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Ethanol-fuelled cooking appliances — Specification

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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 575 was prepared by Joint Technical Committees RSB/JTC 49, 24, 10 and 50, *Renewable energy systems*, *chemical and consumer products*, *Electrical installation and protection against electric shock*, *Electrical generation, transmission and distribution systems* respectively.

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

KS 2759:2018, *Ethanol fuelled cooking appliances —Specification*

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

Committee membership

The following organizations were represented on the Joint Technical Committees RSB/JTC on *Renewable energy systems* (RSB/TC 49), *Chemical and consumer products* (RSB/TC 24), *Electrical installation and protection against electric shock* (RSB/TC 10) and *Electrical generation, transmission and distribution systems* (RSB/TC 50) respectively in the preparation of this standard.

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Ethanol-fuelled cooking appliances — Specification

1 Scope

This Draft Rwanda Standard specifies requirements, sampling and test methods for ethanol-fuelled appliances for household cooking.

It does not cover the requirements for lamps or for gelled-fuel appliances.

NOTE 1 The requirements for Denatured Ethanol for Use as Cooking and Appliance Fuel are covered in ASTM E3050

NOTE 2 The requirements for ethanol gel are covered in SANS 448.

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 ASTM E3050, *Denatured ethanol for use as cooking and appliance fuel*

SANS 448, *Ethanol gel for cooking and other gel burning appliances*

ASTM D4806, *Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines*

RS ISO 19867-1, *Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols — Part 1: Standard test sequence for emissions and performance, safety and durability*

3 Terms and definitions

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

3.1

acceptable

acceptable to the authority administering this standard, or to the parties concluding the purchase contract, as relevant

3.2

appliance

denatured technical alcohol (ethanol-liquid) or ethanol-gel fuelled device used for households cooking and heating

3.3

denatured technical alcohol

ethanol liquid mixture meeting the minimum requirements of RS ASTM E3050

3.4

ethanol gel

ethanol gel mixture meeting the minimum requirements of SANS 448.

3.5

roll boiling

condition when boiling at which vigorous convection is attained

4 Requirements

4.1 Material

4.1.1 General

Material used in the construction of an appliance and its components shall be of such quality and thickness as to withstand (without cracking, warping, buckling, or other permanent damage) the operating conditions to which it will be subjected in normal service (see also 4.3.7 and 4.3.11).

4.1.2 Corrosion resistance

All metallic material shall be intrinsically corrosion-resistant, or shall be protected with an acceptable coating of such quality that, when the coated surface is tested in accordance with 6.11, there shall be no sign of pitting or penetration of the metal.

4.2 Construction

If not fully assembled, the appliance shall be assembled according to the manufacturer's instructions as supplied. Removable components shall fit in a positive, unique and rigid manner. No parts shall become detached if the appliance is knocked over. Permanently fitted components shall be rigid and fixed in a manner suitable for the duty they have to perform. If the design of the appliance is such that special tools are required for removable parts, such tools shall be supplied with the appliance.

4.3 Performance

4.3.1 Filling

The appliance shall be designed in such a way that it can be readily filled with minimum risk of spillage. Where necessary, the appliance shall be supplied with a tool/component that will facilitate the filling process (i.e. funnel for liquid ethanol fuel). It shall not be possible to refill the appliance while it is alight.

4.3.2 Ignition

When the appliance is fully assembled and filled with fuel, it shall be ready to light as per instructions supplied in accordance with 5.3.

4.3.3 Combustion performance

When tested in accordance with 6.3, the appliance shall heat 5 litres of water from 25 °C to 90 °C in less than 20 min and shall boil water within 30 min.

4.3.4 Power output

When tested in accordance with 6.4, the appliance shall produce a heat output of at least 1.4 kW at 45 % thermal efficiency.

4.3.5 Flame regulator

The appliance shall be fitted with a flame regulator, which shall be readily accessible and easily adjusted when the appliance is alight low, medium and high flame settings. The flame regulator must extinguish the stove when closed or turned to the off position.

4.3.6 Emissions

When tested in accordance with 6.5, the CO_2 to CO ratio shall not exceed a volumetric ratio of 1:0.03.

4.3.7 Rigidity (ability to withstand heavy load)

When the appliance is tested in accordance with 6.6, no component shall become distorted, or broken and each component shall maintain its mating component in an operative manner.

4.3.8 Stability of the appliance

When tested in accordance with 6.7, the appliance shall not topple over.

4.3.9 Shutting off the appliance

When tested in accordance with 6.8, there shall be no flame visible when the flame regulator is returned to its “ON” position. The ON and OFF position should be clearly marked.

