

**RWANDA
STANDARD**

**DRS
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Emission limits — Specification —

Part 3:

Thermal power thermal thermal plants

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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Requests for permission to reproduce this document should be addressed to:

Rwanda Standards Board

P.O Box 7099 Kigali-Rwanda

KK 15 Rd, 49

Tel. +250 788303492

Toll Free: 3250

E-mail: info@rsb.gov.rw

Website: www.rsb.gov.rw

ePortal: www.portal.rsb.gov.rw

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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 407-3 was prepared by joint Technical Committee RSB/TC 23 (*Road Vehicles*) and RSB/TC 41 (*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 thermal thermal plants*

Committee membership

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

Akagera Motors

Energy Development Corporation Ltd (EDCL)

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)

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SAR Motors

Standards for Sustainability (SfS)

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

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Emission limits — Specification — Part 3: Thermal power thermal thermal plants

1 Scope

This Draft Rwanda Standard specifies requirements for emission limits and test methods for thermal power thermal thermal plants.

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 7996, *Ambient air — Determination of the mass concentration of nitrogen oxides — Chemiluminescence method*

ISO 4224, *Ambient air — Determination of carbon monoxide — Non-dispersive infrared spectrometric method*

ISO 8186, *Ambient air — Determination of the mass concentration of carbon monoxide — Gas chromatographic method*

ISO 4221, *Air quality — Determination of mass concentration of sulphur dioxide in ambient air — Thorin spectrophotometric method*

ISO 12141, *Stationary source emissions — Determination of mass concentration of particulate matter (dust) at low concentrations — Manual gravimetric method*

3 Terms and definitions

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

3.1

emission

discharge of substances from a power plant into the atmosphere

3.2**emission limit value**

permissible quantity of a substance contained in the waste gases from a power plant which may be discharged into the air during a given period

NOTE It is calculated in terms of mass per volume of the waste gases expressed in mg/Nm³, assuming oxygen content by volume in the waste gas of 15 % for all thermal plants and fuels and fuel types except for boilers (3 % O₂ for gaseous and liquid fuels, 6 % for solid fuels).

3.3**fuel**

any material capable of releasing energy by combustion or by chemical or physical reaction

3.4**gas turbine**

machine which converts thermal energy into mechanical work; it consists of one or several rotating compressors, a thermal device(s) which heats the working fluid, one or several turbines, a control system and essential auxiliary equipment. Any heat exchangers (excluding waste exhaust heat recovery exchangers) in the main working fluid circuit are considered to be part of the gas turbine

3.5**engine**

machine delivering shaft power by the conversion of fuel chemical energy into mechanical work during combustion

3.6**gas engine**

internal combustion engine which operates according to the Otto cycle and uses spark ignition to burn fuel

3.7**diesel engine**

internal combustion engine which operates according to the Diesel cycle and uses compression ignition to burn fuel

3.8

natural gas

complex gaseous mixture of hydrocarbons, primarily methane, but generally includes ethane, propane and higher hydrocarbons, and some non-combustible gases such as nitrogen and carbon dioxide

NOTE Natural gas can also contain components or containments such as sulfur compounds and/or other chemical species.

3.9

solid fuel

any form of solid substance that is burnt to release heat or energy such as coal, peat or biomass

3.10

liquid fuel

any form of liquid substance that is burnt to release heat or energy such as heavy fuel oil, light fuel oil, crude oil, emulsified fuels or liquid bio fuels

3.11

gaseous fuel

any form of gaseous substance that is burnt to release heat or energy such as natural gas

4 Requirements

The following stack emission limit apply to the different types of power thermal thermal plants as outlined in Table 1, Table 2 and

Table 3.

Table 1 — Emission limits for power thermal plants above 50mwth (in mg/Nm³ or as indicated) under reference conditions of 273.15 °K and 101.3 kPa

Combustion technology/Fuel	Particulate Matter (dust)	Sulphur dioxide (SO ₂)	Nitrogen Oxides (NOx)	Carbon monoxide (CO)
Reciprocating engine				
Natural Gas	30	N/A ^a	75	100
Liquid fuel, 50-100MWthb	30	400	450	100
Liquid fuel, 100-300MWthb		250	200	100
Liquid fuel, >300MWth	30	200	150	100
Bio-fuels/gaseous fuels other than natural gas	30	N/A	200	-
Combustion Turbine				
Natural gas (all turbine types of unit > 50 MWth)	N/A	N/A	50	100
Fuels other than natural gas (Unit > 50MWth)	30	400 (for Low calorific gases from coke oven) 200 (for Low calorific gases from blast furnace) 5 (Liquefied gas) 35 (in general)	200	100

