

**RWANDA
STANDARD**

**DRS
107: 2018**

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2018-xx-xx

**Building Sands from natural sources —
Specification**

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 107 was prepared by Technical Committee RSB/TC 09, *Civil Engineering and Building Materials*.

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

- 1) BS 1199 and 1200: *Specification for building sands from natural sources*

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

This second edition cancels and replaces the first edition (RS 107: 2010 Building Sands - Specification), of which has been technically revised.

Committee membership

The following organizations were represented on the Technical Committee on Civil Engineering and Building Materials (RSB/TC 09) in the preparation of this standard.

Green Effect Engineering

Institut d' Enseignement Supérieur (INES- Ruhengeri)

NPD Ltd

Ruliba Clays

EarthEnable

Rwanda Housing Authority (RHA)

Rwanda Transport Development Agency (RTDA)

Standards for Sustainability

Strawtec

University Of Rwanda – College of Science & Technology

Rwanda Standards Board (RSB) – Secretariat

Introduction

The method of determining the grading of sands is restricted to that of washing and decantation, followed by dry sieving, and the method of dry sieving only is no longer permitted. The washing and sieving method specified is considered to be more reproducible and to produce a more realistic measure of the particle size distribution of the sand.

It also determines the clay and silt content which is now incorporated in the grading requirements. This change to washing and sieving necessitates revision of the grading limits as those previously given in this edition were based on results from dry sieving.

This is not intended to lead to changes in the gradings of sand in use, but it will have the effect of bringing the majority of sands in satisfactory use. Experience currently available suggests that satisfactory renderings can be achieved using either grade. Where there is a choice, however, the use of the coarser grade is preferred because finer sands require a higher water to cement ratio which can lead to greater shrinkage than if a coarser grading is used.

Some variability in the measured properties of building sands from any source has to be expected. This is caused by sampling and testing errors in addition to the natural variability of the material itself. The application of statistical methods has been considered, but has not been included at the present time.

Building sands from natural sources— Specification

1 Scope

This Draft Rwanda Standard covers the requirements for naturally occurring sands, crushed stone sand and crushed gravel sands used for external renderings and internal plastering using mixes of lime and sand (with or without the addition of cement or gypsum plaster), cement and sand (with or without the addition of lime). It also relates to sands intended to be used for mortar for masonry, for brickwork (plain and reinforced), for building with clay or concrete block and for masonry.

2 Normative references

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.

RS 96-3, *Aggregates—Test Methods: Part 3: Methods of sampling*

RS 96 – 4, *Determination of particle size distribution – sieve tests*

RS ISO 3310-2, *Test sieves —Part 2: Technical requirements and testing, Part 2: Test sieves and of metal wire cloth*

3 Terms and definitions

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

3.1

sand

Naturally occurring granular material composed of finely divided rock and mineral particles with a diameter of between 0.074 mm to 4.75 mm retained on a standard RS sieve or ISO sieve no. 200 and passing a 4.75mm RS (No. 4)sieve. It may be either natural sand or one obtained by crushing hard rocks or gravels.

3.2

natural sand

sand produced by the natural disintegration of rock which has been deposited by streams or glacial agencies or obtained from pits.

3.3

Coarse sand

Granular materials passing a 4.75-mm sieve (No. 4) and retained on a 2.00-mm (No. 10) sieve. The fraction of coarse sand is composed of particles between 2.00mm to 0.6mm.

3.4

Medium sand

Granular materials passing a 2.00-mm sieve (No. 10) and retained on a 0.475-mm (No. 40). The fraction of medium sand is composed of particles between 0.60mm to 0.2mm.

3.5

Fine sand

Granular materials passing a 0.475-mm (No. 40) sieve and retained on a 0.075-mm (No. 200) sieve. The fraction of fine sand is composed of particles between 0.20mm to 0.06mm.

3.6

Clean sands

These are well-graded sands containing entirely or mostly quartz (SiO₂) particles in wide range of grain size.

3.7

Silty Sands

These are poorly graded sands, which have considerable proportion of silt (particle size between 1/16 – 1/256mm) and other non plastic-fines.

3.8

Clayey Sands

These are poorly graded sands having a prominent clay fraction (particle size below 1/256 mm) and also plastic fines.

3.9

crushed stone sand and crushed gravel sand

Fine aggregate produced by crushing a hard stone or rock and a gravel respectively.

