CERAMIC PRODUCTS FOR BUILDINGS

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1. BRICKS

Generalities

Ceramic materials are obtained by moulding, drying and burning at high temperatures (900 … 1500 ^{o}C) of clay masses.

The appreciation of brick's quality is made on different samples randomly taken from the brick's pile. Determinations are done according to STAS 456-73 and include testing of I, II and III orders.

1.1. Testing of Order No. I

There are periodic tests of bricks and usual tests.

Usual tests are to determinate: indentations, bulging, cracks, halves of bricks, bricks which are insufficient clinkered, brick's colour, and brick's sound.

Periodic tests are: determination of brick's dimensions (10 bricks), determination of apparent density, determination of water absorption, the influence of lime on bricks.

a) *Dimensions checking (length, width. thickness).* The length (l) is obtained by measuring 2 rows of 5 bricks each one placed head to head. The width (b) and the thickness (h) are determined on 1 row of 10 bricks placed one near another on their width and respectively on their thickness, measuring then the row's length and dividing it by 10.

b) *Determination of density.* 5 bricks are weighted and their medium mass is established (the bricks have been dried out at 105±5 ^{o}C until they have a constant mass). The volume is computed after measuring their dimensions.

c) *Water absorption.* It represents the percentage ratio between the mass of water absorbed in 24 hours by one brick sample completely emerged in water and its dried mass.

Working technology:

- 5 bricks are dried out until constant mass and then they are weighted, obtaining their mass **m**;
- The bricks are completely emerged into water at atmospheric pressure and at temperature of 20±5 ^{o}C, placing them on a wood grill such as the water level to be at least 2 cm over their surface but no more than 10 cm;
- The bricks are kept minimum 24 hours in water;
- Then the bricks are taken out from water, dried with a wet cloth, and then they are weighted, obtaining the mass denoted by **m$_1$**.

Water absorption is computed by:

$$\% \ a_m = \frac{m_1 - m}{m} \times 100 \qquad (1)$$

d) *The lime grains influence.* The samples are laid on a grill of a metallic vessel such as the contact between one to each other is avoided. After covering the vessel, the water under the grill is made to boil such as it will reach its boiling temperature after 1 hour, then the boiling is done for

another hour. The samples are then taken out from the vessel and are watched 5 days, observing any deterioration due to swelling of limes grains. Determination is done on at least 5 bricks.

1.2. Testing of Order No. II

The order II testing are made one at one trimester and have the scope to determine the compressive strength, bending strength, freezing – thawing resistance and determination of soluble salts contained into the samples.

Compressive strength determination

It is done on prepared samples: the solid bricks are cut in halves and are stick together with mortar; the same mortar is also used for bricks with hollows to get parallel and plane surfaces (fig. 1).

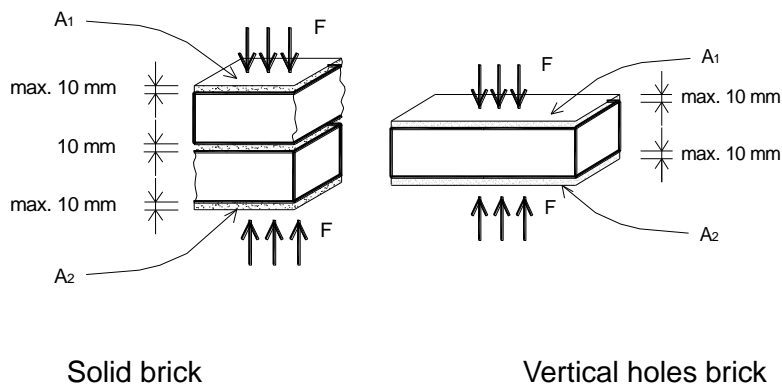Solid brick   Vertical holes brick

Fig. 1

The mortar realised for sticking the two halves of solid brick and the one applied on exterior faces of vertical hollows bricks for obtaining plane and parallel surfaces, is realised from CEM I 42,5R and sand 0/1 mm in volumetric proportion of 1:1.

The sample is placed on one side, with the faces with mortar between the platans of the hydraulic machine and an increasing load of 0.5 ... 0.6 N/mm²xs is applied and force **F** at which the sample collapses is noted.

Compressive strength it is computed by relationship:

$$f_c = \frac{F}{A} \qquad [N/mm^2] \qquad (2)$$

where: F - force, in N;

A – the area of loaded section = $(A_1+A_2)/2$, in mm².

1.3. Testing of Order No. III

These testing are made in special laboratories and refer to the total coefficient of thermal transfer **K** and to the reduction sonar index **R**.

Conditions regarding the ceramic bricks quality are presented in tables 1, 2 and 3.

