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Wood Drying In Construction

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ABSTRACT

The article shows the indicators of the coefficients of shrinkage of wood, stages of shrinkage, the effect of the density of shrinkage of wood.

KEYWORDS

Shrinkage, saturated fiber, shrinkage ratio, moisture, radial shrinkage, tangential shrinkage, moisture absorption.

INTRODUCTION

The property of wood to reduce its linear dimensions and volume while reducing the bound moisture contained in it is called shrinkage. As long as free moisture is removed from the dried wood, shrinkage does not occur. Shrinkage begins after the transition of wood through the fiber saturation point, ie, after the moisture content has dropped beyond 28-30%. This is due to the reduction in the space between micelles after moisture removal. Shrinkage stops when the wood reaches an absolutely dry state. In practice, shrinkage of boards and bars begins before they reach an average moisture content of 25-30%, since their outer layers dry below the moisture saturation point of the fiber before the inner layers begin to dry out. The amount of shrinkage is expressed as a percentage of the original size. For this, the materials of both the authors and other researchers were analyzed [1-10]. The essence of the analysis was to compare the results of the shrinkage value and the actual volume of wood used in our region.

The construction of almost any wooden object is associated with a large number of problems. After all, wood is a natural and very plastic material that is demanding on external conditions. It is devoured by fungi and pests, the tree rots and changes its characteristics. The manufacture of products from raw material leads to subsequent warping, cracking of the base due to drying out. Moreover, the tree decreases in different ways, depending on the sides.

Wood shrinkage is one of the most common problems that are familiar to anyone who has worked with this material. During construction work, it is necessary to provide for allowances on a natural base, in which case the shrinkage process will be painless, and the appearance of the building will remain unchanged.

Wood shrinkage coefficients

Breed	Shrinkage		
	Volumetric	In tangential direction	Radially
Larch	0,52	0,35	0,19
Pine	0,44	0,28	0,17
Spruce	0,43	0,28	0,16
Fir	0,39	0,28	0,11
Cedar pine	0,37	0,26	0,12

Shrinkage accompanies any of the drying processes of natural rocks. Bound and adsorbed water comes out of their fibers.

The initial stage of drying is characterized by the release of the base from free water, there is a slight removal of the bound liquid. The process is taking place at a slow pace. At the moment of evaporation of microcapillary water, the drying process is noticeably accelerated.

Shrinkage changes the least in the longitudinal position of the fibers. This method is often simply ignored. However, one cannot do without it if valuable wood species are taken into account.

The radial direction of this action is determined by the presence of many parameters. It depends on the type of tree species and on the volumetric shrinkage.

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When working with wood, the term "shrinkage factor" is used. It provides information about the transformation of the parameters of a tree due to an increase in its moisture content by 1%. The boundaries are taken into account, starting from the nutrition of the tree cells and ending with the process of removing moisture from them. For more accurate calculations of wet stresses, you should refer to professionals or tables on the network, which present such indicators to different types of natural raw materials.

Indicators of wood shrinkage allow them to be divided into separate, rather extensive groups. There is a linear shrinkage, volumetric and transverse shrinkage.

Linear wood shrinkage along and across the fibers is different: the first value can be taken on average as 0.1%. Complete shrinkage across the fiber is much greater and in the radial direction on average for conifers is 4%, for deciduous - 5%; tangential shrinkage is twice the radial shrinkage.

Volumetric shrinkage on average reaches 12-14%. The amount of shrinkage depends on the breed, and within the same breed - on the volumetric weight, increasing with an increase in the latter.

The transverse shrinkage of an individual fiber reaches 30%, while the longitudinal shrinkage is barely 1%. The unequal shrinkage along the fibers in different cases is explained by the different angle of inclination of the fibrils. The difference between radial and tangential shrinkage is due to the influence of the pith rays and the late zone of the annual layer. The shrinkage of the core rays in width (in the tangential direction) is 4-7 times greater than the shrinkage of other wood elements; likewise, the tangential shrinkage of the late wood is 1–2% higher than the shrinkage of the early wood of the annual layer.