Other gaseous fuels	30	400 (for Low calorific gases from coke oven) 200 (for Low calorific gases from blast furnace) 5 (Liquefied gas) 35 (in general)	120	N/A
Boiler				
Natural gas	30	35	100	100
Other gases		400 (for Low calorific gases from coke oven) 200 (for Low calorific gases from blast furnace) 5 (Liquefied gas)	200	N/A
Liquid fuels (Plant >50 MWth to <100 MWth)	30	400 (for Low calorific gases from coke oven) 200 (for Low calorific gases from blast furnace) 5 (Liquefied gas)	450	100
Liquid fuels (Plant 100-300 MWth)	30	250	200	100
Liquid fuels (plant >300)		200	150	100
Solid fuels (Plant 50 - 100 MWth)	30	400	300	100
Solid fuels (Plant 100 - 300 MWth)	30	250	200	100
Solid fuels (Plant >300 MWth)	30	200	200	100

^a N/A = not applicable (no emissions guideline)

^b MWth = Megawatt thermal is the heat input on Higher Heating Value (HHV) basis

NOTE All emission limit values shall be calculated after correction for the water vapour content of the waste gases and at a standardised O₂ content of 6 % for solid fuels, 3 % for combustion thermal thermal plants, other than gas turbines and gas engines using liquid and gaseous fuels and 15 % for gas turbines and gas engines.

Table 2 — Emission limits for power thermal thermal plants below 50 MWth (in mg/Nm³ or as indicated) under reference conditions of 273.15 °K and 101.3 KPa

Combustion technology/Fuel	Particulate Matter (PM) (dust)	Sulphur dioxide (SO _x)	Nitrogen Oxides (NO _x)	Carbon monoxide (CO)
Reciprocating engine				
Natural gas	N/A	N/A ^a	95 190 (Dual fuel engines in gas mode)	100
Liquid fuel, 1-5 MWth ^b	N/A	N/A	190 225 (Dual fuel engines in liquid mode)	100
Liquid fuel, 5-20 MWth	N/A	N/A	190 225 (Diesel Engines)	100
Liquid Fuels, 20 – 50 MWth	N/A	N/A	225	100
Liquid fuels other than gas oil, 1-5 MWth	20	120 590 (Diesel Engines)	190	100

Liquid fuels other than gas oil , 5 – 20 MWth	10	120 590 (Diesel engines)	225	100
Liquid fuels other than gas oil, 20 - 50 MWth	10	120 590 (Diesel engines)	225	100
gaseous fuels other than natural gas	10	15 40 (biogas)	190 225 (Dual fuel engines in liquid mode)	N/A
Gas turbine				
Natural gas (all turbine types)	N/A	N/A	50	100
Gaseous fuels other than natural gas	N/A	15 40 (Biogas)	190	N/A
Liquid fuels other than gas oil	20	120 590 (diesel engines)	75	N/A
Gas oil	N/A	N/A	75	100
Boiler				
Natural gas	N/A	N/A	100	100
Other gaseous fuels	N/A	35 100 (Biogas)	200	N/A
Liquid fuels (Plant 1 MWth to <5 MWth)	N/A	N/A	200	100
Liquid fuels (Plant 5 -50 MWth)	N/A	N/A	200	100
Liquid fuels other than gas oil	50	350	300	N/A

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Solid fuels (Plant 1 - 5 MWth)	50	400	500	100
Solid fuels (Plant 5 - 50 MWth)	20	400	300	100
<p>^a N/A = not applicable (no emissions guideline)</p> <p>^b MWth = Megawatt thermal is the heat input on Higher Heating Value (HHV) basis</p>				

NOTE All emission limit values shall be calculated after correction for the water vapour content of the waste gases and at a standardised O₂ content of 6 % for solid fuels, 3 % for combustion thermal thermal plants, other than gas turbines and gas engines using liquid and gaseous fuels and 15% for gas turbines and gas engines

Table 3 — Emission limits for existing power thermal thermal plants below 100 MWth

