

UGANDA STANDARD

First Edition
2008-12-11



Specification for clay roofing tiles and ridges



Reference number
US 816: 2008

© UNBS 2008

Compliance with this standard does not, of itself confer immunity from legal obligations

A Uganda Standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application

© UNBS 2008

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilm, without prior written permission from UNBS.

Requests for permission to reproduce this document should be addressed to

The Executive Director
Uganda National Bureau of Standards
P.O. Box 6329
Kampala
Uganda
Tel: 256 414 505 995
Fax: 256 414 286 123
E-mail: unbs@infocom.co.ug
Web: www.unbs.go.ug

Contents	Page
Foreword	v
1 Scope	1
2 Terms and definitions	1
3 Manufacture	2
4 Physical requirements	2
4.1 Appearance	2
4.2 Shape	2
4.2.1 Tile	2
4.2.2 Ridge	2
4.3 Lugs (for Mangalore and Marseille tiles)	6
4.3.1 Batten lug	6
4.3.2 Eaves lugs	6
4.4 Corrugations and cross ribs	6
4.5 Water absorption and breaking load	6
4.6 Dimensions and tolerances	6
4.6.1 Mangalore and Marseille tiles	6
4.6.2 Roman tiles	7
4.6.3 Portuguese tiles	7
5 Performance requirements	7
5.1 Weight	7
5.1.1 Mangalore tiles	7
5.1.2 Marseille tiles	7
5.1.3 Roman tiles	7
5.1.4 Portuguese tiles	7
5.1.5 Ridges	7
5.2 Methods of test	7
5.2.1 Water absorption	7
5.2.2 Permeability	7
5.2.3 Breaking load	8
6 Marking	8
7 Sampling and compliance with specification	8
8 Inspection	8
8.1 Appearance and marking	8
8.2 Shape and dimensions	8
Annex A (normative) Water absorption test	9
A.1 Test specimen	9
A.2 Procedure	9
A.3 Results	9
Annex B (normative) Permeability test	10
B.1 Test specimen	10
B.2 Apparatus	10
B.3 Procedure	10
Annex C (normative) Determination of breaking load (for Mangalore and Marseille tiles)	11
C.1 Test specimen	11
C.2 Apparatus	11
C.3 Procedure	11

C.4	Results	11
Annex D (normative)	Determination of breaking load (for Roman and Portuguese tiles)	12
D.1	Test specimen	12
D.2	Apparatus	12
D.3	Procedure	12
D.4	Results	12

Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Tourism, Trade and Industry established under Cap 327, of the Laws of Uganda. UNBS is mandated to co-ordinate the elaboration of standards and is

- (a) a member of International Organisation for Standardisation (ISO) and
- (b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and
- (c) the National Enquiry Point on TBT/SPS Agreements of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

Committee membership

The following organizations were represented on the Technical Committee for Building and civil engineering standards, UNBS/TC 3, in the development of this standard:

- Africana Clays Ltd.
- Lweza Clays Ltd.
- Makerere University
- Ministry of Energy and Mineral Development (Department of Geological Survey and Mines)
- Ministry of Works and Transport
- Pan Kajjansi Brick and Tiles Works Ltd.
- Uganda Clays Ltd.
- Uganda National Bureau of Standards

Specification for clay roofing tiles and ridges

1 Scope

This specification covers clay roofing tiles and ridges intended for use as roof covering where durability and appearance are required to provide a weather-resistant surface of specified design. This standard specifies requirements for Mangalore, Marseilles, Roman and Portuguese roofing tiles and clay roofing ridges.