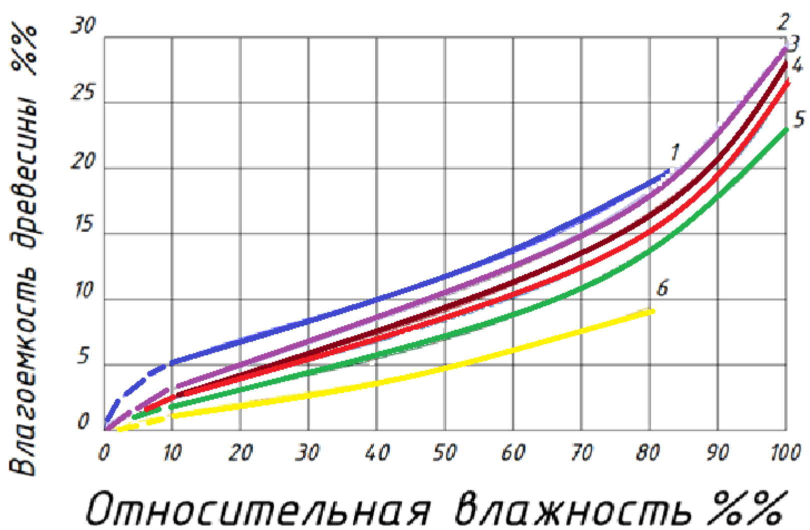
Drying of wood takes place in several stages:

1. At the initial stage, an insignificant fraction of the bound liquid decreases from the material. This is the slowest stage, but the work has already begun. Water does not come out of the wood structure completely, but only partially; a large percentage of moisture still remains in it. Water evaporates most slowly along the fibers. This type of shrinkage should not be postponed and neglected, especially if you work with expensive wood species.
2. The amount of shrinkage is measured in both longitudinal and radial projections. The latter has different parameters for different types of raw materials. As a rule, at the second stage, there is a change in the properties of the building material in the radial direction.
3. At the final stage, volumetric shrinkage occurs. It determines the degree of moisture removal and the condition of the raw materials. One of the main indicators indicating quality shrinkage is its coefficient. It determines how much the geometric parameters of the tree cell will change in the event of a 1% increase in humidity.

An important indicator of this lumber is the percentage of its density. It includes the weight of the product at certain moisture levels. This data can be obtained from formulas or graphically. So, with an increase in humidity, the density will also increase. The highest density is possessed by such raw materials, the cells of which are completely filled with moisture.

Overdried wood will absorb moisture from the air, and this ability is called moisture absorption (hygroscopicity). The limiting amount of moisture that can be absorbed from the air under given conditions determines its moisture capacity, and the absorption rate under equal conditions depends on moisture conductivity.

The moisture content of a tree species depends on the temperature and humidity of the surrounding air. Therefore, under different conditions, wood is able to absorb different amounts of moisture from the air, reaching the end when it does not absorb or evaporate moisture. This dependence can be explained by the following moisture absorption diagram.



In one example, consider the amount of shrinkage and the actual volume of wood used in our region. According to the documents received, the moisture content of lumber at the time of receipt was more than 37%, and at the time of sale from 14-16% (for spruce, pine, cedar and fir wood) and 20% for larch wood (considering that Fergana is dry and hot climate) we recommend determining the actual cross-section of the boards depending on the thickness of 40 mm and 50 mm, and the width from 100 to 300 mm for spruce, pine, cedar and fir wood according to table 1 and for larch wood according to table 2, *GOST 6782.1-75*.

The methodology for calculating the actual volume of sawn timber due to shrinkage is given below in the text: (spruce, pine, cedar, and fir) is 40 mm, then its shrinkage at an initial moisture content of 37% and a final moisture content of 15% in thickness according to table 1. *GOST6782.1-75* is *1.6-0.2 = 1.4 mm* ; and with a nominal thickness of 50 mm it is *2.0-0.3 = 1.7 mm*; with a board width of *100 mm*, shrinkage is *3.7-0.6 = 3.1 mm*; with a board width of *150 mm*, *5.2-0.8 -4.4 mm*; with a board width of *200*

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mm, 6.7-0.9 = 5.8 mm; with a board width of *250 mm, 8.4-1.2 = 7.2 mm*; with a board width of *300 mm, 9.3-1.5 = 7.8 mm*.

The actual size of the cross-section of a board with a nominal size of *40x100 mm*, taking into account shrinkage, is $A_1 = 38.6 \times 96.9$ *mm*. If to calculate $1m^3$ of volume with a length of 1 pm of a board, *1000/40 = 25* boards are required for the height of the stack and *1000/100 = 10* boards for the width, then the actual volume can be calculated as follows:

$V_f = A_1 x25x10 = 0.0386x0.0969x25x10 = 0.93508$ *m3, for 100 m3* $V_f = 0.93508x100 = 93.508$ *m3.*

CONCLUSION

As can be seen from these simple calculations, the correct accounting for wood shrinkage is important both when calculating the wooden structures of buildings, and when calculating the volume of products, lumber.

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