3. 10

fine aggregate

aggregate of particle size such that at least 90 % of its mass passes a sieve that has square apertures of nominal size 4,75 mm and that no greater mass percentage than that permissible in terms of table 1 is retained on a sieve that has square apertures of nominal size 75 µm.

3.11

mortar

mixture of fine aggregate and one or more cementitious binders and water, and that is used for the bedding and jointing of masonry units.

3.12

plaster

mixture of fine aggregate and one or more cementitious binders and water, and that is applied to surfaces (interior or exterior) other than floors, as a protective coating or as a decorative coating, or as both.

4 Sampling and Testing

4.1 Guidelines for sampling and testing of sands shall be carried out in accordance with the requirements of RS 96 - 3 & 96 -2.

4.2 Testing of sands shall be carried out in accordance with the requirements of relevant parts of RS 96.

4.3 The grading of sands shall be determined by the method of sieve analysis by washing and decantation followed by dry sieving using the following nominal aperture size test sieves: 4.75 mm square hole perforated

plate; 2.36 mm, 1.18 mm, 600 μm , 300 μm , 150 μm , 75 μm woven wire as described in RS 96-4 or RS ISO 3310-2

4.4 When testing is carried out, compliance of the material with this Standard shall be judged using the average of two single test results obtained by testing different test portions

5 Quality of sands

5.1 General Requirements

5.1.1 Sands shall consist of natural sand, manufactured sand, crushed stone sand or crushed gravel sand, or a combination of any of these. The sand shall be hard, durable, clean and free from impurities.

5.1.2 The various sizes of particles of which sand is composed shall be uniformly distributed throughout the mass.

5.1.3 Sands shall be chemically inert and not containing salts that can cause dampness

Note: Some variability in the measured properties of building sands from any source has to be expected. This is caused by sampling and testing errors in addition to the natural variability of the material itself.

5.2 Specific Requirements

5.2.1 Deleterious materials

Sands shall not contain harmful materials such as iron pyrites, salts, coal or other organic impurities such as mica, shale or similar laminated materials, or flaky or elongated particles in such a form or in sufficient quantity to affect adversely the hardening, the strength, the durability or the appearance of the final product or any materials in contact with it.

Sands shall be free from adherent coatings and organic matter and shall not contain clay, silt and dust more than a specified amount as described in 5.2.2

5.2.2 Limits of deleterious materials

Unless found satisfactory, as a result of further tests as may be specified by the engineer in charge of work, or unless evidence of such performance is offered which is satisfactory to him/her, the maximum quantities of clay, fine silt, fine dust and organic impurities in the sand shall not exceed the following limit;

- a) clay, fine silt and dust: Not more than 4% by weight.
- b) organic impurities; the colour of liquid shall be below that indicated by comparison with the standard solution specified in Annex B of this standard. Estimation of organic impurities shall be determined in accordance with RS ASTM C33 or Annex A of this standard.

5.2.3 The average compressive strength, determined by the standard procedure of mortar cubes with mix cement to sand mix ratio of 1:6, shall be not less than 3 N/mm² at 28 days.

6 Grading

6.1 Grading for sands for external renderings and internal plastering with cement and lime

The sand shall be of type A or type B and graded within the limits given in Table 1, when determined according to clause 4.3.

Table 1 – Sands for external renderings, internal cement and lime plastering

RS sieve	Percentage by mass passing RS sieves	
	Type A	Type B
mm	%	%
6.30	100	100
4,75	95 - 100	95 - 100
2,36	60 – 100	80 – 100
1,18	30 – 100	70 – 100
µm		
600	15 – 80	55 - 100
300	5 – 50	5 - 75
150	5 – 35	
75	Not greater than 5	Not greater than 5

6.1.1 Sands complying with the grading requirements in Table 1 for sieve apertures in the range 4.75 mm to 600 µm but exceeding the requirements for the percentage passing the 300 µm, 150 µm and 75 µm sieves shall also be considered as being satisfactory where there is evidence of acceptable performance in use. Although insufficient information exists to provide generalized and authoritative guidance on the use of such materials, local experience of their performance in use should help in the evaluation of their suitability for particular applications.

6.1.2 A sand whose grading falls outside the above limits on sieves other than the 4, 75 mm sieve in Table 1 by a total amount not exceeding 5% shall be regarded as being within those limits. This 5% can be split up, for example, as 1% on each of three sieves and 2% on another, or 4% on one sieve and 1% on another.

6.1.3 Sands which just fall outside the above limits due to a small excess of coarse particles can often be made to comply with this Rwanda Standard by screening through a suitably sized sieve.

