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Natural stone products — Modular tiles — Requirements

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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 522 was prepared by Technical Committee RSB/TC 9, *Civil engineering and building materials.*

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

1) EN 12057:2004Natural stone products - Modular tiles - Requirements

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

Committee membership

The following organizations were represented on the Technical Committee on *Civil engineering and building materials* (RSB/TC 9) in the preparation of this standard.

A+ Construction Group Ltd

Africeramics Ltd

Consultants Engineers Group (CEG) Ltd

D&D Resources Ltd

Dutureheza Ltd

Enabel Rwanda

Greenpack Africa Ltd

Integrated Polytechnic Regional Centre (IPRC) - Musanze

Mass Design Group

NP Construction Construction Company (NPCC) Ltd

Road Transport Development Agency (RTDA)

Rwanda Housing Authority (RHA)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

Rwanda Quarries Association (RQA)

SKAT Consult

St Joseph Engineering Company (SJEC) Ltd

Standards for Sustainability (SfS)

Stonecraft Industries Ltd

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

Rwanda Standards Board (RSB) – Secretariat

Natural stone products — Modular tiles — Requirements

1 Scope

This Draft Rwanda Standard specifies requirements for flat modular tiles of natural stone which are made for internal (including enclosed public transport premises) and/or external uses as floorings, stairs and wall and ceiling finishes.

This Draft Rwanda Standard does not cover mineral aggregates and artificial agglomerated stone material and does not cover installation. This standard does not also cover fixing by means of mortar and adhesives

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.

DRS 515, Natural stone — Terminology

DRS 524, Masonry and masonry products — Methods for determining thermal properties

DRS 525, Natural stone test methods — Determination of water absorption coefficient by capillarity

DRS 526, Natural stone test methods — Determination of real density and apparent density, and of total and open porosity

DRS 527, Natural stone test methods — Petrographic examination

DRS 528, Natural stone — Denomination criteria

DRS 530, Natural stone test methods — Determination of geometric characteristics on units

DRS 531, Natural stone test methods — Determination of resistance of marble to thermal and moisture cycles

DRS 531, Natural stone test methods — Determination of resistance of marble to thermal and moisture cycles

DRS 532, Natural stone test methods — Determination of the abrasion resistance

DRS 533, Natural stone test methods — Determination of flexural strength under concentrated load

DRS 541, Natural stone test methods — Determination of resistance to ageing by thermal shock

DRS 547, Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests

DRS 549, Natural stone test methods — Determination of water absorption at atmospheric pressure

ISO 10456, Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values

ISO 12572, Hygrothermal performance of building materials and products — Determination of water vapour transmission properties

3 Terms and definitions

For the purposes of this standard, the terms and definitions in DRS 515 and the following apply.

3.1

modular tile

flat piece of natural stone square or rectangular shapes, obtained by cutting or splitting at a nominal thickness ≤ 12 mm

3.2

dimensions of modular tiles

length *l*, width *b* and thickness *d*, given in the stated sequence in millimetres (see Figure 1)

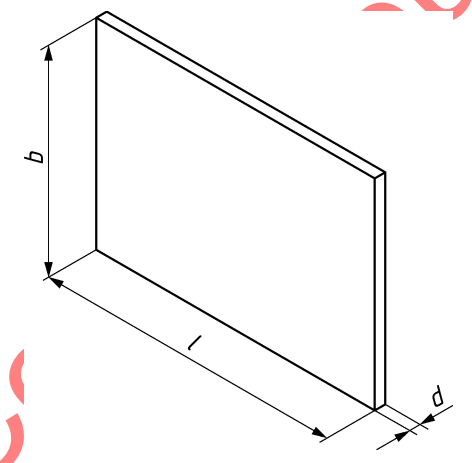


Figure 1 — Dimensions of a modular tile

3.3

calibrated tile

tile which fulfils stricter tolerances for thickness, flatness and squareness

3.4

lower expected value

lower expected value (E_L) corresponds to the 5 %-quantile of a logarithmic normal distribution for a confidence level of 75 %

3.5

higher expected value

higher expected value (E_H) corresponds to the 95 %-quantile of a logarithmic normal distribution for a confidence level of 75 %

4 Characteristics of natural stone modular tiles

4.1 Geometrical characteristics

4.1.1 General

All measurements shall be carried out in accordance with DRS 530 and all measured values of individual units shall fall within the required tolerances

The deviations for dimensions, flatness and squareness shall be as given in Table 1. *