2 Terms and definitions

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

2.1

clay

earthy or stony mineral aggregate consisting essentially of hydrous silicate of alumina; plastic when sufficiently pulverized and wetted; rigid when dry; and vitreous when fired to a sufficiently high temperature

2.2

clay roofing tile

solid unit of clay formed into any of a range of generally rectangular planar shapes while plastic and fired in kiln and are used for roofing

2.3

ridge tile

solid unit of clay formed into a triangular shape covering the apex of two slopes on a pitched roof

2.4

defective

tile or ridge that fails to comply with the relevant requirements of the specification

2.5

lot

not more than 20 000 roofing tiles of the same type and nominal dimensions, from one manufacturer, submitted for inspection and testing

2.6

drying shrinkage

percentage reduction in length or volume of tiles on drying, due to the removal of the film of water which surrounds the individual grains in the plastic form

2.8

face of tile

upper surface of the tile when fixed on the roof

2.9

back of tile

lower surface of the tile when fixed on the roof

2.10

breaking load

load at which the roofing tile or ridge breaks during testing

2.11

water absorption

percentage amount of water absorbed by the roofing tile or ridge

3 Manufacture

The roofing tiles shall be made from clay of even texture and shall be burnt throughout. They shall be free from irregularities, such as twists, bends, cracks and laminations.

The roofing tiles shall be free from impurities like particles of stone, lime or foreign materials visible to the naked eye either on the surface or on the fractured face of the tile obtained by breaking the tile. When struck, the tile shall give a characteristic ringing sound and when broken the fracture shall be clear and sharp at the edges.

4 Physical requirements

4.1 Appearance

Tiles and ridges shall be well burnt and free from cracks and unslaked lime particles, and from excrescences and depressions not forming part of the pattern of the tile or ridge. Surface grazing shall not be regarded as a defect.

4.2 Shape

4.2.1 Tile

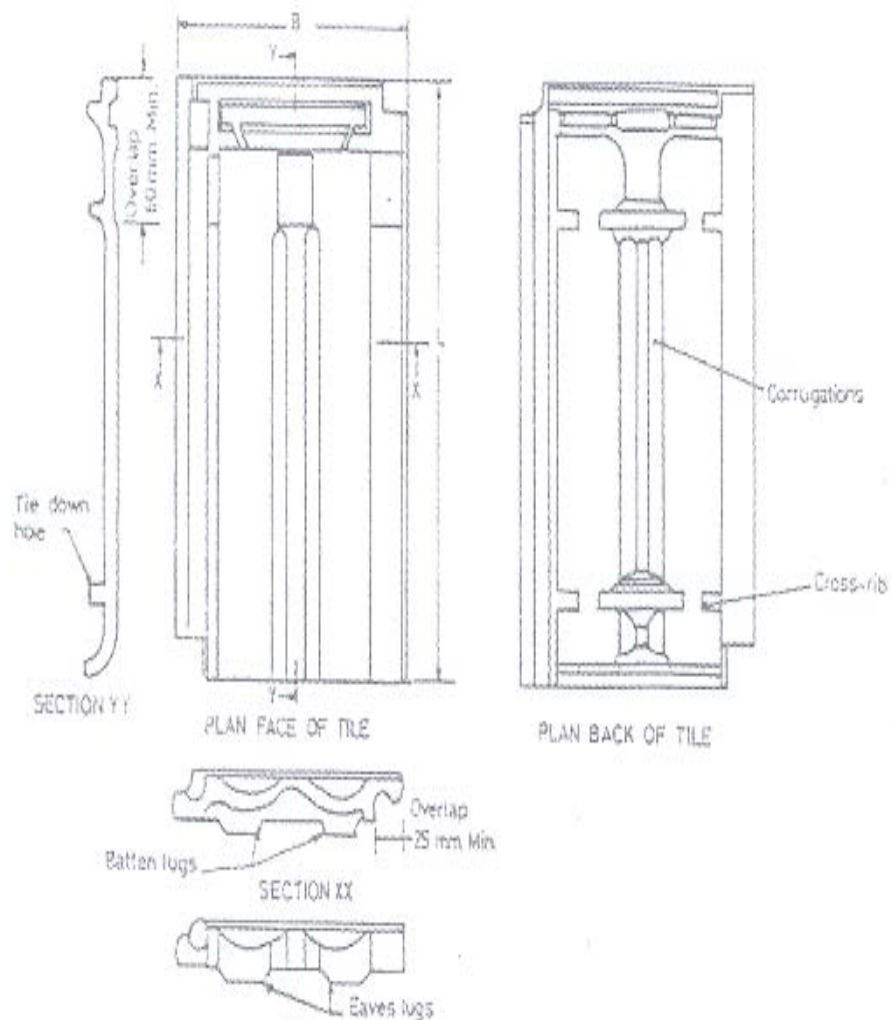
The patterns of Marseille, Mangalore, Portuguese and Roman are shown in figures 1, 2, 3, and 4 respectively.