Note: The most suitable grading of sand for an external rendering will depend, to some extent, upon the finishing. The sand grading will, in general, be suitable for the undercoats and for some finishing coats such as the smooth (floated) finishing coats, the scraped finishes and for pebble-dash or dry-dash. For some textured finishes, such as those produced by treatment of the freshly applied final coat with a tool, it may be desirable to remove the coarser particles (e.g. by screening through a 2 mm sieve), while for others such as “torn texture”, some proportion of material coarser than 5 mm may be needed. For roughcast (wet dashing or hurling) the grading and maximum size, will vary according to the texture required and the type of aggregate: the proportion of coarse material (over 5 mm) to fine should be about 1 : 2.

6.2 Grading for sands for masonry mortar

The grading of the sand when determined according to clause 4.3 shall be within the limits given in Table 2. Appropriate to its type. Additionally, for the upper limit for the percentage by mass sand passing the 75 μm sieve, no test result shall be greater than 10 % for uncrushed sands and 15 % for crushed stone sands and not more than 1 in 10 consecutive results shall be greater than 8 % for uncrushed sands and 12 % for crushed stone sands.

Table 2 — Sands for mortar for plain and reinforced brickwork, block-walling and masonry

RS sieve	Percentage by mass passing RS sieves	
	Type A	Type B
mm	%	%
6.30	100	100
4,75	98 - 100	98 - 100
2,36	90 – 100	90 – 100
1,18	70 – 100	70 – 100
μm		
600	40 – 100	40 - 100
300	5 – 70	20 - 90
150	5 – 15	0 - 25
75	0 – 5	0 – 8
For crushed stone sands	0 – 10	0 – 12

7 Supplier's certificate and cost of tests

7.1 The supplier shall ensure that the output at the source of production complies consistently with the requirements of this Rwanda Standard and, if requested, shall give a certificate to this effect to the purchaser or his representative.

7.2 If the purchaser or his representative requires independent tests or the certification of individual consignments, the samples shall be taken before or immediately after delivery at the option of the purchaser or his representative, and these tests shall be carried out in accordance with the appropriate requirements of this Standard on the written instructions of the purchaser or his representative.

7.3 Unless otherwise specified with the enquiry and order, the supplier shall supply free of charge the material required for testing and the cost of the tests (unless otherwise stipulated) shall be borne:

- c) by the supplier, in the event of results showing that the material does not comply with the standard; and
- d) by the purchaser, in the event of results showing that the material does so comply.

8 Additional information to be furnished by the supplier

8.1 The direct purchaser of sand shall include the information in 8.2 of this standard in the purchase order as applicable. A project specifier shall include in the project documents information to describe the type of sand to be used in the project as stated in 8.2

8.2 When requested by the purchaser or his/her representative, the supplier shall provide any of the following additional particulars:

- a) source of supply (for material dredged from rivers, the precise locality from which the material was obtained shall be stated.)
- b) Reference to this specification as DRS 107
- c) The Quantity in cubic meters
- d) Physical properties: the relative density and water absorption determined according to RS 96, and the bulk density in kilograms per cubic metre
- e) Grading; a typical sieve analysis determined according to the requirements of clause 4.3

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Annex A (normative)

Estimation of Organic Impurities

A.1 General

This method of test covers an approximate method of estimating whether organic compounds are present in natural sand in sufficient quantities to be harmful, and hence intended to show whether further tests are necessary or desirable.

Note: Harmless organic materials may cause colouration and certain naturally occurring organic compounds do not cause colouration.

Procedure

The sand shall be tested as delivered and without drying. A 350-ml graduated clear glass medicine bottle shall be filled to the 75-ml mark with 3 percent solution of sodium hydroxide in water. The sand shall be added gradually until the volume measured by the sand layer is 125ml. The volume shall then be made up to 200 ml by adding more solution. The bottle shall be stoppered and shaken vigorously and then allowed to stand for 24 hours.

Other tests shall be made if the colour of the liquid above the sand is darker than a standard solution freshly prepared as follows:

Add 2.5 ml of 2 percent solution of tannic acid in 10 percent alcohol, to 97.5 ml of a 3 percent sodium hydroxide solution. Place in a 350-ml bottle, stopper, shake vigorously and allow to stand for 24 hours before comparison with the solution above the sand. Alternatively, an instrument or coloured acetate sheets for making the comparison can be obtained, but it is desirable that these should be derived on receipt by comparison with the standard solution.

