

- This will be evident as in these cases the NO<sub>x</sub> output will be lower, which is the result of complete combustion confirming your result. Checking the exhaust over time will see the HC reducing.

**g. Dynamometer test**

1. A Dynamometer test can be completed entirely in a single session. It is possible to measure exhaust content (if the Dyno has that feature) and horsepower/torque changes.
2. It is also possible to check fuel economy as well by filling from a fuel drum.
3. For typical Dyno testing, set up your vehicle and perform testing under load at 60 Kmh, 80Kmh and 100Kmh.
4. Record your results.
5. Install it to vehicle.
6. Wait 30 minutes for fuel to become treated.
7. Run the engine for 5 to 10 minutes at 3/4 of full RPM to run through untreated fuel between the fuel tank and the engine.
8. Run the vehicle for at least 60 Km's on the Dyno to familiarise the ECU with the changed fuel properties.
9. Repeat the full load tests for same time, load and speeds and compare the results.
10. If you would like to check fuel consumption, you will need to fill the tank from a fuel drum to the very top of the fuel neck so you have a visual full tank reference.
11. You will require "accurate" electronic scales to determine the weight of the fuel and drum. Weigh the fuel/drum before the test.
12. Run a Dyno test cycle for at least 100 km's. Refill fuel tank to your visual full reference point and note the weight of fuel used to refill.
13. Install it to vehicle, allow 30 minutes for fuel to become treated and then run engine at 3/4 full rpm for 5 to 10 minutes to run out untreated fuel.
14. Run the vehicle for at least 60 Km's on the Dyno to familiarise the ECU with the changed fuel properties.
15. Run Dyno test cycle exactly as the baseline test. Note weight of fuel/drum and top up vehicle fuel tank to visual reference point. Check weight of fuel consumed.
16. Note: Conversion factor for petrol is 0.711, so one litre of petrol weighs 0.711kg at 60°F or 16°C.
17. Remember, if you want to perform both types of tests, you will need to do all of your baseline tests before fitting. Once you have fitted, you cannot return the vehicle to pre-treated condition.

**h. Warranty Requirements**

- i. The minimum warranty period from the time of installation shall be **one** Year.
- ii. The warranty shall cover, at a minimum, manufacturing defects that impede operation under normal use and protection from early device failure.
- iii. Full terms of the warranty shall be available to the consumer in writing in a way that enables the end user to verify and understand the terms of the warranty prior to purchase.



## Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010. ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1970.

*ESA's objectives are:-*

- ❖ Develop Ethiopian standards and establish a system that enable to check whether goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

## Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.

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**International Involvement**

ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the international Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM). It is a founding member of the African Regional Organization for standardization (ARSO).

### More Information?

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