The gap at the corners of the tiles, when placed on plain surface in the normal position, shall be not more than 8.0 mm. The design shall provide a good interlocking arrangement securing the roof against leakage or rain water. The tiles shall be free from faulty shape or any other defects liable to affect their strength or suitability for use.

4.2.2 Ridge

The pattern of ridge is as shown in Figure 5.

Dimensions in millimetres



L = 410 mm ± 5 mm, B = 235 mm ± 5 mm

Figure 1 — Typical details of a Marseille tile

Dimensions in millimetres

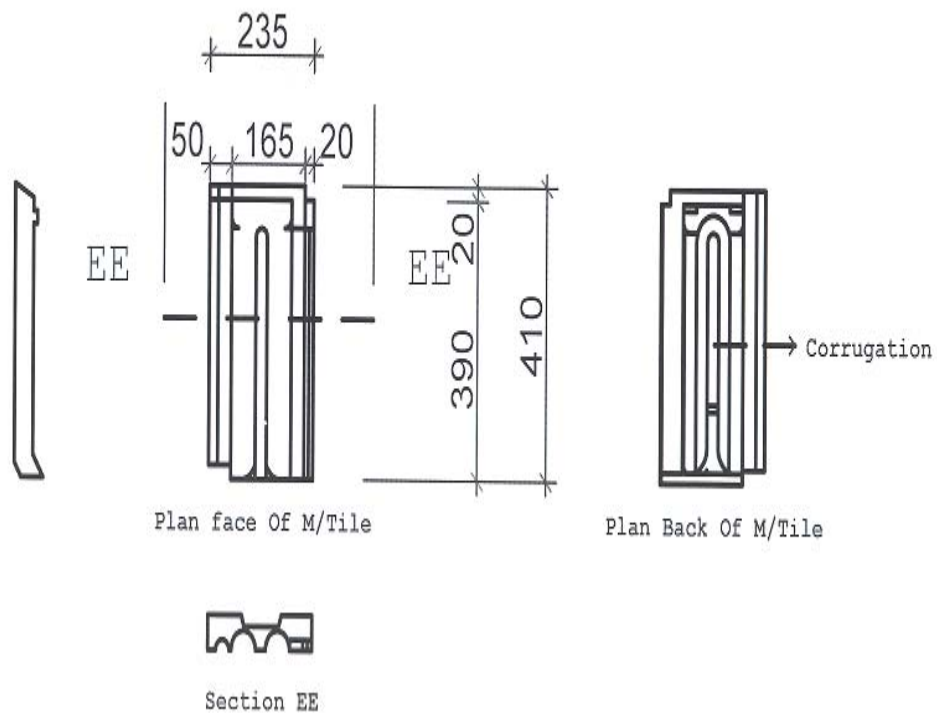


Figure 2 — Mangalore tile