Table 1 — Tolerances on dimensions and shape

Property		Tolerances on dimensions and shape	
		Not calibrated tiles	Calibrated tiles[a]
Dimensions	*l*, *b*	±1 mm	±1 mm
	d	±1.5 mm	±0.5 mm
Flatness (for honed and polished surface only)[b]		0.15 %	0.10 %
Squareness[b]		0.15 %	0.10 %

[a] Calibrated tiles indicate a product submitted to specific mechanical finishing in order to obtain more precise dimensions; they might be suitable to be fixed by thin mortar bed or adhesives

[b] in accordance with DRS 530

4.1.2 Surface finish

4.1.2.1 General

Surface finishes shall extend uniformly to the edges of the modular tiles.

The surface finishing of some types of stones may typically involve the use of patching, fillers or other similar products for natural holes, faults or cracks; this is to be considered as part of the normal processing. In such cases the type of treatment, as well as the type and nature of additional materials, shall be declared.

4.1.2.2 Requirements for surfaces after surface finishing

Surfaces shall be worked to achieve the specified finish and shall have a regular appearance as a result of the finishing process (e.g. making reference to samples, see 4.2.3). For definitions of surface finishes, (see DRS 515).

4.2 Physical and mechanical characteristics

4.2.1 General

Whenever stone processing is likely to change the characteristics of the raw material (e.g. as a consequence of the type of processing or because the use of patching, fillers or other similar products for natural holes, faults, cracks and similar), then this has to be considered when determining the characteristics requested by this document.

The following characteristics shall be declared where requested by this document or with reference to the use conditions

4.2.2 Denomination

The denomination shall always be declared in accordance with DRS 528 (it means traditional name, petrological family, typical colour and place of origin).

NOTE The place of origin can be given by GPS coordinates.

The petrographic definition shall be determined in accordance with DRS 527.

4.2.3 Visual appearance

4.2.3.1 General

The colour, veining, texture, etc. of the stone shall be identified visually, typically by a reference sample of the same stone suitable for providing a general description of visual appearance. The reference sample shall be provided by the supplier.

4.2.3.2 Reference sample, visual inspection and acceptance criteria

A reference sample shall be an adequate number of pieces of natural stone of sufficient size to indicate the general appearance of the finished work. The dimensions of individual pieces shall be at least 0.01 m^2 (typical values are between 0.01 m^2 and 0.25 m^2 in face area but may be more), and shall indicate the range of appearance regarding the colouring, the vein pattern, the physical structure and the surface finish. In particular the reference sample shall show specific characteristics of the stone, such as typical holes, glass seams, spots and crystalline veins.

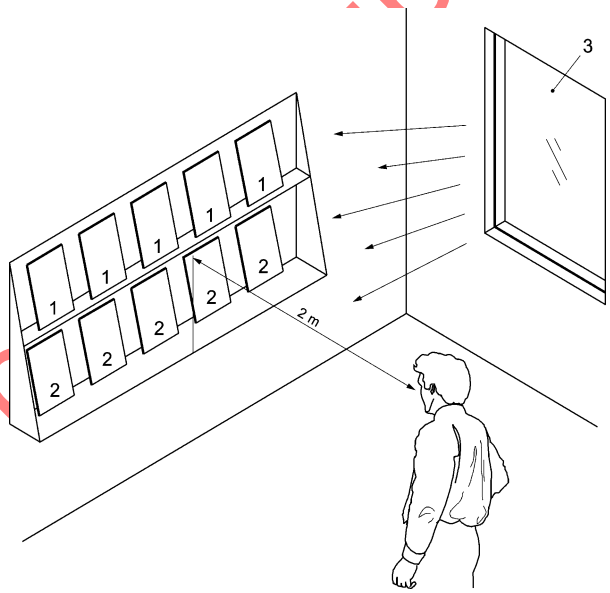
The reference sample does not imply strict uniformity between the sample itself and the actual supply; natural variations may always occur.

If the processing of the stone involves the use of patching, fillers or other similar products for natural holes, faults or cracks, then the reference sample shall similarly display the impact of the same on the finished surface.

All the characteristics as shown by the reference sample shall be considered typical of the stone and not as flaws, therefore they shall not become a reason for rejection, unless their concentration becomes excessive and the typical character of the stone is lost.

The name and address of the producer or the supplier, as well as the denomination of the stone in accordance with 4.2.2 above, shall be indicated on the reference sample.

