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Emission limits — Specification

Part 2:

Non-road mobile machinery



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In order to match with technological development and to keep continuous progress in industries, standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition

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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 407-2 was prepared by Joint Technical Committee RSB/TC 023, *Road vehicles* and RSB/TC 041, *Environmental protection*.

DRS 407 consists of the following parts, under the general title *Emission limits — Specification*:

- *Part 1: Road vehicles*
- *Part 2: Non-road mobile machinery*
- *Part 3: Thermal power plants*

Committee membership

The following organizations were represented on the Joint Technical Committee on Road vehicles (RSB/TC 23) and Environmental protection (RSB/TC 41) in the preparation of this standard.

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Integrated Polytechnic Regional College (IPRC) Kigali

Metropole Motors

Ministry of Environment (MoE)

Ministry of Infrastructure (MININFRA)

Ministry of Trade and Industry (MINICOM)

PurePro® Ltd

Real Contractors Ltd

Rwanda Environment Management Company (RWEMACO)

Rwanda Garages Association (RGA)

Rwanda National Police (RNP)

Rwanda Transport Development Agency (RTDA)

Rwanda Utility Regulatory Agency (RURA)

SAR Motor

Standards for Sustainability (SfS)

Sulfo Industries Rwanda

TUMECO Garage

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Introduction

This Draft Rwanda Standard was preceded by a Rapid Situational Assessment Report that established that there are currently no Rwanda standards or emission limits in place for non-road mobile machinery (NRMM) including construction and agricultural machinery, engine-run hand-held equipment and generators. The report further established that, whereas in a few developed countries e.g. UK have in-use emission limits for some of the NRMM, the majority of countries only have type approval/certification emission standards for new (off-factory) equipment. This is because of the small numbers of these kinds of equipment and their sparse distribution; hence their overall impact on air quality is generally very low and localized, and overall air pollution reductions from their regulation is also very small.

Additionally, testing infrastructure for in-use NRMM, engine-run hand-held equipment and generators does not exist in most countries, just like in Rwanda. The report, therefore, recommended Rwanda to develop standards for new (off-factory) equipment that are placed in the Rwandan market, mainly through importation, noting that Rwanda does not currently manufacture any of these equipment. Such a standard as proposed herein can be easily implemented/enforced, for example, through a regulation requiring that all imported NRMM be accompanied by a type-approval certificate/sticker issued by an approval authority in the country of manufacture.

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Emission limits — Specification — Part 2: Non-road mobile machinery

1 Scope

This Draft Rwanda Standard specifies emission limits for all categories of internal combustion engines installed in non-road mobile machinery used in Rwanda.

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.

ISO 8178-4, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 4: Steady-state and transient test cycles for different engine applications*

3 Terms and definitions

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

3.1

non-road mobile machinery

mobile machine, transportable industrial equipment or vehicle with or without body work, not intended for passenger or goods transport on the road, in which an internal combustion engine as specified in Annex A (Table A1) is installed

3.2

type-approval

procedure whereby an approval authority in the country of manufacture certifies that an internal combustion engine type satisfies the relevant technical requirements with regard to the emission limits specified in this standard or other equivalent/greater standard

3.3

approval authority

competent authority in the country of manufacture responsible for all aspects of type-approval of an engine and for verifying the manufacturer's conformity of emission requirements

3.4

hand-held engine

engine that meets at least one of the following requirements:

- a) engine must be used in a piece of equipment that is carried by the operator throughout the performance of its intended functions;
- b) engine must be used in a piece of equipment that must operate multipositionally, such as upside down or sideways, to complete its intended function(s);
- c) engine must be used in a piece of equipment for which the combined engine and equipment dry weight is under 20 kg and at least one of the following attributes is also present:
 - 1) operator must alternatively provide support or carry the equipment throughout the performance of its intended function(s);
 - 2) operator must provide support or attitudinal control for the equipment throughout the performance of its intended function(s); or
 - 3) engine must be used in a generator or a pump.

3.5

non-hand-held engine

engine that is used in a piece of equipment that is not carried or supported by the operator during the performance of its intended functions

3.6

engine type

category of engines which do not differ in such essential engine characteristics

3.7

engine family

manufacturer's grouping of engines which, through their design, are expected to have similar exhaust emission characteristics and which comply with the requirements in Clause 4 of this standard

3.8

compression ignition (C.I.) engine

internal combustion engine which works on the compression-ignition principle, i.e., an engine in which ignition of the fuel, which is injected into the combustion chamber, is caused by the elevated temperature of the air in the cylinder due to the mechanical compression, and is generally a diesel engine

3.9**spark ignition (SI) engine**

internal combustion engine which works on the spark-ignition principle, i.e., where the combustion process of the air-fuel mixture is ignited by a spark from a spark plug, and is generally a petrol engine

3.10**test cycle**

sequence of test points, each with a defined speed and torque, to be followed by the engine under steady state

3.11**rated speed**

maximum full load speed allowed by the governor as specified by the manufacturer

3.12**per cent load**

fraction of the maximum available torque at an engine speed

3.13**maximum torque speed**

engine speed at which the maximum torque is obtained from the engine, as specified by the manufacturer

3.14**intermediate speed**

engine speed which meets one of the following requirements:

- a) for engines which are designed to operate over a speed range on a full load torque curve, the intermediate speed shall be the declared maximum torque speed if it occurs between 60 % and 75 % of rated speed;
- b) if the declared maximum torque speed is less than 60 % of rated speed, then the intermediate speed shall be 60 % of the rated speed;
- c) if the declared maximum torque speed is greater than 75 % of the rated speed then the intermediate speed shall be 75 % of rated speed; or
- d) for engines to be tested on cycle G1, the intermediate speed shall be 85 % of the maximum rated speed.

