

Plywood — Calculation method for some mechanical properties

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National foreword

This Draft for Development is the English language version of ENV 14272:2002.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because there is at present insufficient experience in the use of this test method. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European organization responsible for its conversion into a European Standard. A review of this publication will be initiated 2 years after its publication by the European organization so that a decision can be taken on its status at the end of its three-year life. The commencement of the review period will be notified by an announcement in *Update Standards*.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European Standard, to extend the life of the prestandard or to withdraw it. Comments should be sent in writing to the Secretary of BSI Subcommittee B/541, Timber structure, at 389 Chiswick High Road, London W4 4AL, giving the document reference and clause number and proposing, where possible, an appropriate revision of the text.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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English version

Plywood - Calculation method for some mechanical properties

Contreplaqué - Méthode de calcul pour certaines caractéristiques

Sperrholz - Rechenverfahren für einige mechanische Eigenschaften

This European Prestandard (ENV) was approved by CEN on 5 April 2002 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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Foreword

This document ENV 14272:2002 has been prepared by Technical Committee CEN/TC 112 "Wood-based panels", the secretariat of which is held by DIN.

The annexes A and B are informative.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Prestandard gives a calculation method for the estimation of some mechanical properties of plywood (strength and stiffness) with a symmetrical composition.

The resulting values are intended as predictive only.

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 Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 635-2, *Plywood — Classification by surface appearance — Part 2: Hardwood.*

EN 635-3, *Plywood — Classification by surface appearance — Part 3: Softwood.*

EN 636-1, *Plywood — Specifications — Part 1: Requirements for plywood for use in dry conditions.*

EN 636-2, *Plywood — Specifications — Part 2: Requirements for plywood for use in humid conditions.*

EN 636-3, *Plywood — Specifications — Part 3: Requirements for plywood for use in exterior conditions.*

3 Principle

To derive by calculation the mechanical properties of a panel, using the corresponding mechanical properties of the wood species compounding the layers. Each pair of layers (or layer) values are weighted by a geometrical factor related to its weight in the panel cross section.

4 Terms and definitions and symbols

4.1 Terms and definitions

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

4.1.1

characteristic strength

population fifth percentile value relating to a temperature of 20 °C and a relative humidity of 65 %

4.1.2

characteristic stiffness

either the population fifth percentile or the mean value relating to a temperature of 20 °C and a relative humidity of 65 %

4.1.3

characteristic density

population fifth percentile value with mass and volume corresponding to equilibrium at a temperature of 20 °C and a relative humidity of 65 % either of the wood species or of the panels, single species or mixed species

The density values found from calculation refer to the minimum acceptable density of veneers used in the lay-up of plywood. In the case of single species plywood these values are taken as the characteristic values for the plywood.

In the case of mixed species plywood the characteristic value of density of the panel is calculated from the characteristic densities of the individual veneers according to the proportion of each species

4.1.4

basic value

characteristic value of properties to be used in the equations of the calculation method for each pair of layers (or layer)

NOTE Characteristic values are mean values for modulus of elasticity and fifth percentile values for strengths and modulus of elasticity.

4.2 Symbols

In the tables the following symbols are used:

4.2.1 Main symbols

A	Area ($b \cdot t_{\text{nom}}$), in square millimetres
f	Strength, in newtons per square millimetre
E	Modulus of elasticity, in newtons per square millimetre
G	Modulus of rigidity, in newtons per square millimetre
b	Unit width of panel, in millimetres
t	Thickness of panel or a pair of layers, in millimetres
W	Section modulus, equal to $b t_{\text{nom}}^2 / 6$, in cubic millimetres
I	Second moment of area, equal to $b t_{\text{nom}}^3 / 12$, in millimetres to the fourth power
	Density, in kilograms per cubic metre
k_a	Modification factor, appearance class
a	Thickness of the layer (distance between the outer faces of a pair of layers), in millimetres
L / L	Relative elongation of the face plies (bending, tension and compression)
V	Strength or modulus, in newtons per square millimetre

4.2.2 Subscripts

m	Bending
t	Tension
c	Compression
v	Panel shear
r	Planar shear
w	Applies to the plywood species with the lower ratio strength/modulus (f / E) for a given property in a panel with a lay-up mixing several species
nom	Nominal
n	Number of pairs of layers of the panel
j	Pair of layers (or layer) under consideration starting from the face, associated to n , its value is comprised between 1 and n
i	Starting from the face, rank of pair of layers having the shortest relative elongation in failure (bending, tension and compression)

Density

- 0 Length of the plywood (direction of the grain of the outer layers)
- 90 Perpendicular to the length
- 05 5 percentile characteristic value

5 Calculation method

5.1 General

The estimate of the mechanical properties of plywood can be found by calculation.

The calculation method described can only be applied to plywood panels with a symmetrical composition.

For the classification of plywood see:

- EN 636-1 for use in dry conditions
- EN 636-2 for use in humid conditions
- EN 636-3 for use in exterior conditions

5.2 Basic values for the calculation method

For calculation of an estimate of characteristic values of mechanical properties for different plywood compositions, the basic values of the layers are derived from the characteristic values of the properties of single species plywood panels.

NOTE Annex B gives a method for deriving basic values.

Depending on the purpose, the basic values for layers are derived from testing small or semi-size test pieces.

The needed basic values are as given in Table 1.

Table 1 — Basic values for the calculation method

Property
Characteristic strength values, N/mm ²
$f_{m, 05}$: Bending
$f_{t, 05}$: Tension
$f_{c, 05}$: Compression
$f_{v, 05}$: Panel shear
$f_{r, 05}$: Planar shear
Mean stiffness values, N/mm ²
E_m : Bending
E_t : Tension
E_c : Compression
G_v : Panel shear
Characteristic stiffness values, N/mm ²
$E_{m, 05}$: Bending
$E_{t, 05}$: Tension
$E_{c, 05}$: Compression
$G_{v, 05}$: Panel shear
ρ_{05} : Density values, kg/m ³

5.3 Wood species

For calculating an estimate of the characteristic values of mechanical properties basic values for each wood species concerned in the plywood composition shall be used.

5.4 Factors for plywood composition

The characterization of plywood composition is shown in Figure 1.