Annex B (normative)

Determination of Clay, Fine silt and Fine Dust (Sedimentation Method)

B.1 General

This is a gravimetric method for determining the clay, fine silt and fine dust, which includes particles up to 20 micron. Differences in the nature and density of materials or in the temperature at the time of testing may vary the separation point.

B.2 Apparatus

The apparatus shall consist of the following:

- a) A weight screw-topped glass jar of dimensions similar to a 1-kg fruit preserving jar.
- b) A device for rotating the jar about its long axis with this axis horizontal, at a speed of 80 ± 20 rev/min
- c) A sedimentation pipette of the Andreason type or its equivalent of approximately 25 ml capacity. This consists mainly of a pipette fitted with at the top with a two-way tap and held rigidly in a clamp which can be raised or lowered as required, and which is fitted with a scale from which the changes in height of the pipette can be read.

The Volume of the pipette, including the connecting bore of the tap B is determined by filling with distilled water; by reversing the tap, the water is run out into a bottle, weighed and the volume calculated.

- d) A 1000 – ml measuring cylinder.
- e) A scale or balance of capacity not less than 10 kg, readable and accurate to one gram.
- f) A scale of balance of capacity not less than 250 g, readable and accurate to 0.001 g.
- g) A well-ventilated oven, thermostatically controlled, to maintain a temperature of 100°C to 110°C .

B.3 Chemicals

A solution containing 8 g of sodium oxalate per litre of distilled water shall be taken. For use, this stock solution is diluted with distilled water to one tenth (that is 100 ml diluted with distilled water to one litre.)

B.4 Test Sample

The sample for test shall be prepared from the main sample taking particular care that the test sample contains a correct proportion of the finer material. The amount of sample taken for test shall be in accordance with table B.1.

Table B 1: Weight of Sample for determination of Clay Fine Silt and Fine Dust

Maximum size present in Substantial Proportions (mm)	Approximate Weight of sample for Test (kg)
63 to 25	6
20 to 12.5	1
10 to 6.3	0.5
4.75 or smaller	0.3

B.5 Test Procedure

(Method of fine Aggregate)

B.5.1 Approximately 300g of sample in the air dry condition, passing the 4.74mm RS or ISO Sieves, shall be weighed and placed in the screw-topped glass jar, together with 300 ml of the diluted sodium oxalate solution. The rubber washer and cap shall be fixed, care being taken to ensure water tightness. The jar shall then be rotated about its long axis, with this axis horizontal, at a speed of 80 ± 20 rev/min for a period of 15 minutes.

B.5.2 At the end of 15 minutes, the suspension shall be poured into the 100-ml measuring cylinder and the residue washed by gentle swirling and decantation of successive 150-ml portions of sodium oxalate solution, the washings being added to the cylinder until the volume is made up to 1 000ml. The determination shall be completed as described in B.5.3.

B.5.3 The suspension in the measuring cylinder shall be thoroughly mixed by inversion and the tube and contents immediately placed in position under the pipette. The pipette A shall then be gently lowered until the tip touches the surface of the liquid, and then lowered a further 10 cm into the liquid. Three minutes after placing the tube in position. The pipette A and bore of tap B shall be filled by opening B and applying gentle suction at C. A small surplus may be drawn to run away and any solid matter shall be removed from the measuring cylinder and its contents run into a weighed container, any adherent solids being washed into the container by distilled water from E through the tap B.

The contents of the container shall be dried at 100 to 110°C to constant weight, cooled and weighed.

B.5.4 Calculations

The Proportion of the fine silt and clay or fine dust shall then be calculated from the following formula;

$$\text{Percentage of clay and fine silt or fine dust} = \frac{100}{W_1} \left(\frac{1\,000 W_2}{V} - 0.8 \right)$$

Where

W_1 = weight in g of the original sample,

W_2 = weight in g of the dried residue,

V = Volume in ml of the pipette, and

0.8 = weight in g of sodium oxalate in one litre of the diluted solution

Note: - No correction is made for water soluble salts which may be present in the sand, since the amount of such salts should be small.

B.5.5 Reporting Results

The clay, fine silt and fine dust content shall be reported to the nearest 0.1 percent.

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Bibliography

[1] SANS 1090: 2002: *Aggregates from natural sources — Fine aggregates for plaster and mortar*

[2] IS 2386: *Methods of Tests for Aggregates, Part II: Estimation of deleterious materials and organic impurities*

[3] RS ISO 14688, *Geotechnical Investigation and Testing*

[3] RS 96-7, *Methods of test for aggregates – Part 7- Determination of moisture content*

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