Dimensions in millimetres

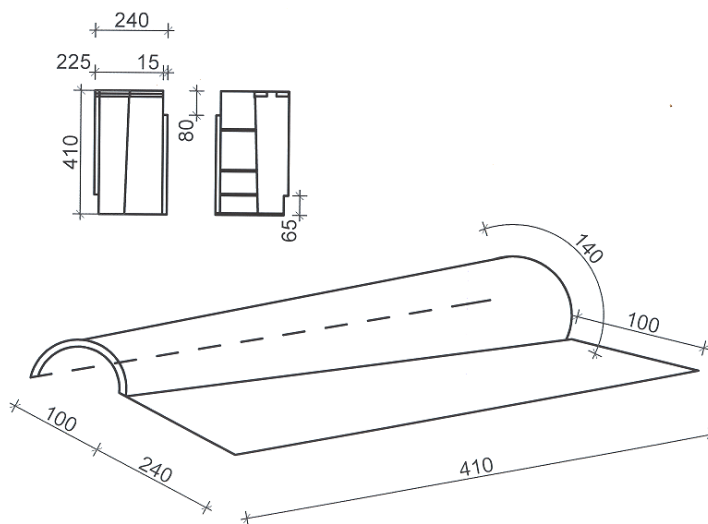


Figure 3 — Portuguese tile

Dimensions in millimetres

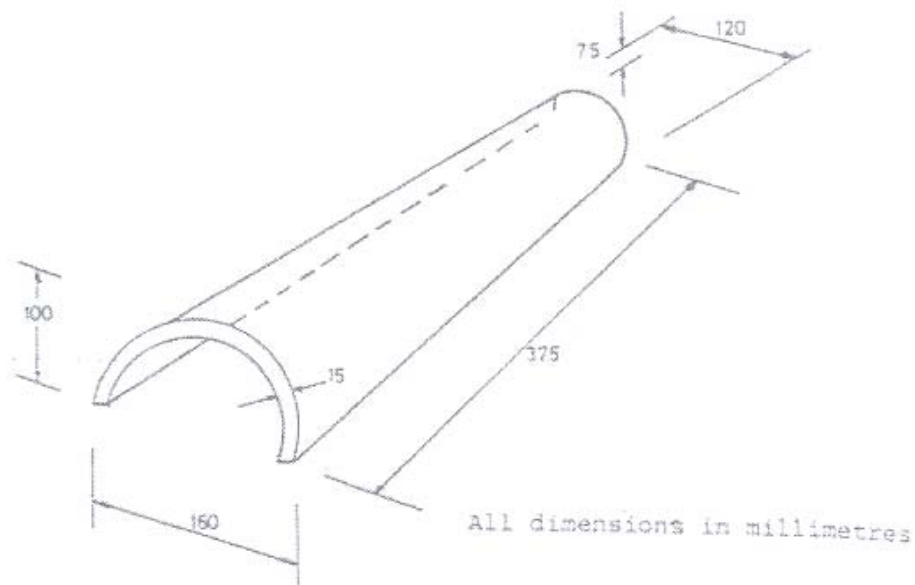


Figure 4 — Roman tile

Dimensions in millimetres

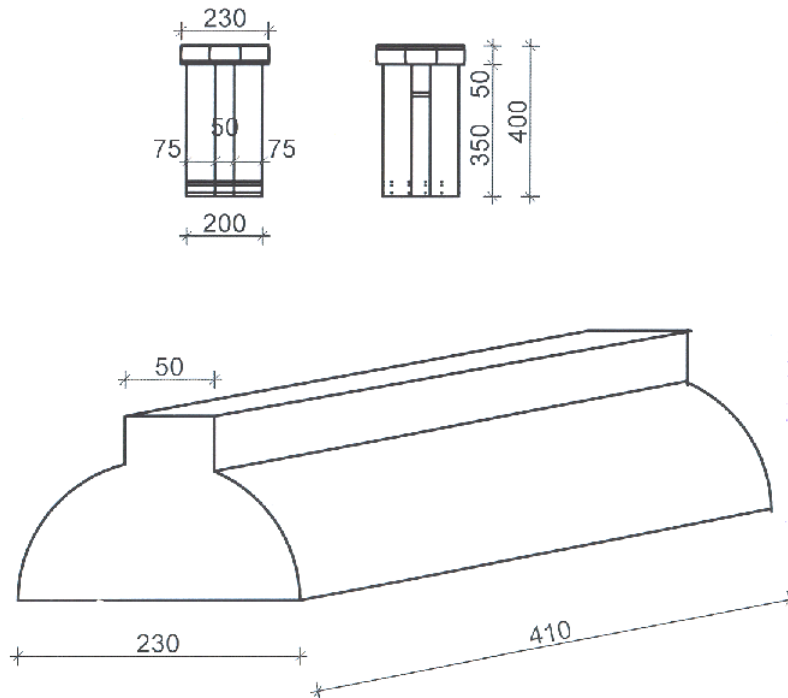


Figure 5 — Ridge tile

4.3 Lugs (for Mangalore and Marseille tiles)

4.3.1 Batten lug

The tile shall have at least two batten lugs with a base thickness (thickness at the bottom) not less than 15 mm and a thickness at the top not less than 10 mm. The projection from the surface of the tile shall be between 7 mm and 12 mm (see Figure 1 and Figure 2).