Any comparison between production sample and reference sample shall be carried out by placing the reference sample against the production samples and viewing them at a distance of about two metres under normal daylight conditions and recording any visible differences in the characteristics of the stones (see Figure 2)



Where,

1 reference sample
2 production sample
3 daylight

Figure 2 — Comparison between production sample and reference sample

4.2.4 Flexural strength

When required the flexural strength shall be determined using the test method in DRS 533 and the mean value, lower expected value and standard deviation shall be declared. Where the surface finish of the delivered product has an influence on the characteristic, the test shall be carried out with this finish, in accordance with the technological tests defined in DRS 533.

4.2.5 Water absorption at atmospheric pressure

When required this characteristic shall be determined using the test method in DRS 549 and the higher expected value (E_H) shall be declared.

4.2.6 Reaction to fire

When required this characteristic shall be declared.

Natural stone tiles may be considered reaction to fire Class A1with the following exceptions.

— Natural stones containing asphalt at greater than 1 % by mass or volume, whichever is the more onerous, and having a final use subject to fire regulations, shall be tested for reaction to fire and classified in accordance with DRS 547.

— Whenever processing of natural stones involves the use of organic patching, fillers or other similar products for natural holes, faults, cracks or similar, at greater than 1 % by mass or volume, whichever is the more onerous and the same stones have a final use subject to fire regulations, then they shall be tested for reaction to fire and classified in accordance with DRS 547.

4.2.7 Water absorption by capillarity

When required (e.g.: when the modular tile is to be used for elements in contact with a horizontal surface where water may be present) this characteristic shall be determined using the test method in DRS 525 and the higher expected value (E_H) shall be declared.

For stone having an open porosity less than 1,0 % this test shall not be performed.

4.2.8 Apparent density and open porosity

When required the apparent density and open porosity shall be determined using the test method in DRS 526 and the mean values of the results declared.

4.2.9 Abrasion resistance

When required, this characteristic shall be declared, for tiles for flooring and stairs only, and shall be determined using the test method in DRS 532 and the higher expected value (E_H) shall be declared and expressed in millimetres when under method A or in $cm^3/50\ cm^2$ under method B.

4.2.10 Resistance to thermal and moisture cycling

The resistance of marble to thermal and moisture cycling shall be declared upon request only for marble intended for cladding of building facades and determined according to DRS 531. For scientific definition of marble, refer to DRS 515.

4.2.11 Thermal shock resistance

When required this characteristic shall be declared and determined using the test method in DRS 541 and the changes both in mass and in flexural strength expressed accordingly.

4.2.12 Water vapour permeability

This characteristic shall be declared when the tile is to be used in a location subject to vapour control requirements.

The permeability coefficient shall be tested or given as tabulated values in accordance with RS ISO 12572 and/or RS ISO 10456.

4.2.13 Slip resistance

This characteristic shall be declared, for tiles for flooring and stairs only, where subject to regulatory requirements or upon request and when the roughness of the surface is less than 1 mm measured following DRS 530.

The slip resistance shall be determined using test methods in DRS 542 and the results expressed accordingly.

Whenever results indicate an insufficient slip resistance of tiles for stairs, then adequate provisions shall be adopted in order to improve this parameter.

NOTE Slip resistance may be improved by mechanical reworking of the surface, or by inserting anti-slip products e.g. rubber profiles, carborundum strips, metal bars or similar.

4.2.14 Skid resistance

This characteristic shall be declared only, where subject to regulatory requirements or upon request and when the roughness of the surface is less than 1 mm measured following DRS 530.

The skid resistance shall be determined as slip resistance (see 4.2.11).

4.2.15 Tactility

This characteristic shall be declared, for tiles for flooring and stairs only, where subject to regulatory requirements or upon request.

The tactility shall be expressed by a description of surface corrugation obtained by mechanical finishes.

4.2.16 Direct airborne sound insulation

When required this characteristic shall be declared and expressed as density and determined using the test method in DRS 526 and expressed as mean value.

4.2.17 Thermal conductivity

Where required this characteristic shall be declared and determined using the test method in DRS 524 and expressed as mean value.

5 Testing, assessment and sampling methods

5.1 Testing

References to the test methods are given in Clause 4.

5.2 Sampling

5.2.1 General

This clause specifies methods for obtaining samples of natural stone from quarries, or plants or buildings. Sampling from buildings may be necessary if the delivered natural stone product is already applied in a building.

