
**Agroprocessing machines —
Specification —**

Part 4:

Heated air mechanical grain dryer

ICS 65.060.01

Reference number

DRS 268-4: 2020

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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 268-4 was prepared by Technical Committee RSB/TC 047, *Steel aluminium and related products*.

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

1) XYZ: Title

2) XYZ: Title

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

This second edition cancels and replaces the first edition (RS 268-4: 2015) which has been technically revised.

DRS 268 consists of the following parts, under the general title *Agroprocessing machinery — Specification*:

- Part 1: Rice thresher
- Part 2: Power operated maize sheller
- Part 3: Rice mill
- Part 5: Maize mill

Committee membership

The following organizations were represented on the Technical Committee on *Steel alminum and related products* (RSB/TC 047) in the preparation of this standard.

University of Rwanda/college of science and technology

University of Rwanda/College of agriculture animal science and veterinary medicine

Kabizu business group Ltd

Rwanda Polytechnic/IPRC Kigali

Rwanda Polytechnic/IPRC Ngoma

Rwanda Polytechnic/IPRC Musanze

RWANTECH Boilers

Rwanda Inspectorate and competition authority

Rwanda Institute for Conservation Agriculture

ACER Ltd

Rwanda Standards Board (RSB) – Secretariat

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Agroprocessing machines — Specification — Part 4: Heated air mechanical grain dryer

1 Scope

This Draft Rwanda Standard specifies the classification, requirements, methods of test and sampling for heated air mechanical grain dryer used for commercial purposes. It does not include dryers for seeds

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.

DRS 269-4, *Agroprocessing machines— Test methods — Part 3: Rice mill*

RS 241, *Agriculture machinery— Methods of sampling*

RS 236, *Acoustics — Noise pollution — Tolerance limit*

3 Terms and definitions

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

3.1

batch type

mechanical grain dryer where in the grain in fixed volume is held in the drying chamber in batches until the grain reaches the desired moisture content

3.2

continuous flow dryer

dryer in which the material being dried moves through the drying chamber in a substantially continuous stream and is discharged without being recirculated

3.3

cracked grains

grains which show signs of fissures or fractures or splinters

3.4

dryer, direct-fired

dryer in which the products of combustion come into direct contact with the product being dried

3.5

dryer, indirect-fired

dryer in which the products of combustion do not come in contact with the products being dried

3.6

head rice

grain or a fraction of grain with its size equal to or greater than eight-tenth (8/10) of size of the whole grain

3.7

heated-air mechanical grain dryer

device used to remove grain moisture by forcing heated air through the grain mass until the desired moisture content is attained

3.8

moisture gradient

difference between the maximum and the minimum grain moisture content randomly sampled after drying.

4 Classification

Heated-air mechanical grain dryers shall be classified based on:

4.1 System of operation

Heated – air mechanical grain dryers based on system of operation shall be as follows:

a) batch type; and

- 1) flat bed: shallow bed batch type dryer wherein a fixed volume of grain is held stationary in a horizontal grain holding bin
- 2) recirculating: batch type dryer equipped to circulate and/or mixed fixed volume of grain during the drying operation; and
- 3) vertical bin: columnar type batch type dryer wherein a fixed volume of grain is held stationary in a vertical grain holding bin

b) continuous flow

- 1) concurrent-flow: parallel flow type continuous flow dryer wherein the product being dried moves in the same direction as drying air
- 2) counter-flow: continuous flow dryer wherein the grain being dried move in one direction and the drying air moves in the opposite direction
- 3) cross-flow: continuous flow dryer wherein the flow of air is transverse to the direction of flow of the grain being dried
- 4) Mixing: continuous flow dryer wherein the drying bin is similar to columnar drying bin except that it includes louvers causing mixing to occur as the grain flows through the system
- 5) non-mixing: continuous flow dryer wherein the grains in the drying bin flows through the column in a straight path.

