

# UGANDA STANDARD

Second Edition  
2019-03-05

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## Clay roofing tiles and ridges — specification

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Reference number  
WDUS 816: 2019

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WORKING DRAFT UGANDA STANDARD

## Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to coordinate the elaboration of standards and is

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- (c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

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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.

The committee responsible for this document is Technical Committee UNBS/TC 03, *Building and Construction*.

This second edition cancels and replaces the first edition (US 816:2008), which has been technically revised.



# Clay roofing tiles and ridges — Specification

## 1 Scope

This standard specifies requirements for 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.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1 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

### 3.2 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

### 3.3 ridge tile

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

### 3.4 defective

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

### 3.5 lot

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

### 3.6 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

### **3.8**

#### **face of tile**

upper surface of the tile when fixed on the roof

### **3.9**

#### **back of tile**

lower surface of the tile when fixed on the roof

### **3.10**

#### **breaking load**

load at which the roofing tile or ridge breaks during testing

### **3.11**

#### **water absorption**

percentage amount of water absorbed by the roofing tile or ridge **term**

## **4 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.

## **5 Physical requirements**

### **5.1 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.

### **5.2 Shape**

#### **5.2.1 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.

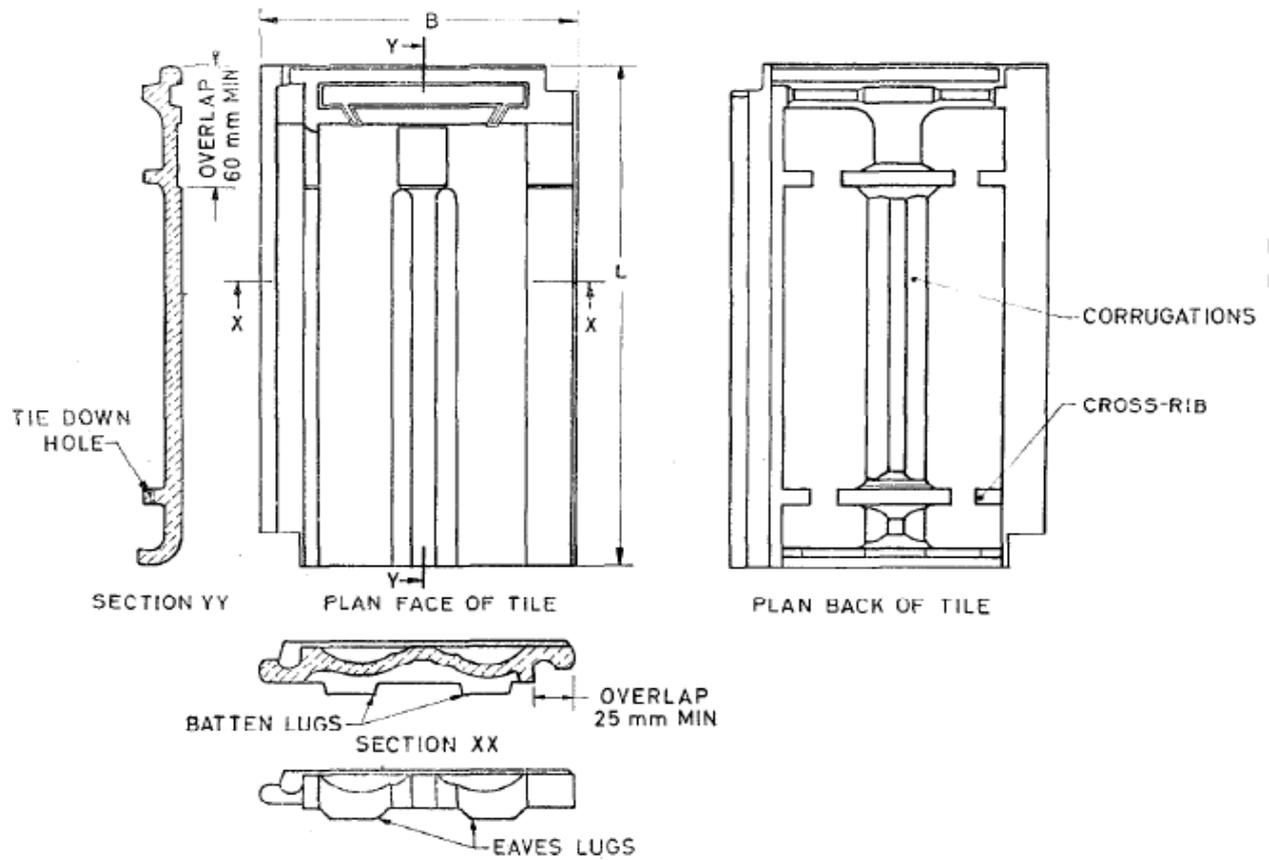
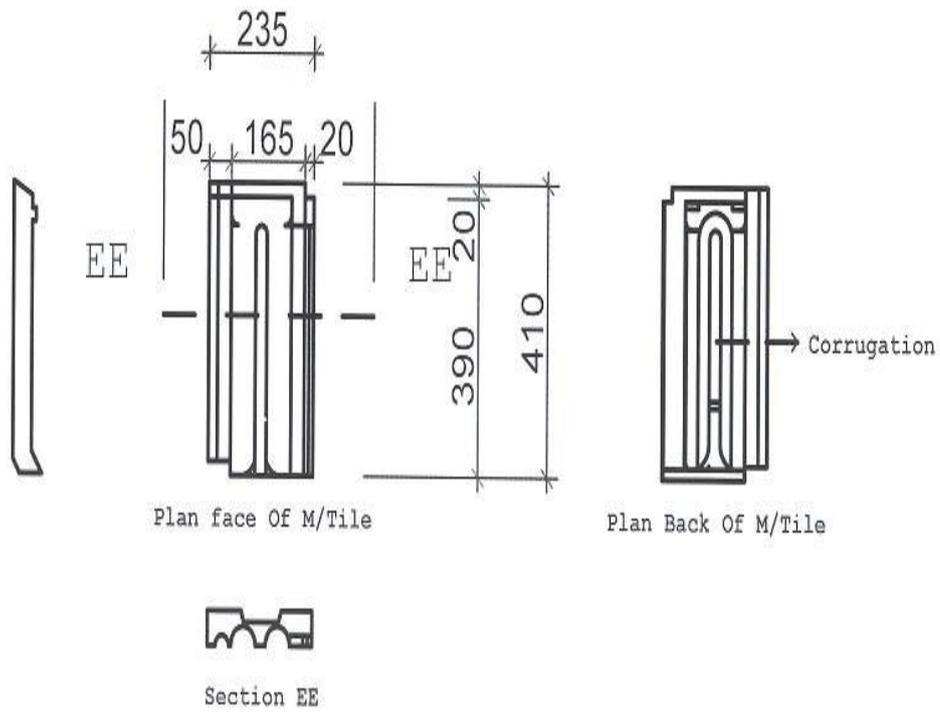
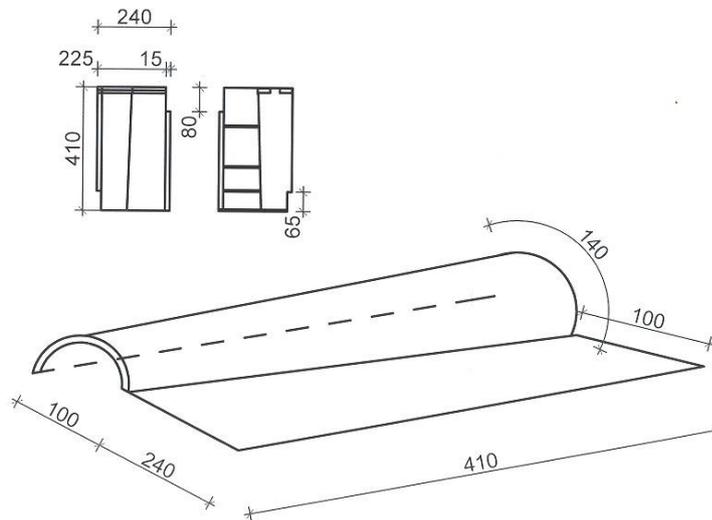