4.3.10 Surface temperature

When tested in accordance with 6.9, the surface temperature of any part of the appliance that may need to be touched during its operation shall not exceed 60 °C.

4.3.11 Durability

When tested in accordance with 6.10, the appliance and all its components shall be free of damage and distortion and all parts shall maintain their mating component in an operative manner.

4.4 Finish

All exposed surfaces of the appliance shall be easily cleanable; edges and corners shall be smooth. Corners edges and control levers on appliances shall not entangle clothes and overturn the stove.

4.5 Additional requirements for an appliance for heating

4.5.1 The burner of the appliance shall be covered with a guard that will prevent:

a) any contact with the burner, and

b) any loose, heated components from becoming dislodged from the appliance.

4.5.2 If the appliance is intended to be portable, it shall be furnished with a carrying handle that is applied in a position that the user cannot burn his/her hand**.**

5 Packing, marking, instructions, and warnings

5.1 Packing

Each appliance shall be packed to prevent damage to the appliance and its components and fittings during normal transportation and handling and there shall be no fuel in the fuel container.

5.2 Marking

Each appliance shall carry the following information legibly and indelibly marked in an easily identifiable position directly on the body or on an acceptable name plate or a heat-resistant sticker effectively attached to the body:

a) the name or trademark of the manufacturer and the country of origin;

b) the manufacturer's model name and type number;

c) the manufacturer's batch number;

d) the words "USE ETHANOL GEL ONLY" or "USE LIQUID ETHANOL ONLY";

e) on and off marking;

f) efficiency;

g) maximum withstanding weight;

h) manufacturing date; and

i) QR code detailing cooking appliance's specifications such as safety, performance, and fuel type.

5.3 Instructions and warnings

The manufacturer of the appliance shall provide written instructions and warnings accompanying the appliance concerning its assembly, safe use, maintenance and operation. This shall be written at least in English and have sufficient pictograms to ensure comprehension. The manufacturer's instruction shall include the following:

a) before lighting the appliance, ensure that all the components are undamaged and properly assembled in accordance with the illustrated design;

b) do not place the appliance near flammable items;

c) place the appliance on a reasonably level and stable surface. The level can be checked by placing a pan of water on the surface;

d) use only the recommended ethanol fuel. Do not use paraffin, petrol, methylated spirit or water in the appliance;

e) store ethanol fuel out of reach of children;

f) use the appliance in a well-ventilated area;

g) do not refill the appliance when lit;

h) do not carry or move a cooking appliance when lit;

i) do not use the appliance near combustible materials;

j) do not use a cooking appliance as a heating appliance;

k) do not leave children alone when the appliance is lit; and

l) appearance of a persistent yellow flame indicates a malfunction.

NOTE 1 The manufacturer should include any other special instructions or warnings to ensure the safe and efficient operation of the appliance.

NOTE 2 The manufacturer should include instructions for the maintenance and servicing of the appliance to ensure optimum operation.

6 Inspection and test methods

6.1 Test room conditions and preparation of the appliance

6.1.1 Test room conditions

The appliance shall be tested in a well ventilated test room that shall be free of draughts likely to affect the performance of the appliance. The room temperature shall be 20 °C ± 5 °C.

6.1.2 Preparation of the appliance

6.1.2.1 Both the appliance and the fuel shall be at room temperature at the start of the tests.

6.1.2.2 The appliance shall be placed on a reasonably level surface, in the case of a stove, a pot shall be put on the cooking surface.

6.2 Inspection

6.2.1 Visually inspect each appliance for compliance with all the relevant requirements of clauses 4 and 5, compliance with which is not assessed by the tests given in 6.3 to 6.11 (inclusive).

6.2.2 Check and examine each appliance to ensure that all components are undamaged and are properly assembled and positioned according to the manufacturer's instructions.

6.3 combustion performance test

6.3.1 apparatus

6.3.1.1 Stove, which is designed to operate on ethanol fuel.

6.3.1.2 Aluminium pot, 225 mm ± 5 mm in diameter and 125 mm ± 5 mm in depth without lid.

6.3.1.3 Stopwatch.

6.3.1.4 Thermocouple, that is able to measure temperature up to 100 °C.

6.3.2 Procedure

6.3.2.1 Ensure that the ambient air temperature of the laboratory is maintained at 20 °C ± 5 °C.

6.3.2.2 Introduce 1 L of water into the pot.

6.3.2.3 Fill the stove to its maximum extent with ethanol fuel.

6.3.2.4 Ignite the burner and adjust the flame to the highest level.

6.3.2.5 After ignition, place the pot on the cooking surface and immediately start the stopwatch.

6.3.2.6 Record the temperature rise of water every 5 min until it reaches 90 °C.

6.3.2.7 As soon as the water attains 90 °C, stop the stopwatch.

6.3.2.8 Continue heating water until roll boiling is achieved.

6.3.2.9 Record the total time taken to heat water from 25 °C to 90 °C.

6.3.2.10 Check for compliance with 4.3.3.

6.4 Determination of power output

6.4.1 Fill the appliance to the maximum level with fuel. Determine the mass of the fuel and appliance to ±1 g. If the appliance is designed as a cooker, place a pot containing 2.5 L of water on the appliance.