Table 1 *Conditions regarding solid bricks dimensions*

Type of dimension	Dimension, [mm]	
	nominal	Admissible variations
Length (l)	240	+5 -6
Width (b)	115	+4 -6
Thickness (h)	63	±3

Table 2 *Conditions regarding the dimensions of vertical hollows bricks*

Type of dimension	Dimension, [mm]	
	Nominal	Admissible variation
Length (l)	240	+4

		-6
Width (b)	115	±4
Thickness (h)	88	±3

Table 3 *Classification of ceramic bricks*

Characteristic		Solid brick (STAS 457-86)	Vertical holes brick (STAS 5185/1-86)
Water absorption a_m, [%]		8 - 18% quality A 8 - 20% quality I and II	Max. 16% quality A Max. 18% quality I and II
Density classes ρ_a, [kg/dm^3]		C_1 ($\rho_a = 1.0...<1.3$) C_2 ($\rho_a = 1.3...<1.5$) C_3 ($\rho_a = 1.5... 1.8$)	C_0 ($\rho_a < 1.0$) C_1 ($\rho_a = 1.0...<1.3$) C_2 ρ ($_a = 1.3 ... 1.5$)
Minimum compressive strength f_c, [N/mm^2]	Mark 50	2.6	3.5
	Mark 75	5.0	5.5
	Mark 100	7.5	7.5
Medium compressive strength f_c, [N/mm^2]	Mark 50	5 ... < 7.5	
	Mark 75	7.5 ... < 10	
	Mark 100	≥ 10	

2. Tiles and Copings

Generalities

The tiles and copings quality used for roofs is appreciated making tests both on each plot and also periodical tests (according to STAS 514-77 and SR EN 1304+A1).

2.1. Tiles Plot Testing

A tiles or copings plot is formed with products which have the same dimensions, types etc. These tests include:

a) *Checking of the shape and dimensions:*
   - the shape is checked by help of standard forms. The length (L), thickness (h) and width (l) are measured.
b) *Aspect checking.*
c) *Structure checking.*
d) *Mass checking.*
e) *Sound checking-* must be a metallic one.
f) *Lime grains influence checking*

2.2. Periodic Tests

a) *Verification of bearing capacity* is made on 5 tiles and it is a flexure test; the test span is 180 mm for plain tiles and 300 mm for gutter tiles.

b) *Water impermeability*

It is made on 10 tiles at 15 days. The period of time without any infiltration must be shorter than 3 hours.

Table 4 *Characteristics of ceramic tiles for roofs*

Type of product	Way of moulding	Dimension in horizontal plane		Mass, [kg]	Bearing capacity, [N]
With lateral gutters	pressed		**405x230** (±7)x(±5)	2.60	750
With lateral gutters and at the ends	pressed	A	**390x235** (±5)x(±5)	2.60	900
		B	**405x235** (±5)x(±5)	2.60	800
With one gutter	processed through the fliers		**390x220** (±5)x(±4)	2.40	800
Plate tiles	processed through the fliers	A	**350x170** (±5)x(±3) **420x210** (±5)x(±4)	1.35	700
		B	***350x170*** (±5)x(±3) ***420x210*** (±5)x(±4)	1.60	1000

BIBLIOGRAPHY

1. Bob C., Velica Paraschiva, *Materiale de construcții*, Ed. Didactică şi pedagogică, Bucureşti, 1978.

2. Bob C., Velica Paraschiva, Roşu Maria, Meteş Lucia, Roşu Constanța, Jebelean E., *Materiale de construcții*, Îndrumător de laborator, Ed. I. P. „Traian Vuia", Timişoara, 1978.

3. Bob C., *Unele considerații privind stabilirea compoziției betonului*, Rev. Materiale de construcții, vol. XVI, nr. 2, 1986.

4. Bob C., Buchman I., Roşu Maria, Roşu Constanța, Ilca Anita, Jebelean E., *Chimie şi Materiale de construcții*, Îndrumător de laborator, Ed. Universității Tehnice Timişoara, 1991.

STAS 1030-1985; C 168/1980; STAS 10473/1-1987, STAS 10473/2-1986; SR ISO 3048:1996; SR ISO 3049:1996; SR ISO 3052:1997; STAS 545/1-1980; SR 4474-1,2:2000; STAS 4474/3,4,5-1987; STAS 4474/6-1990; SR 10275-1:1997; STAS 10275/3,5,6 –1982; STAS 10275/4-1991

SR ENV 459-1,2:1997; SR 3910-2:1998; STAS 11394/8,9-1987

SR EN 196/1-1995; SR EN 196/3-1995; SR EN 196/6-1994; SR EN 196/7-1995; ISO 565; SR EN 197/1-2002; SR 3011/1996; SR 7055/1996; SP 4/1995; SP 7 1995