TIMBER FOR BUILDINGS

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Generalities

Wood is an important building material due to its resistance to mechanical loads, easy processing and it can be also used for interior design and furniture.

Upon its internal microstructure two wood essences exist:

- Deciduous tree, characterised by high compactness and high mechanical resistance;
- Resinous tree, characterised by low compactness and reduced mechanical resistance.

The physical-mechanical properties of wood, at its humidity during the tests that will be determined during laboratory work are: apparent volume mass, compressive strength parallel to timber's fibres and also, compressive strength perpendicular to its fibres. The minimum necessary number of samples will be established for each test.

1. DETERMINATION OF APPARENT VOLUME MASS

The timber samples used for determination of apparent density at the humidity of wood when the test is done, are of prismatic shape (their length is of 25±5 mm, parallel to wood's fibres and their cross-section is a square of edge of 20±0.5 mm) (according to STAS 84-87).

When the width of annual rings is bigger than 4 mm, the dimensions of transversal sections of the tested samples should be chosen such as they will contain at least five annual rings.

The mass of the samples should be determined by a precision of weighting of 0.01 g.

The volume of the samples is determined by measuring on the symmetry axis the length and the edges of the cross section, by a measuring accuracy of 0.1 mm.

Volume mass (density) ρ_U, established at the humidity of the wood at the determination time U%, is computed by:

$$\rho_U = \frac{m_U}{V_U} \qquad [kg/m^3] \qquad (1)$$

where:

m_U- samples' mass at the humidity U%, in kg;

V_U – volume of the sample at the humidity U%, in m^3.

Some apparent densities for different types of wood are presented in the table 1.

Table 1

Type of tree	Apparent density, in kg/m³, for wood:	
	green	dried
Fir	1000	410
Spruce fir	740	430
Pine	700	490
Oak	1110	650
Beech	1010	690
Ash wood	920	680
Locust tree	880	730
Linden tree	740	490

It should be noticed that the humidity has a big influence on wood's density.

2. TESTING TO COMPRESSION PARALLEL WITH THE FIBRES

This test is done according to the STAS 86/1-87 on straight prismatic shaped sample, having their cross-section a square of 20±5 mm edge, and the length parallel to timber's fibres of 30...60 mm. The visible annual rings on the samples' surface should be parallel with two longitudinal faces of the sample and perpendicular on the other two. At the middle of the edge the dimensions of the cross-section are measured with a precision of 0.1 mm, then the sample is placed in the hydraulic press, having its longitudinal axis on the same direction as the force will be applied (fig. 1). The load it will be continuously applied, until the breaking of the tested sample. The velocity of applying the load is chosen such as the breaking of the sample should happen at 1.5...2 minutes after the test starts.
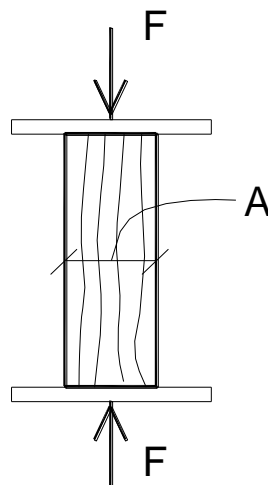

Fig. 1

Compression strength parallel to fibres σ_{cll}, at the humidity when the test is done, is computed by:

$$\sigma_{cII} = \frac{F_{max}}{A} \qquad [\text{N/mm}^2] \qquad\qquad (2)$$

where: F_{max} – breaking force, in N;

               A – sample section, in mm^2.

The resistance to breaking at compression parallel to the fibres is computed as an arithmetical mean of the values obtained on each tested samples, rounded to 0.5 N/mm^2.

3. TESTING TO COMPRESSION PERPENDICULAR TO THE FIBRES

By testing the compression perpendicular to the fibres (acc. to STAS 1348-87), the conventional limit compression strength perpendicular to the fibres that corresponds to the *limit of proportionality* between the load and deformation is determined. For this, it is determined the load value for which the sample passes from uniform deformations (the load value it is proportional to the deformation – elastic behaviour of the material) to an accelerated deformation.