4 Requirements

4.1 General requirement

Any non-road mobile machinery, which is subject to this standard, shall fall in one of the following two categories:

Category 1: diesel-powered machinery

Category 2: gasoline-powered machinery

4.2 Specific requirements

All non-road mobile machinery, which are subject to this standard, shall meet emission requirements set out in Table 1 & Table 2.

Table 1 — Type approval/certification emission limits for new imported diesel-powered (compression ignition) engines for non-road mobile machinery

Net engine power (p) (KW)	Limit values ^a in g/kWh				Test method	
	CO	HC	NOx	PM	ISO 8178-4 mode/NRSC*	CI-8
p>560	3.5	0.5	6.0	0.2		
130≤p≤560	3.5	1.0	6.0	0.2		
75≤p<130	5.0	1.0	6.0	0.3		
37≤p<75	5.0	1.3	7.0	0.4		
18≤p<37	5.5	1.5	8.0	0.8		

*Non-Road Steady Cycle

Table 2 — Type approval/certification emission limits for new imported gasoline-powered engines for non-road mobile machinery (spark ignition engines)

Engine Category	Limit values in g/kWh					Test method
	Class	CO	HC	NOx	HC +NOx	
Hand-held engine	SH1	805	295	5.36	N/A ¹	ISO 8178-4
	SH2	805	241	5.36	N/A	
	SH3	603	161	5.36	N/A	
Non-hand-held engine	SN1	519	N/A	N/A	50	

¹ N/A: Not Applicable

	SN2	519	N/A	N/A	40	
	SN3	519	N/A	N/A	16.1	
	SN4	519	N/A	N/A	13.4	

NOTE For more detailed information on SH and SN, refer to Annex A.

5 Test methods

Emissions testing for all non-road mobile machinery subject to this standard shall be carried out in accordance with the test methods outlined in Annex B.

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Annex A

(informative)

Classes of spark-ignition (SI) engines

Spark-ignition (SI) engines are divided into the following classes:

Main class S: small engines with a net power <19 kW

The main class S shall be divided into two categories based on engine displacement:

H: engines for hand-held machinery

N: engines for non-hand-held machinery

Table A1 — Engines classification based on their displacement

Category	Class	Displacement (d) (cubic cm)
Hand-held Engines	SH1	$d < 20$
	SH2	$20 \leq d < 50$
	SH3	$d \geq 50$
Non-Hand held engines	SN1	$d < 66$
	SN2	$66 \leq d < 100$
	SN3	$100 \leq d < 225$
	SN4	$d \geq 225$

Annex B (normative)

Test methods

B.1 Testing of non-road mobile machinery with compression-ignition (CI) engines

All non-road mobile machinery operating with compression ignition engines shall be tested according to the test procedures and conditions described under ISO 8178-4 CI-8 mode/Non-Road Steady Cycle (NRSC) Test. This test cycle consists of a number of speed and torque (load) modes, which cover the typical operating range of diesel engines.

B.2 Testing of non-road mobile machinery with spark-ignition (SI) engines

Emissions from small non-road mobile machinery with spark-ignition engines shall be measured over one of four steady-state engine dynamometer test cycles (ISO 8178-4), depending on the type of machinery as follows:

- a) Cycle D: engines with constant speed and intermittent load. Such machines include generating sets with intermittent load including generating sets on board ships and trains (not for propulsion), refrigerating units, welding sets; gas compressors;
- b) Cycle G1: non-hand-held intermediate speed applications. Typical examples include front or rear engines riding lawn mowers; golf carts; lawn sweepers; pedestrian-controlled rotary or cylinder lawn mowers; snow-removal equipment; waste disposers;
- c) Cycle G2: non-hand-held rated speed applications. Example include portable generators, pumps, welders and air compressors; may also include lawn and garden equipment, which operate at engine rated speed; and
- d) Cycle G3: hand-held applications such as blowers; chain saws; hedge trimmers; portable saw mills; rotary tillers; sprayers; string trimmers; vacuum equipment.

Bibliography

- [1] Directive 97/68/EC of the European Parliament and of the Council, *on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery*
- [2] Directive 2002/88/EC of the European Parliament and of the Council amending Directive 97/68/EC, *on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery*
- [3] Directive 2004/26/EC of the European Parliament and of the Council amending Directive 97/68/EC *on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery*

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