4.3.2 Eaves lugs

The tile shall have at least two eaves lugs with a base thickness not less than 15 mm and a thickness at the top not less than 10 mm. The projection from the surface of the lug shall be not less than 10 mm and shall be shaped to fit into the corrugations (see Figure 1 and Figure 2).

4.4 Corrugations and cross ribs

The cross-section of the roofing tile shall be such as to give the tile structural rigidity. This may be achieved by providing longitudinal corrugations with intermediate cross ribs or stiffeners (see Figure 1 and Figure 2).

4.5 Water absorption and breaking load

Roofing tiles and ridges shall conform to the physical requirements as prescribed in Tables 1 and 2 respectively.

Table 1 — Physical requirements for tiles

S No.	Characteristic	Requirement	
		Mangalore/Marseille	Roman/Portuguese
(i)	Water absorption, %, max	14	14
(ii)	Breaking load, N/mm, min		
	Average	4.5	13.0
	Individual	4.0	10.0

Table 2 — Physical requirements for ridges

S No.	Characteristic	Requirement
(i)	Water absorption, %, max	14
(ii)	Breaking load, N/mm, min	
	Average	4.5
	Individual	4.0

4.6 Dimensions and tolerances

4.6.1 Mangalore and Marseille tiles

The tiles shall have an overall length of 410 mm and an overall width of 235 mm with a permissible deviation of ± 5 mm.

Thickness shall be not less than 10 mm and not more than 15 mm. The measurement shall be done along the troughs.

The minimum overlap shall be 60 mm lengthwise and 25 mm width wise.

4.6.2 Roman tiles

The tiles shall be 375 mm long with a permissible deviation of ± 5 mm and shall be not less than 15 mm thick and other dimensions shall be as shown in Figure 4.

The minimum overlap shall be 30 mm lengthwise and 30 mm width wise.

4.6.3 Portuguese tiles

The dimensions of the tiles shall be as shown in Figure 3, with permissible deviation of ± 5 mm.

5 Performance requirements

5.1 Weight

5.1.1 Mangalore tiles

The average weight of ten tiles, when dried at 105 °C to 110 °C to constant weight and weighed, to the nearest 0,01 kg, shall not be less than 2.2 kg and not more than 2.65 kg.

5.1.2 Marseille tiles

The average weight of ten tiles, when dried at 105 °C to 110 °C to constant weight and weighed, to the nearest 0.01 kg, shall not be less than 2.2 kg and not more than 2.65 kg.

5.1.3 Roman tiles

The average weight of ten tiles, when dried at 105 °C to 110 °C to constant weight and weighed, to the nearest 0.01 kg, shall not be less than 1,6 kg and not more than 1.85 kg.

5.1.4 Portuguese tiles

The average weight of ten tiles, when dried at 105 °C to 110 °C to constant weight and weighed, to the nearest 0,01 kg, shall not be less be than 3.3 kg and not more than 3.60 kg.

5.1.5 Ridges

The average weight of ten ridges, when dried at 105 °C to 110 °C to constant weight and weighed, to the nearest 0.01 kg, shall not be less than 2.2 kg and not more than 2.65 kg.

5.2 Methods of test

5.2.1 Water absorption

The water absorption of tiles and ridges shall conform to the requirements laid down in Table 1 and Table 2, when determined in accordance with the test procedure laid down in Annex A.

5.2.2 Permeability

The tile and ridge shall be tested for permeability in accordance with the procedure laid down in Annex B.

