SLOVENSKI STANDARD
SIST ENV 1156:2000

01-maj-2000

Lesne ploġ e - Ugotavljanje faktorjev trajanja obremenitve in lezenja

Wood-based panels - Determination of duration of load and creep factors

Holzwerkstoffe - Bestimmung von Zeitstandfestigkeit und Kriechzahl

Panneaux a base de bois - Détermination des facteurs de durée de charge et de fluage

Ta slovenski standard je istoveten z: **ENV 1156:1998**

ICS:

79.060.01	Lesne ploġ e na sploġno	Wood-based panels in general

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English version

Wood-based panels - Determination of duration of load and creep factors

Panneaux à base de bois - Détermination des facteurs de durée de charge et de fluage

Holzwerkstoffe - Bestimmung von Zeitstandfestigkeit und Kriechzahl

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 112 "Wood-based panels", the secretariat of which is held by DIN.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Prestandard specifies a method of determining in a constant climate both a duration of load factor and a creep factor for wood-based panels stressed in flatwise bending with and without a shear component. Details of an alternative but provisional method employing medium sized test pieces are given in Annex B; this method can also be used for test pieces loaded under varying climates.

NOTE: The duration of load factor is necessary to modify the characteristic strength values obtained in short-term structural tests in order to derive long-term values. The creep factor obtained in the test is used to predict a long-term deflection from the initial elastic deflection.

2 Normative references

This European Prestandard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 310
Wood-based panels
Determination of modulus of elasticity in bending and of bending strength

EN 325
Wood-based panels
Determination of dimensions of test pieces

EN 326-1
Wood-based panels
Sampling, cutting and inspection
Part 1: Sampling and cutting of test pieces and expression of test results

EN 1058
Wood-based panels
Determination of characteristic values of mechanical properties and density

ENV 1995-1-1
Eurocode 5 – Design of timber structures – Part 1-1: General rules and rules for buildings

3 Principle

Determination in a constant climate of the load duration factor (loss in strength with time under load) and the creep factor (ratio of increase in deflection with time to the initial elastic deflection) in bending by applying and sustaining a constant moment over the central region of a test piece; both the time to failure, and the increase in deflection with time are measured.

4 Apparatus

4.1 Measuring instruments as specified in EN 325.

4.2 A number of test rigs (see figure 1), having essentially the following components:

4.2.1 Two parallel cylindrical supports of length exceeding the width of the test piece and of diameter d = (15±0,5) mm. The distance between the supports shall be adjustable, and each support shall be capable of rotating in its frame.

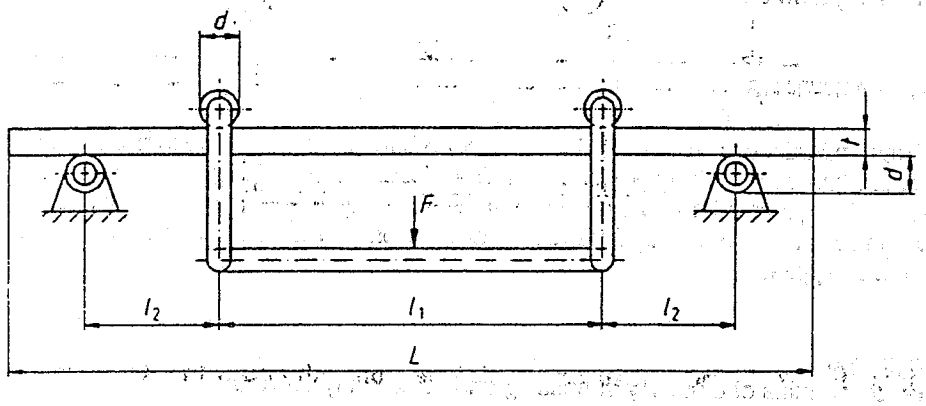
Two cylindrical loading rollers of the same length and diameter as the supports. These shall lie parallel to the supports, be capable of rotating, and be linked together with cross-arms of fixed length.

The distance l_1 between the loading rollers shall be 150 mm, the distance between one support and the nearer loading roller shall be five times the nominal thickness t of the test piece. The horizontal and vertical components of the loading cradle shall be rigidly connected.

NOTE 1: For boards with a low bending stiffness large deflections can occur. In general, the test configuration described here is suitable for a test piece with a stiffness ($E_m I$) greater than 9 000 kNmm^2; test pieces with a lower stiffness can be tested by proportionately reducing the distances between the rollers (l_1+2 l_2) as well as the distance between the deflection measuring points.

NOTE 2: The load can be applied to the cross-arms through some form of mechanical advantage.