The aim of sampling is to obtain a bulk sample that is representative of the average properties of the batch and of its variability.

The methods described are based on manual procedures. The methods described are limited to building and civil engineering purposes.

It is important that samplers are accordingly trained in the application of the methods set out in this document.

In case of dispute or if tests are to be done by more than one organization all interested parties shall have the opportunity to observe the sampling and shall agree upon the number of sampling increments to be taken.

5.2.2 Principles of sampling

Proper and careful sampling and sample transport is a prerequisite for an analysis that will give reliable results. An adequate number of samples shall be taken to obtain a good estimation of the natural heterogeneity of the batch.

The sampler shall be informed of the aim of the sampling.

5.2.2.1 Taking bulk samples

The number and sizes of samples depend on the test methods for which they are taken. The number and shape of specimens are given in the relevant test methods.

5.2.3 Preparing a sampling plan

A sampling plan shall be prepared, prior to sampling, taking into account the following:

a) the type of the natural stone

b) the aim of the sampling including a list of the properties to be tested;

c) the identification of sampling points;

d) the approximate size of samples;

e) the number of samples;

f) the sampling apparatus to be used;

g) the methods of sampling;

h) the marking, packaging and dispatch of the samples.

5.2.4 Sampling apparatus

Any suitable cutting equipment for natural stone may be used for sampling. In addition, drills, which are suitable for taking drill cores, may be used.

5.2.5 Sampling methods

5.2.5.1 General

The sampling methods shall involve the samplers working at a quarry, plant or building. requirements for safety and ergonomics shall be followed.

5.2.5.2 Sampling from quarries

5.2.5.2.1 General

The sample shall be taken by a qualified personnel, experienced in the examination of natural stone deposits. The main objective of sampling from such deposits is to establish, the average, the range of variations and the differences in the structure and properties of the natural stone, taking account of the fabric and geological structure and the anticipated quarrying conditions.

5.2.5.2.2 Sampling of solid rock

a) Identification of anisotropy and orientation of samples

If the exploratory work reveals a pronounced fabric or geological structure which is not necessarily visible at the sample scale (e.g. stratification, massive bedding, lamination, cleavage or rift), the sample shall be marked accordingly.

b) Sampling for petrographic analysis

For petrographic analysis, hand specimens shall be taken from all distinct types and varieties which characterize the rock in terms of mineral composition, fabric and geological structure.

Samples from drilling (cores and pieces) may also be used.

In addition to samples of fresh material, samples shall also be taken to illustrate the effects of weathering.

c) Sampling for physical testing

For physical testing, sample blocks shall be used as samples, their number and location depending on the results of the petrographic analysis and the required test methods.

The sample blocks shall measure approximately 0,40 m × 0,25 m × 0,25 m or more where a coarse-grained and/or a large-pored rock is to be sampled.

Samples shall be taken from larger natural stones which have been least affected by blastings. Care shall be applied to ensure the sample blocks do not show any hairline cracks resulting from the removal process.

Note: Samples may also be cut from rough blocks, slabs or dimension stones, the number and size of samples depending on the particular test method.

5.2.5.3 Sampling from plants

A representative sample of adequate size and characteristic of the natural stone in terms of mineral composition, fabric and geological structure, shall be taken from the material to be tested (e.g. slabs, dimension stones), taking into account the intended use of the material.

5.2.5.4 Sampling at the point of delivery

Where sampling at the point of delivery (e.g. a construction site) of the products is required with regard to ensuring the accuracy, reliability and stability sample testing and assessment of each consignment shall be carried out.

The testing and control shall consist of at least the following characteristics.

— Geometrical properties;

— Visual appearance;

— Mechanical strength by direct or indirect test

5.2.6 Marking, packaging and dispatch of the samples

The samples or containers shall be clearly and durably marked. Marking shall include:

a) a unique code, or

b) identification of the laboratory samples, place of sampling, date of sampling and denomination of the material.

The laboratory samples shall be packed and transported in such a way that they are protected from damage.

5.2.7 Sampling report

5.2.8.1 The sampler shall prepare a sampling report for each laboratory sample or for each group of laboratory samples from a single source. The sampling report shall refer to this draft Rwanda Standard and state:

a) the sampling report identification (serial number);

b) the laboratory sample identification mark(s);

c) the date and place of sampling;

d) sampling point(s) or identification of the batch sampled;

e) a reference to the sampling plan prepared according to 5.2.3;

f) the name of the sampler(s).