This test is done according to the STAS 86/1-87 on straight prismatic shaped sample, having their cross-section a square of 20±1 mm edge, and the length parallel to timber's fibres of 30...60 mm. The visible annual rings on the samples' surface should be parallel to two longitudinal faces of the sample and perpendicular on the other two.

The length and width of the samples are measured with the precision of 0.1 mm, such as: in tangential direction for radial compression test and in radial direction for tangential compression test.

The samples are placed on the hydraulic press with processed face tangential for radial test, and with processed face radial for tangential compression test (fig. 2 and 3).
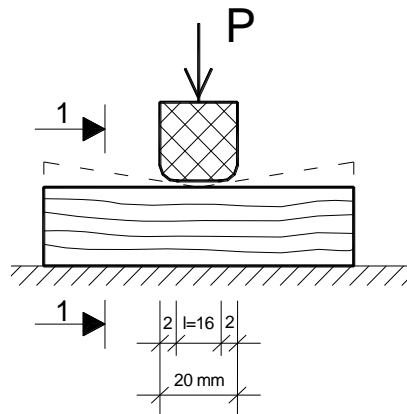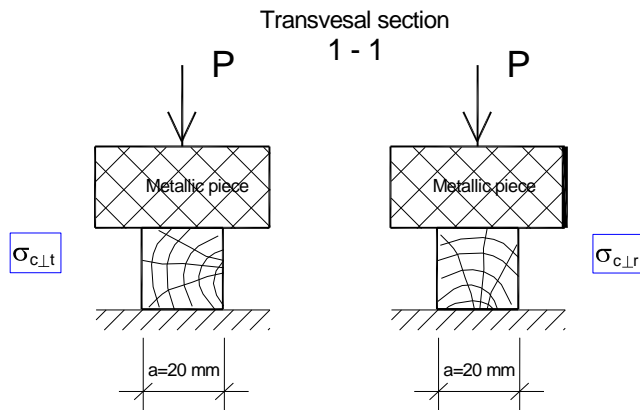
Fig. 2

Transvesal section
1 - 1

Fig. 3

The load is continuously applied, the direction of application being perpendicular to the longitudinal axis of the sample.

The test continues until the proportionality limit it is exceeded, showed by high deformation speed of the sample.

With the obtained dates during the test, the load-deformation curve is drawn, and the force P corresponding to the *limit of proportionality* is determined. This corresponds to the ordinate of the point on the curve for which the following condition is full field (fig. 4):

$$\text{tg } \gamma = 1.5 \text{ tg } \beta \qquad (3)$$

where:

        β - The angle of the curve in its rectilinear portion regarding the vertical line;

        γ - the angle of the tangent to the curve in the point which defineness the proportionality limit with the vertical line.
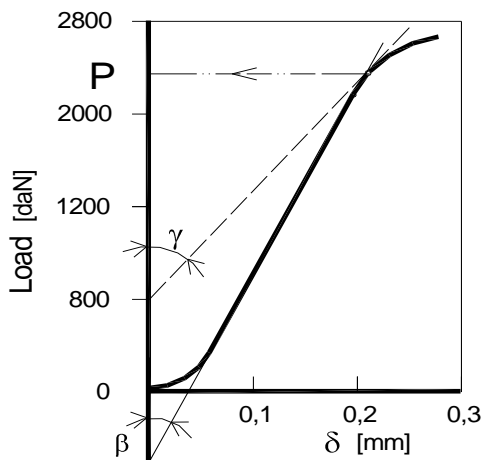

Fig. 4

The conventional limit resistance at perpendicular compression tangential to the fibres $\sigma_{c\perp t}$ or radial $\sigma_{c\perp r}$ (in N/mm^2), for timber humidity at the testing time (U%), is computed with the following relationship:

$$\sigma_{c\perp t} \text{ or } \sigma_{c\perp r} = \frac{P}{a \times l} \tag{4}$$

where:

P – load corresponding to the proportionality limit at compression perpendicular to the fibres, in N;

a – the width of the sample, in mm;

l – the length of the contact surface with the sample, in mm.

REFFERENCES

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