6.4.2 Ignite the appliance and note the time.

6.4.3 Adjust the flame to the highest level.

6.4.4 Allow the appliance to burn for 30 min without refuelling while adjusting the flame, if needed, to its highest level.

6.4.5 After 30 min, extinguish the appliance and remove the pot.

6.4.6 Once more, determine the mass of the appliance to ± 1 g.

6.4.7 Calculate the power output in kW as follows:

where

$P = [(M_{ci} - M_{cf}) \times H_c] / (T*1000)$;

P is power (kW);

M_{ci} is the initial mass of fuel in the cookstove (grams);

M_{cf} is the final mass of fuel in the cookstove (grams);

Hc is the energy content of the fuel (J/g);

T is the time of the combustion phase (seconds).

NOTE 1 The calorific value of the fuel has to be determined.

NOTE 2 Using 24200 Kj/kg is the highest Net calorific value of pure Ethanol

6.4.8 Check for compliance with 4.3.4.

6.5 Emissions test

6.5.1 Apparatus

6.5.1.1 Aluminium pot, 225 mm ± 5 mm in diameter and 125 mm ± 5 mm in depth.

6.5.1.2 Collecting hood, as illustrated in figure 1 in the case of a stove.

6.5.1.3 Gas measuring instrument, that can determine the quantity of carbon monoxide and carbon dioxide developed inside the collecting hood while the appliance is in operation.

6.5.2 Procedure

6.5.2.1 Fill and light the appliance and adjust the flame to the highest level.

6.5.2.2 For the stove, place the pot filled with water on the cooking surface and place the collecting hood over the stove such that the hood fits securely on the pot and the steam that develops is conveyed by means of the vents. Let the appliance run for 10 min before taking the samples.

6.5.2.3 Using a suitable measuring instrument, collect sufficient samples of gas and determine the CO_2:CO ratio and check for compliance with 4.3.6.

6.6 Rigidity test

6.6.1 Apparatus

20 kg mass piece, of diameter 250 mm ± 3 mm.

6.6.2 Procedure

6.6.2.1 At the conclusion of the determination of the power output test (see 6.4) refill and light the appliances.

6.6.2.2 Place the mass piece on top of each cooking surface for a period of 8 h, refilling and relighting the appliance as necessary.

6.6.2.3 Carefully remove the mass piece, and inspect the appliance and components for compliance with 4.3.7.

6.7 Stability test

6.7.1 Apparatus

Aluminium pot, 225 mm ± 5 mm in diameter and 125 mm ± 5 mm in depth filled with 3 L of water.

6.7.2 Procedure

6.7.2.1 When the appliance is full

Fill the appliance to its maximum extent. Tilt the appliance through an angle of 15°, maintain that position for 3 min, and check for compliance with 4.3.8. Repeat the test in three other directions, each 90° from the preceding one.

6.7.2.2 When the appliance is empty

Empty the appliance of all fuel. Place the pot on the appliance. Tilt the appliance through an angle of 10° and check for compliance with 4.3.8. Repeat the test in three other directions, each 90° from the preceding one.

6.8 Shutting off the appliance test

6.8.1 Apparatus

6.8.1.1 Aluminium pot, 225 mm ± 5 mm in diameter and 125 mm ± 5 mm in depth.

6.8.1.2 Stopwatch

6.8.2 Procedure

6.8.2.1 Fill the fuel tank to its maximum extent.

6.8.2.2 Light the burner(s) and adjust the flame to the highest level. Place the pot filled with 2 L of water on the cooking surface of the appliance. Let the appliance burn for 1 h.

6.8.2.3 Turn the flame regulator to the “OFF” position and simultaneously start a stopwatch.

6.8.2.4 5s later, turn the flame regulator to the “ON” position and check that the flame has been extinguished.