5.2.8.2 Depending on the circumstances other information might be relevant. Table 2 shows an example of a comprehensive sampling report

Table 2 — Example of a sampling report

Sampling report identification (serial n°):
Laboratory sample identification mark: no. of package

Description of the natural stone and sampling places

Name of the quarry or production plant or building:
Name of producer:
Origin of batch:
Purpose for which the natural stone is to be used:
Location of sampling point(s):

Identification of the batch:
Size of the batch:
Other comments (e.g. warnings, if appropriate):

Description of the sampling method

Date and time of sampling:
Reference to sampling plan used:
Sampling procedure (drilling, cutting, etc.)
Purpose of the sampling

Samples

No. and dimensions of samples:
Other comments:
Dispatch of the samples:
Sampler(s) (print name):

Contract details

Contract identification:
Name and address of party requesting the sampling:……..
Name of person(s) present at sampling:……
Signatures:…… ……

6 Assessment and verification of constancy of performance (AVCP)

6.1 General

The compliance of natural stone modular tiles with the requirements of this standard and with the declared values shall be demonstrated by:

— Determination of the product type on the basis of type testing;

— Documented factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

6.2 Type Testing

6.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. A list of possible characteristics is given in Table 3.

Assessment previous type tests performed in accordance with the provisions of this standard, shall be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product(s) of similar design, construction and functionality, such that the results are applicable to the product in question.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for those same characteristics for all products within that same family.

NOTE Products may be in different families for different characteristics.

Reference to the test method standards shall be made to allow the selection of a suitable representative sample.

In addition, the determination of the product type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance

— at the beginning of the production of a new or modified modular tile natural stone (unless a member of the same family), or they shall be repeated for the appropriate characteristic(s), whenever a change occurs identified by the Factory Production Control in the modular tile natural stone design, in the raw material or in the supplier of the components, or in the production process, which would affect significantly one or more of the characteristics;

— at the beginning of a new or modified method of production (where this may affect the stated properties).

6.2.2 Test samples, testing and compliance criteria

The number of samples of the natural stone for floorings, stairs and walls and ceiling finishes to be tested/assessed shall be in accordance with Table 3.

Table 3 — Number of samples to be tested and compliance criteria

Characteristic	Requirement	Assessment method	No. of samples	Compliance criteria
Geometrical characteristics	4.1	5.2 and 4.1	DRS 530	4.1
Petrographic description	4.2.2	5.2 and 4.2.2	DRS 527	4.2.2

Visual appearance	4.2.3	5.2 and 4.2.3	4.2.3	4.2.3
Flexural strength	4.2.4	5.2 and 4.2.4	DRS 533	4.2.4
Water absorption atmospheric at pressure	4.2.5	5.2 and 4.2.5	DRS 549	4.2.5
Reaction to fire	4.2.6	5.2 and 4.2.6	DRS 547	4.2.6
Water absorption capillarity by	4.2.7	5.2 and 4.2.7	DRS 525	4.2.7
Apparent density and open porosity thaw	4.2.8	5.2 and 4.2.8	DRS 526	4.2.8
Abrasion resistance	4.2.9	5.2 and 4.2.9	DRS 532	4.2.9
Thermal shock resistance	4.2.11	5.2 and 4.2.11	DRS 541	4.2.11
Water vapour permeability	4.2.12	5.2 and 4.2.12	RS ISO 10456	4.2.12
Slip resistance	4.2.13	5.2 and 4.2.13	See DRS 542	4.2.13
Skid resistance	4.2.14	5.2 and 4.2.13	DRS 542	4.2.14
Direct airborne sound insulation	4.2.15	5.2 and 4.2.15	DRS 526	4.2.16
Thermal conductivity	4.2.16	5.2 and 4.2.16	DRS 524	4.2.17

6.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the modular tile natural stone to which they relate.

6.3 Factory production control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product. All the elements, requirements and provisions adopted by the manufacturer shall be recorded in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

6.3.2 Requirements

6.3.2.1 General

This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with this Rwanda Standard.

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting the constancy of performance of the product, shall be defined. This applies in particular to personnel that needs to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register problems relevant to the constancy of performance of the product.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

— Identify procedures to demonstrate the constancy of performance of the product at appropriate stages;

— identify and record any instance of non-constancy;

— identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the conformity of the product. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-constancy and, if necessary, revise the FPC to rectify the cause of non-constancy.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that all the information necessary to fulfil responsibilities according to this Rwanda Standard are received..