Dimensions in millimetres



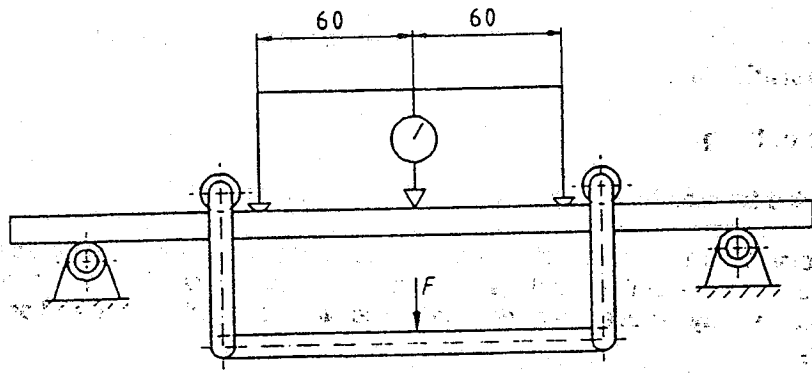
F dead-load
t thickness

l_1 = 150
l_2 = 5 t
L = l_1+10 t+60
d = 15±0,5

Figure 1: Test arrangement for applying load for static bending and creep tests with test piece in position

4.2.2 A suitable instrument for measuring the deflection of the test piece in the middle of the span to the nearest 0,001 mm, enabling readings of the displacement at the centre of the upper surface of the test piece to be taken in relation to two points on the upper surface of the test piece each 60 mm from the transverse centre line (see figure 2). This general method will measure creep in bending free of any influence of shear (method 1).

Dimensions in millimetres

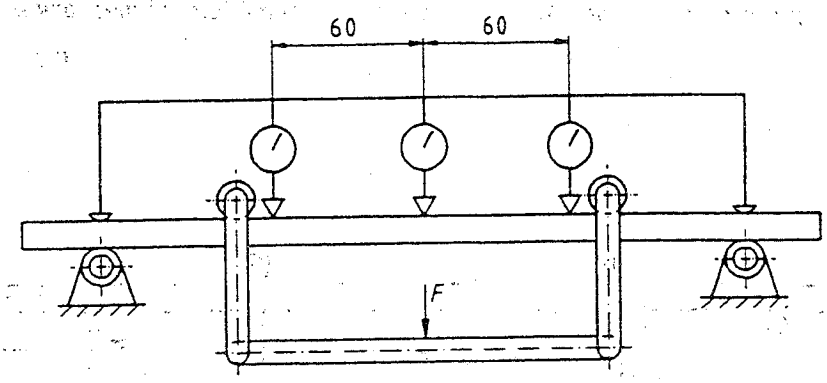


F dead-load

Figure 2: Method 1 (general method) for the measurement of deflection

Where it is desired to measure creep in bending both with and without a shear component a measuring system as illustrated in figure 3 shall be used (method 2).

Dimensions in millimetres



F dead-load

Figure 3: Method 2 for the measurement of deflection with and without a shear component

4.3 An arrangement for testing the short-term bending strength with the same loading configuration to the creep test arrangement.

4.4 Weights (= dead load) for applying different constant loads (forces) on the test pieces.

4.5 A controlled environment room capable of maintaining a fixed temperature to ±1 °C and a fixed relative humidity to ±3 %.

4.6 Equipment for recording temperature and relative humidity.

5 Sampling of panels and preparation of test pieces

5.1 Sampling and cutting

Panels shall be sampled from production sites in accordance with EN 1058.

Where previous static bending tests have indicated that the differences between the means of strength or modulus of elasticity in the two directions of the panel, i.e. longitudinal and transverse, is equal to, or less than 15 %, then a single set of test pieces may be used, provided that these are orientated in the direction of the lower values of strength and elasticity.

Where these tests have indicated differences greater than 15 % in strength or modulus in the two directions, then two sets of test pieces shall be used. However, if the end-use direction of span is known, then it is only necessary to carry out tests in that direction.

Where there is no available information on the relative strength and modulus in the longitudinal and transverse directions, then this shall be determined prior to the start of creep testing. Test pieces from the two directions shall be removed and tested according to EN 310.

For creep, and load-duration tests, each set of test pieces shall comprise 70 pairs of side-matched test pieces cut in a manner that ensures that all panels and test pieces are sampled as equally as possible. This number of samples is based on the assumption that at low stress levels the material is behaving in a linear viscoelastic mode. However, if there is doubt about this assumption, then creep tests should be carried out at more than one stress level as recommended in 6.4.3, and this will necessitate additional test pieces equivalent to an extra 10 for each additional stress level.

Test pieces shall be free of visible strength-reducing characteristics.

NOTE: Test pieces containing visible strength-reducing characteristics and of a larger size can be tested according to the provisional test method given in annex B.

5.2 Dimensions of test pieces

The test pieces shall be rectangular, and of the following dimensions:

The width shall be (50±0,5) mm.

For test pieces having a stiffness ($E_m I$) greater than 9 000 kNmm^2 the length L shall be 10 times the nominal thickness plus 210 mm, with a maximum length of 1 200 mm.