The tiles and ridges shall be considered as conforming to the test if no water is found dripping at the bottom of the tile after the test.

5.2.3 Breaking load

The breaking load of the tiles and ridges shall conform to the requirements laid down in Table 1 and Table 2, when determined in accordance with the test procedures laid down in Annex C and Annex D. The ridges shall be tested as the tiles.

6 Marking

The following information shall be legibly impressed on the back of each tile and ridge:

- a) name, trade name or trade mark of the manufacturer; and
- b) batch identification number.

7 Sampling and compliance with specification

The following sampling procedure shall be applied in determining whether a lot complies with the relevant requirements of the specification. The samples so taken shall be deemed to represent the lot for the respective properties.

From the lot draw at random the number of tiles given in column 2 of Table 3 relative to the lot size shown in column 1.

Table 3 — Samples for inspection and tests

1	2	3
Lot size (number of tiles)	Sample size (number of tiles)	Number of defectives max
Up to 1000	20	3
1001 – 5000	30	4
5001 – 10000	40	5
10001 – 20000	55	6

8 Inspection

8.1 Appearance and marking

Inspect each tile or ridge in the sample drawn in accordance with Clause 7 for compliance with the requirements of 4.1 and 6.

8.2 Shape and dimensions

Check the dimensions and shape of each tile or ridge in the sample drawn in accordance with Clause 7 for compliance with the requirements of 4.2 - 4.4 and 4.6.

Annex A (normative)

Water absorption test

A.1 Test specimen

Ten tiles shall be randomly selected to form the sample size according to the lot size as shown in Table 3 and used for this test.

Ten ridges shall be randomly selected to form the sample size according to the lot size as shown in Table 3 and used for this test

A.2 Procedure

Dry the ten tiles (or ridges) selected in an oven at a temperature of 105 °C to 110 °C till they attain constant weight and then cool to ambient temperature and weigh.

When cool, immerse the dry specimens completely in clean water at 24 °C to 30 °C for 24 h. Remove each specimen, wipe off the surface water carefully with a damp cloth and weigh the specimen. Weigh the specimen to the nearest gram within three minutes after removing the specimen from the tank.

A.3 Results

A.3.1 The percentage water absorption is given by:

$$\frac{B-A}{A} \times 100 \%$$

where,

A is the mass, in grams, of the dry specimen; and

B is the mass, in grams, of the specimen after 24 h immersion in water.

A.3.2 The average percentage water absorption of the ten tiles (or ridges) shall be calculated and reported as percentage water absorption.

Annex B (normative)

Permeability test

B.1 Test specimen

Ten tiles shall be randomly selected to form the sample size according to the lot size as shown in Table 3 and used for this test.

Ten ridges shall be randomly selected to form the sample size according to the lot size as shown in Table 3 and used for this test

B.2 Apparatus

The test shall be conducted in a rectangular trough (see Figure 6) which is open at the bottom, the dimensions at the bottom being equal to the size of the tile.

B.3 Procedure

B.3.1 The test shall be conducted at a temperature of $27\text{ °C} \pm 2\text{ °C}$ and relative humidity of $65\% \pm 5\%$.

B.3.2 The tile (or ridge) shall be fitted at the bottom of the trough and the space between the tile and the sides of the trough plugged water-tight with suitable material like wax, bitumen, etc.

Water shall be poured into the mould so that it stands over the lowest tile surface to a height of 50 mm.

B.3.3 The water in the trough shall be allowed to stand for a period of six hours. The bottom of the tile shall then be carefully examined to see whether the water has seeped through the tile.

Annex C (normative)

Determination of breaking load (for Mangalore and Marseille tiles)

C.1 Test specimen

Ten tiles shall be randomly selected to form the sample size according to the lot size as shown in Table 3 and used for this test.

C.2 Apparatus

A suitable form of apparatus is shown in Figure 7, consisting of two parallel self-aligning steel bearers, with the bearing surface rounded to 38 mm diameter, so placed that the distance between the centres could be altered. The load is applied through a third steel bearer of similar shape midway between and parallel to the supports. The length of all the bearers shall exceed the maximum width of the tile under test.