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass these responsibilities on to a subcontractor.

NOTE Manufacturers having an FPC system, which complies with RS ISO 9001 standard and which addresses the provisions of the present Rwanda standard are considered as satisfying the FPC requirements

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

6.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.3 Raw materials and component

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the attestation of conformity level of the component shall be that given in the appropriate harmonized technical specification for that component.

6.3.2.4 Traceability and marking

Natural stone modular tiles shall be identifiable and traceable with regard to the original source. The manufacturer shall have recorded procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

6.3.2.5 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

During the manufacturing process the manufacturer shall apply a continuous verification of selected characteristics in accordance with manufacturer's FPC plan.

The control testing of each of these characteristics is to be carried out using the most appropriate direct or indirect test/check method(s), which is to be detailed in the manufacturer's quality control plan for the parameter(s).

6.3.2.6 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics declared, are maintained. The characteristics and the means of control are given in Table 4.

Table 4 — Characteristics and means of control for factory production control

Reference to clause for applica-bility[a]	Properties/ characteristics	Controls during manufacturing process	Minimum control frequency[c]	Test method in accordance with
4.2.2	Petrographic description	Continuous verification in accordance with manufacturer's factory production	10 years	DRS 527
4.2.3	Visual appearance		Every production lot	Visual
4.1	Geometrical characteristics		Every production lot	DRS 530
4.2.4	Flexural strength		2 years	DRS 533
4.2.5	Water absorption at atmospheric pressure		2 years	DRS 549

4.2.6	Reaction to fire[b] (only where testing is required)	10 years	DRS 547
4.2.7	Water absorption by capillarity[b]	10 years	DRS 525
4.2.8	Apparent density and open porosity	2 years	DRS 526
4.2.9	Abrasion resistance[b]	10 years	DRS 532
4.2.11	Thermal shock resistance[b]	10 years	DRS 531
4.2.12	Water vapour permeability[b]	10 years	RS ISO 10456
4.2.13	Slip resistance[b]	10 years	DRS 542
4.2.14	Skid resistance[b]	10 years	DRS 542
4.2.15	Tactility[b]	10 years	—
4.2.16	Direct airborne sound insulation[b]	10 years	DRS 526
4.2.17	Thermal conductivity[b]	10 years	DRS 524

[a] Reference shall be made to these clauses in order to decide which characteristics need to be declared.

[b] Only for products intended for uses subject to this requirement.

[c] The testing frequency should be established so that it represents a means to guarantee the constancy of the product's performance and a reliable declaration for both the users and the manufacturer.

6.3.2.7 Non-complying products

The manufacturer shall have recorded procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this Rwanda standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

6.3.2.8 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

6.3.2.9 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

6.3.3 Product specific requirements

6.3.3.1 The FPC system shall

— address this Rwanda Standard and

— ensure that the products placed on the market comply with the declared performance characteristics.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan,

and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

6.3.4 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The natural stone modular tile produced as a one-off, prototypes assessed before full production is established, and products produced in very low quantities up to 10 m^2 per year) shall be assessed as follows

For type assessment, the provisions of 6.2.1, 3rd paragraph apply, together with the following additional provisions:

a) in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

b) on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and

FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

a) the FPC-documentation; and

b) the factory.

In the initial assessment of the factory and FPC it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this Rwanda standard will be available, and

b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this Rwanda standard and that the product will be the same as the

samples used for the determination of the product type, for which compliance with this Rwanda standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply.

6.3.5 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type, as described in 6.2.2 and 6.3.2.8.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

7 Marking and packaging

As a minimum of identification, each consignment shall carry the following indications:

a) the denomination of the natural stone

b) quantities and dimensions of the modular tiles

Additional information is advisable:

— the mass of the modular tiles;

— dimensions and mass of packaging.

These indications shall be given on labels, packaging or on accompanying documents.

The modular tiles packaging shall allow adequate, solid and durable protection for packed tiles, both during transport and during handling and storage. Movement of tiles inside the packaging has to be prevented.

The modular tiles shall be clean before packaging.

Packaging and tapes which are likely to stain shall not be used.

Sensitive polished surfaces shall be protected by appropriate means (e.g. plastic foil). Products with caustic properties shall not be used.

Bibliography

[1] ASTM D5873, Standard Test Method for Determination of Rock Hardness by Rebound Hammer Method

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