6.8.2.5 Check for compliance with 4.3.9.

6.9 Surface temperature

6.9.1 Apparatus

6.9.1.1 Aluminium pot, 225 mm ± 5 mm in diameter and 125 mm ± 5 mm in depth.

6.9.1.2 Thermocouple.

6.9.2 Procedure

6.9.2.1 Fill the appliance to its maximum extent.

6.9.2.2 Place a pot filled with 2 L of water on each cooking surface. Light the burner(s) and run the appliance for 1 h.

6.9.2.3 Using a thermocouple, measure the surface temperature of the flame regulator and any other parts that may need to be touched during normal operation.

6.9.2.4 Check for compliance with 4.3.10.

6.10 Durability test

6.10.1 Ignite the appliance and adjust the flame to its highest level. Allow the appliance to burn at this rate for 6 h, refilling and relighting the appliance as necessary. After this period, allow the appliance to cool to room temperature. Repeat this procedure 10 times. Leave the appliance to cool for 1 h, thereafter, inspect the appliance and its components for any damages.

6.10.2 Check for compliance with 4.3.11.

6.11 Corrosion resistance test for ethanol gel fuelled stoves

6.11.1 Procedure

6.11.1.1 Remove any residue from the fuel container of the appliance with warm water, and dry it.

6.11.1.2 Examine the fuel container for any signs of damage or corrosion. Check for compliance with 4.1.2.

6.11.1.3 Fill the container with a gel fuel that complies with the requirements of SANS 448 according to the manufacturer's instructions.

6.11.1.4 Place the appliance in a fume cupboard or fume hood operated at an air velocity sufficient to remove the products of combustion for 10 min.

6.11.1.5 Ignite the fuel and allow it to burn completely, then leave the appliance in the fume cupboard until the next test.

6.11.1.6 Repeat 6.11.1.1 to 6.11.1.5 (inclusive) above every day for a total of 20 working days.

6.11.1.7 Inspect the appliance closely, note observations, and check the appliance for compliance with 4.1.2.

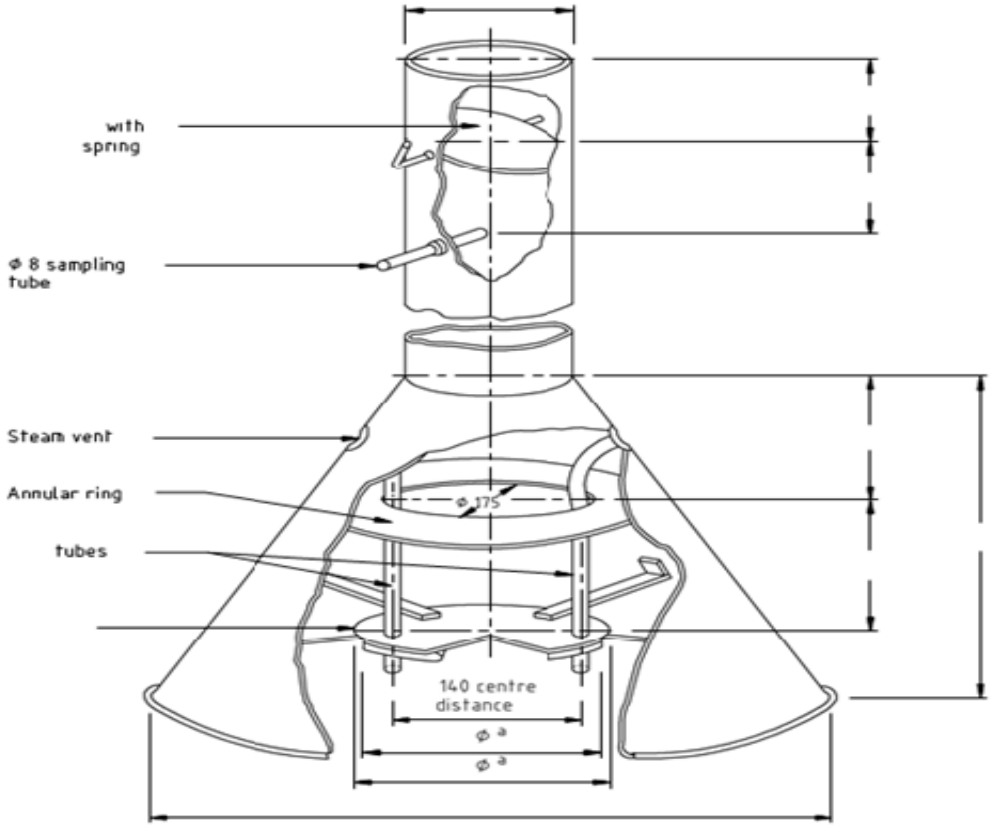

Figure 1 — Collecting hood for cooking stove

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