Combustion technology/Fuel	Particulate Matter (PM) (Dust)	Sulphur dioxide (SO _x)	Nitrogen Oxides (NO _x)	Carbon monoxide (CO)
Reciprocating engine				
Natural gas	N/A	N/A	190 380 (Dual fuel engines in gas mode)	175
Liquid fuel, 1-5MWth ^b	N/A	N/A	250 1850 (Engines constructed before 2006 and dual fuel engines)	175
Liquid fuel, 5-20 MWth ^b	N/A	N/A	225	175

Liquid fuel, 20-50MWth ^b	N/A	N/A	190	175
Liquid fuels , 50 – 100 MWth	Not to exceed 250 (Daily Average)	850	450	250
Liquid fuels other than gas oil below 5 MWth	10	120	250	N/A
Liquid fuels other than gas oil (5 – 20 MWth)	20	120	225	N/A
Liquid fuels other than gas oil 20- 50 MWth	10	120	190	N/A
Liquid fuels other than Gas oil (Plant 50-100MWth)	Not to exceed 250 (Daily Average)	850	450	250
Gaseous fuels other than natural gas (thermal plants below 50 Mwth)	10	15 60 (Biogas)	250	N/A
Gaseous fuels other than natural gas (thermal plants 50 - 100 Mwth)	Not exceeding 250 (daily Average)	35 800 (Low calorific gases from gasification of refinery residues,	300	250

		coke oven gas, blast-furnace gas)		
Combustion turbine				
Natural gas (all turbine types of Unit below 50MWth)	N/A	N/A	150	175
Natural gas (all turbine types of Unit 50 - 100MWth)	N/A	35	75	250
Gaseous fuels other than Natural gas (thermal plants below 50MWth)	N/A	15 60 (Biogas)	200	N/A
Gaseous fuels other than Natural gas (thermal plants 50 – 100 MWth)	N/A	35 800 (Low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas)	120	250
Liquid fuels other than gas oil (thermal plants below 50 MWth)	10	120	200	N/A
Gas oil (thermal plants 50 – 100 MWth)	Not exceeding 250 (Daily Average)	850	450	175
Boiler				
Natural gas	N/A	N/A	200	175

Other gaseous fuels (1- 5 MWth)	N/A	200	250	N/A
Other gaseous fuels 5 – 20 MWth)	N/A	35	250	N/A
Other gaseous fuels (20 - 50 MWth)	N/A	35	250	N/A
Other gaseous fuels (thermal plant 50 -100 MWth)	Not exceeding 250	35 800 (Low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas)	300	250
Gas oil (thermal plant below 50 MWth MWth)	N/A	N/A	200	175
Gas oil (thermal plants 50-100 MWth)	Not to exceed 250 (daily Average)	850	450	250
Liquid fuels other than gas oil (plant 1- 5 MWth)	50	350	650	N/A
Liquid fuels other than gas oil (plant 5-20 MWth)	50	350	650	N/A
Liquid fuels other than gas oil (plant 20 – 50 MWth)	30	350	650	250

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Liquid fuels other than gas oil (Plant 50 – 100 MWth)	Not to exceed 250 (Daily Average)	850	450	250
Solid fuels (Plant 1 MWth – 5 MWth)	30	1100 200 (biomass)	650	175
Solid fuels (thermal plant 5 MWth – 20 MWth)	50	1100 200 (biomass)	650	175
Solid fuels (thermal plants 20-50 MWth)	50	400	650	175
Solid fuels (thermal plants 50 – 100 MWth)	Not to exceed 250 (daily average)	850	600	250
<p>a N/A = not applicable (no emissions guideline);</p> <p>b MWth = Megawatt thermal is the heat input on Higher Heating Value (HHV) basis</p>				

NOTE All emission limit values shall be calculated at a temperature of 273,15 K, a pressure of 101,3 kPa and after correction for the water vapour content of the waste gases and at a standardised O₂ content of 6 % for solid fuels, 3% for combustion thermal thermal plants, other than gas turbines and gas engines using liquid and gaseous fuels and 15 % for gas turbines and gas engines.

5 Test methods

The testing of the various pollutants shall be carried out according to the test methods outlined in the table below:

Pollutant	Test method
Particulate Matter (dust)	ISO 12141
Sulphur oxides (SO _x)	ISO 4221
Nitrogen oxides (NO _x)	ISO 7996
Carbon monoxide (CO)	ISO 4224 and ISO 8186

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