Figure 1 — Typical details of a Mangalore tile



**Figure 2 — Typical Marseille tile**

Dimensions in millimetres



**Figure 3 — Typical Portuguese tile**

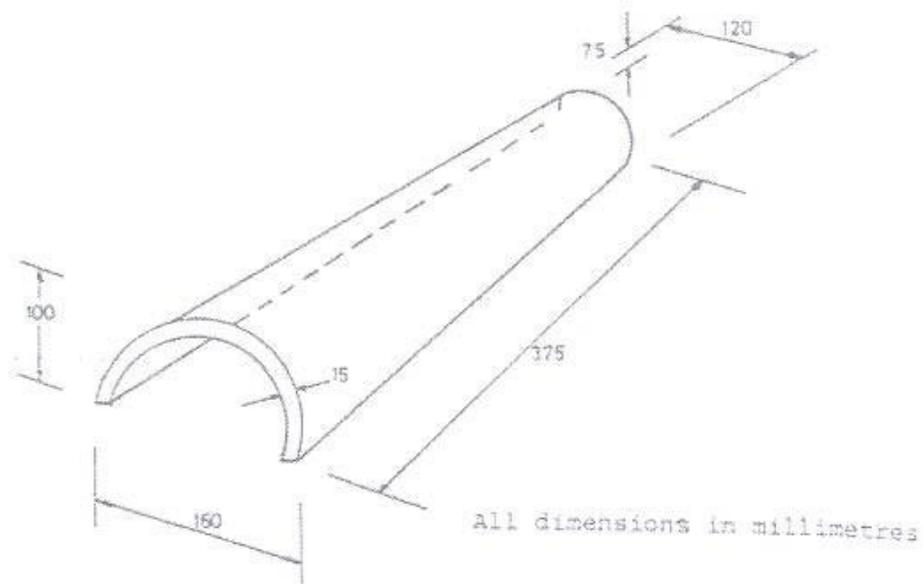


Figure 4 — Typical Roman tile

### 5.2.2 Ridge

The pattern of ridge is as shown in Figure 5.