C.3 Procedure

Test ten tiles in wet condition after soaking them in water at $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 24 h. Support the tile centrally on the bearer set with a span of 25 cm and resting on the bottom surface. Apply the load with the direction of the load perpendicular to the span, at a uniform rate of 440 N/min to 540 N/min.

C.4 Results

Report the average breaking load from the ten tests in N/mm width.

Annex D (normative)

Determination of breaking load (for Roman and Portuguese tiles)

D.1 Test specimen

Ten tiles randomly selected to form the sample size according to the lot size as shown in Table 3 shall be used for this test.

Ten ridges shall be randomly selected to form the sample size according to the lot size as shown in Table 3 and used for this test

D.2 Apparatus

This test may be conducted with any standard compression testing machine with provision for adjusting the rate of loading. A typical arrangement is shown in Figure 8.

D.3 Procedure

Ten tiles or ridges in wet condition after soaking in water for 24 h shall be tested. The two longitudinal edges of the Roman or Portugal tile shall be kept, in normal position, over two strips of 25 mm thick rubber sheet placed on the table of the testing machine.

The load shall be applied to the tile or ridges by means of a wooden block of size 75 mm x 100 mm x 300 mm lined with rubber at the bottom, located symmetrically. The load shall be applied to the block at a uniform rate of 450 N/min – 600 N/min.

D.4 Results

The individual breaking strength shall be obtained by dividing the breaking load by the width of the tile and the average of the value shall be calculated. The result shall be expressed in N/mm width.