NOTE It consists of two parallel screens or columns of louvers. The space between the two columns is the plenum chamber where heated air is introduced and forced through the grain

4.2 Heating system

Heated – air mechanical grain dryers based on heating system shall be as follows:

a) method of heat introduction; and

- 1) direct
- 2) indirect

b) fuel source

- 3) conventional
- 4) non-conventional

5 Requirements**5.1 Performance**

5.1.1 The performance of heated-air mechanical grain dryers shall be as specified in Table 1.

Table 1 — Performance criteria for mechanical grain dryer

| S/N | Criteria | Rice | Maize |
|--|--|-------------------------|-------------------------|
| | | Batch/(Continuous Flow) | Batch/(Continuous Flow) |
| 1. | Final moisture content, % w.b | 14.0 | 14.0 |
| 2. | Moisture gradient, %, max. | 2.0 | 2.0 |
| 3. | Product quality* | | |
| | - Cracked grain, % increase, max. | 5.0 (2.0) | 35 |
| | - Head rice, % decrease, max. | 5.0 | N/A |
| | - Hulled/damaged grain, % increase, max. | 3.0 | N/A |
| | - Broken/Split kernels, % increase, max | N/A | 7.0 |
| 4. | Spillage, %, max. | 0.5 | 0.5 |
| 5. | Drying efficiency, % min. | 75 | 75 |
| 6. | Heating system efficiency, % min | | |
| | Petroleum based fuel direct fired | 90 | 90 |
| | Petroleum based indirect-fired | 75 | 75 |
| | Biomass fuel direct-fired | 65 | 65 |
| | Biomass fuel indirect-fired | 50 | 50 |
| * allowable difference between the laboratory analysis and machine's performance | | | |

5.1.2 The indicated grain holding capacity must be attained.

5.1.3 The dried grain shall have no additional discoloration, no traces of unburned fuel or ashes on grain surface and no fermented or musty smell.

5.1.4 The dryer shall be provided with thermometer to measure the actual air temperature entering the grain mass and a pressure gauge to measure the working static pressure in the plenum.

5.2 Safety

5.2.1 It shall have adequate provision for fire control.

5.2.2 It shall have adequate protection from or for all moving parts. All rotating parts shall be dynamically balanced.

5.2.3 It shall be provided with features for access to parts during repair, maintenance and operation.

5.2.4 The noise emitted by the heated-air mechanical grain dryer shall comply with the requirements given in RS 236

5.2.5 Provision shall be made for dust control. Its dust emission shall be within the acceptable limits set by the National Authority in charge of Environmental management. The emission shall be controlled and managed

6 Workmanship and finish

6.1 Heated-Air mechanical grain dryer shall be free from defects that may be detrimental to its use and shall be free from sharp edges and surface that may hurt the operator.

6.2 All metal parts shall be machine bend, pressed and cut to avoid rough surfaces and all rough surfaces shall be machine finished and smoothed.

6.3 Uniformity of parts and components for same brand and model shall be maintained

7 Maintenance and operation

7.1 Each heated-air mechanical grain dryer shall be provided with a set of relevant mechanic tool kit.

7.2 An instruction manual (User's manual, parts catalogue and service manual) shall be provided.

7.3 All components that require regular maintenance, servicing and adjustment should be easily accessible

8 Sampling and testing

8.1 The heated-air mechanical grain dryer shall be sampled for testing in accordance with RS 241.

8.2 The sampled heated-air mechanical grain dryer shall be tested in accordance with RS 269-4

Marking

Heated air mechanical grain dryer shall be indelibly and legibly marked with the following information in one of three official languages used in Rwanda:

- a) registered trademark of the manufacturer;
- b) type; serial number;
- c) name and address of the manufacturer;
- d) country of manufacture;
- e) load capacity, tons;
- f) rated power/voltage/frequency/phase;
- g) dry weight, kg;

h) dimension; and

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