Dimensions in millimetres

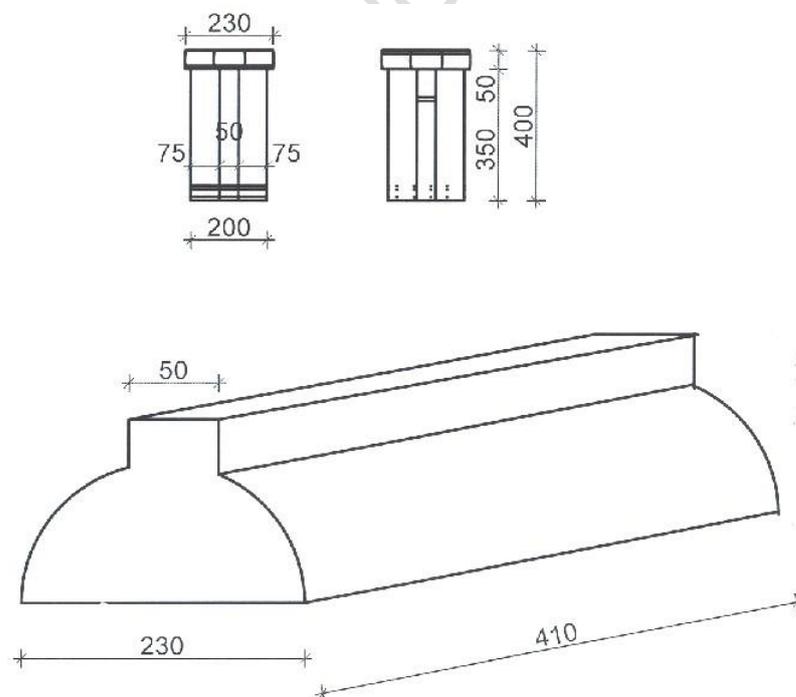


Figure 5 — Typical Ridge tile

### 5.3 Lugs (for Mangalore and Marseille tiles)

#### 5.3.1 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).

#### 5.3.2 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).

### 5.4 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).

### 5.5 Water absorption and breaking load

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

Table1 — 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

### 5.6 Dimensions and tolerances

The manufacture shall declare the dimensions of the tiles, ridges and the permissible deviation shall be  $\pm 5$  mm.

## 6 Performance requirements

### 6.1 Weight

The manufacturer shall declare weight per square meter ( $w/m^2$ ) for all tiles and ridges when dried at 105 °C to 110 °C to constant weight and weighed, to the nearest 0.01 kg

### 6.2 Methods of test

#### 6.2.1 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.

#### 6.2.2 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.

#### 6.2.3 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.

## 7 Marking

7.1 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.

Where the batch number on an individual tile or ridge is not possible, it shall be provided on a consignment slip in a package or on the package.

7.2 The tiles and ridges shall be packaged with a brochure bearing the following information;

- a) weight per square metre; and
- b) dimensions (length, width and thickness).

## 8 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

## 9 Inspection

### 9.1 Appearance and marking

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

### 9.2 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.

## 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  $20\text{ °C} \pm 2\text{ °C}$  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.