For test pieces having a stiffness ($E_m I$) of 9 000 kNmm^2 or less, the length of test piece may be reduced according to NOTE 1 of 4.2.1.

5.3 Conditioning

Before testing, the test pieces shall be conditioned to constant mass in an atmosphere corresponding to the most severe conditions in each of the service classes (SC) according to ENV 1995-1-1 to which the appropriate characteristic values apply: these are 20 °C/65 % relative humidity for SC1, 20 °C/85 % relative humidity for SC2, and 20 °C/95 % relative humidity for SC3 (for tolerances see 4.5). Constant mass is considered to be reached when the results of two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0,1 % of the mass of the test piece.

6 Procedure

6.1 Measurement of dimensions

Measure the width and thickness of each test piece in accordance with EN 325 at the following points:

– the thickness at the intersection of the diagonals;

– the width at the mid length.

6.2 Setting up the test rigs with test pieces

Adjust the distance between the centre of the support rollers of both the static bending rig and the creep test arrangement to within 1 mm of 150 mm plus 10 times the nominal thickness of the panel (see figure 1). Measure the distance between the centres of the support rollers to the nearest 0,5 mm. Reference points for the subsequent measurement of deflection shall be added to the top surface of each of the 10 creep test pieces; these will usually take the form of thumbtacks, or small glass or metal plates with the measuring contact point defined with a limit of error under 0,001 mm.

6.3 Determination of short-term bending strength

Place one of the side-matched test pieces flat on the supports of the static bending test arrangement, with its length axis at right angles to those of the supports (see figure 1).

Determine its short-term static bending strength, under the same climatic conditions in which it was conditioned, by applying a load at a constant rate of cross-head movement throughout the test. The rate of loading shall be adjusted so that the maximum load F_{max} is reached within (60±30) s. Record the ultimate load to an accuracy of 1 % and calculate the bending strength f_m of the test piece from equation (1):

$$f_m = F_{max}\, l_2/(2\, W) \qquad (1)$$

where

W is the section modulus equal to $bt^2/6$, in cubic millimetres;

(t is the measured thickness of test piece, in millimetres

and

b is the measured width of test piece, in millimetres).

Repeat the test with the face of half of the test pieces (each test piece being half of a matched pair) lying upwards in the rig, and half with it lying downwards.

6.4 Determination of the duration of load and creep factors

6.4.1 General testing required

Place the second of the two side-matched test pieces on a creep test arrangement with the same surface lying upwards as in the static bending test in 6.3. Ensure that the climatic conditions are identical to those prevailing during the short-term bending test. The climatic conditions during test shall be monitored continuously.

Attach a mass to the centre of the cross-arm linkage, taking care to avoid too rapid loading, especially at high stress levels. Immediately after loading, record the time of starting to the nearest minute (T_o).

The mass applied shall be a percentage of the maximum load (stress level) of the other test piece of the matched pair.

NOTE: Smooth application of load can be achieved by supporting the weights with a stand which can be smoothly lowered over 5 s to 10 s, until the mass is fully supported by the test piece.

6.4.2 Testing for duration of load

For determination of the duration of load factors, carry out a series of tests with recommended loads corresponding to 55 %, 60 %, 65 %, 70 %, 75 % and 80 % of F_{max} for 20 °C/65 % relative humidity conditions. For conditions of 20 °C/85 % relative humidity and 20 °C/95 % relative humidity it is recommended that a lower set of stress levels be adopted e.g. 50 %, 55 %, 60 %, 65 %, 70 % and 75 %.

At each stress level, carry out 10 tests. From the seventy or more test pieces, select each set of ten test pieces such that as far as possible, each test piece within a set comes from a different production site or production period.

For all tests, record the time to failure in minutes expressed to the nearest 1 % of the elapsed time (T_f). Usually, the measurement of deflection is dispensed with when determining duration of load.

The tests shall continue until at least 7 test pieces at each stress level have failed.

6.4.3 Testing for creep

For the determination of creep factor, carry out a second series of tests at a single stress level. Where it is desired to carry out this determination of creep factor concurrently with the duration of load factor, a load corresponding to 25 % of F_{max} shall be used. Alternatively, the load applied shall correspond to the stress level necessary to ensure a particular life span as set out in 6.4.2 and 7.1.

NOTE 1: The use of a single level of stressing in order to calculate the creep factor rests on the assumption that the material is linearly viscoelastic up to levels of at least 40 % of F_{max}. If there is doubt about the validity of this assumption either in new board products, or in existing board types at high levels of relative humidity, then a series of creep tests should be carried out over a range of stress levels between 10 % and 40 % of F_{max}.

Carry out 10 tests at one or more stress levels (see previous NOTE). From the seventy or more test pieces, select each set of ten test pieces such that as far as possible, each test piece within a set should come from a different production site or production period.