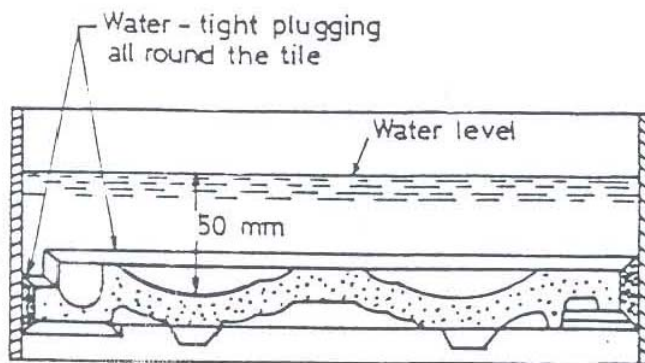


Figure 6 — Arrangements for permeability test

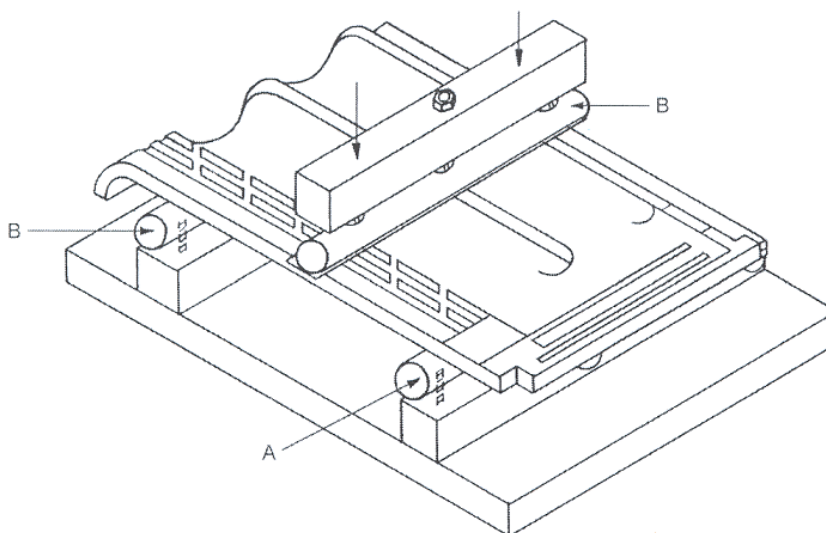


Figure 7(a) — Apparatus for testing transverse strength

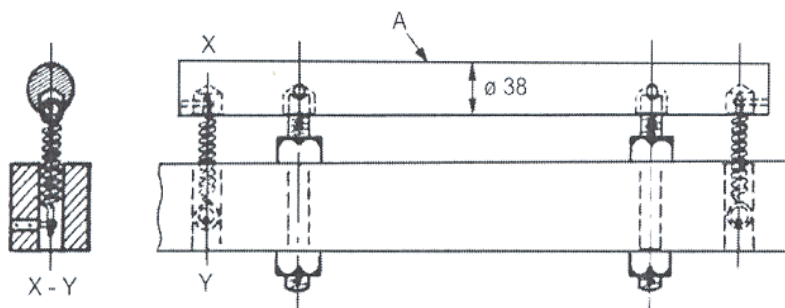


Figure 7(b) — Sectional view of apparatus for testing transverse strength

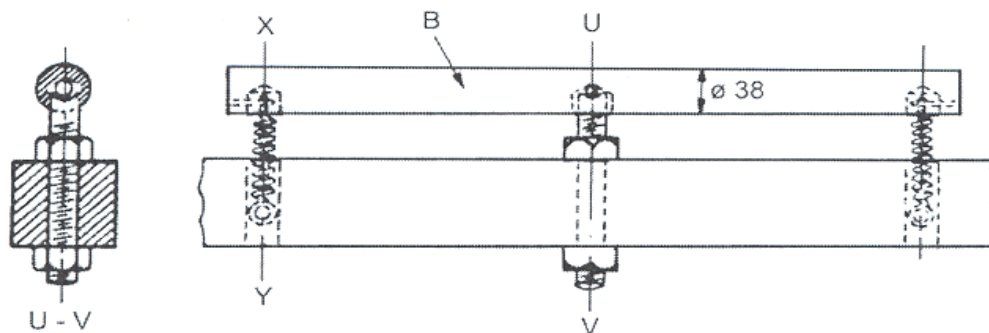


Figure 7(c) — Sectional view of apparatus for testing transverse strength

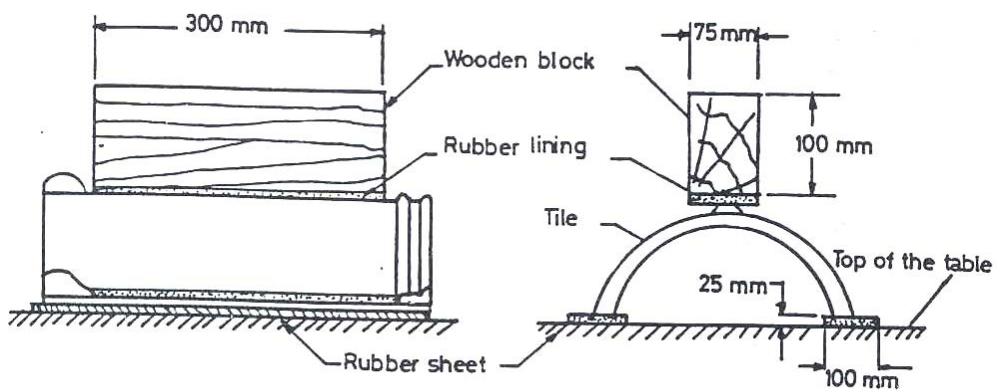


Figure 8 — Arrangements for flexural strength test of Roman tile

Certification marking

Products that conform to Uganda standards may be marked with Uganda National Bureau of Standards (UNBS) Certification Mark shown in the figure below.

The use of the UNBS Certification Mark is governed by the Standards Act, and the Regulations made thereunder. This mark can be used only by those licensed under the certification mark scheme operated by the Uganda National Bureau of Standards and in conjunction with the relevant Uganda Standard. The presence of this mark on a product or in relation to a product is an assurance that the goods comply with the requirements of that standard under a system of supervision, control and testing in accordance with the certification mark scheme of the Uganda National Bureau of Standards. UNBS marked products are continually checked by UNBS for conformity to that standard.

Further particulars of the terms and conditions of licensing may be obtained from the Director, Uganda National Bureau of Standards.