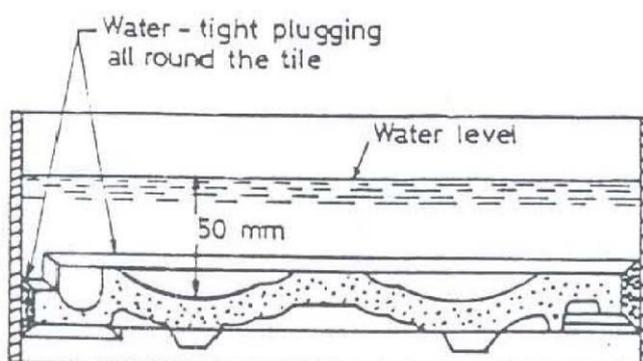


Figure 6 — Arrangements for permeability test

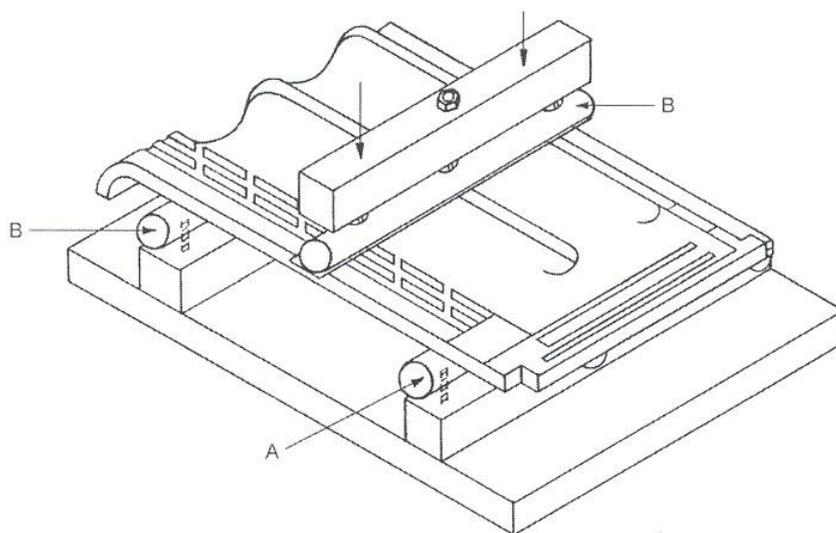


Figure 7(a) — Apparatus for testing transverse strength

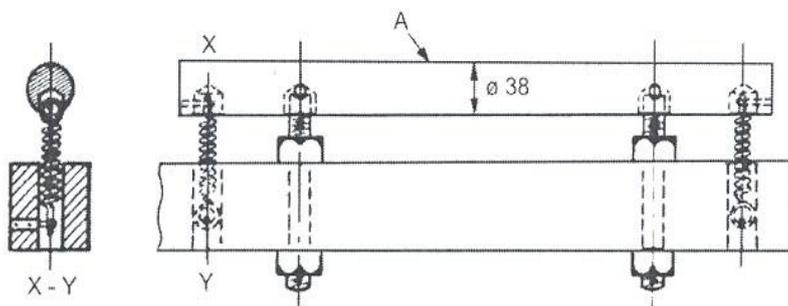


Figure 7(b) — Sectional view of apparatus for testing transverse strength

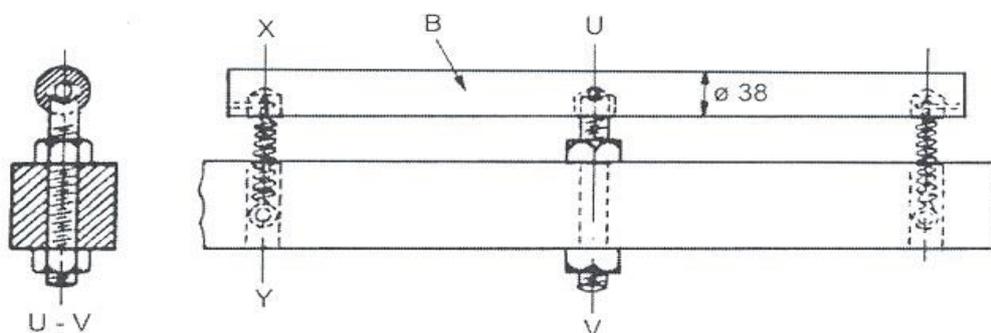


Figure 7(c) — Sectional view of apparatus for testing transverse strength

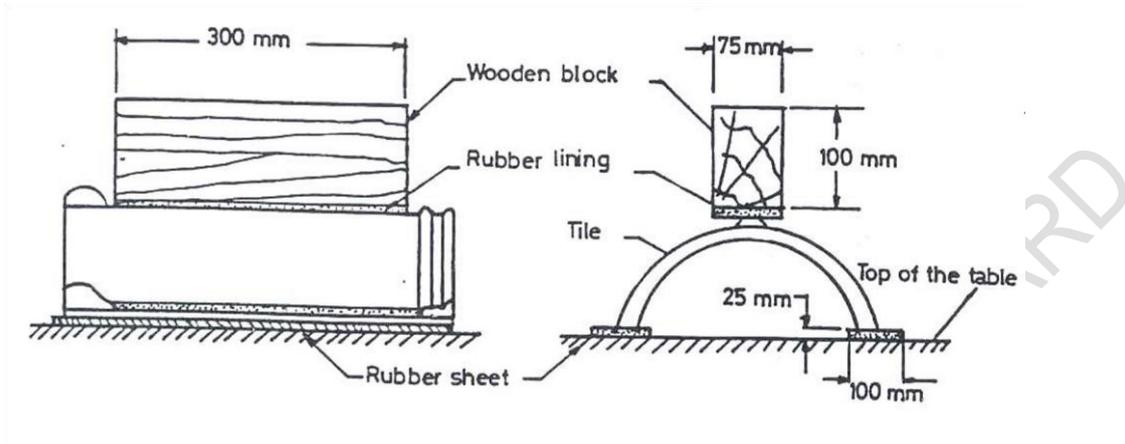


Figure 8 — Arrangements for flexural strength test of Roman tile

## Bibliography

- [1] KS 431-1: 2006, *Clay roofing tiles — Specification*

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