

**Träkonstruktioner – Förband – Karakteristiska värden på kapacitet och styvhet för förband med mellanläggsbrickor**

**Timber fasteners – Characteristic load-carrying capacities and slip-moduli for connector joints**

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English version

## Timber fasteners - Characteristic load-carrying capacities and slip-moduli for connector joints

Eléments de fixation du bois - Valeurs caractéristiques de capacité résistance et du module de glissement des assembleurs mécaniques du bois

Holzverbindungsmittel - Charakteristische Tragfähigkeiten und Verschiebungsmoduln für Verbindungen mit Dübeln besonderer Bauart

This European Standard was approved by CEN on 4 October 2001.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 124, "Structural timber", the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2002, and conflicting national standards shall be withdrawn at the latest by May 2002.

This standard is one of a series of standards for building materials. It was prepared by a working group under the convenorship of DIN, Germany.

It is recognized that the characteristic load-carrying capacities of connector units defined in this standard will be interpreted with respect to design, structural detailing, and control, by reference to ENV 1995-1-1.

The annexes A and B are normative.

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

**EN 13271:2001 (E)****1 Scope**

This European Standard specifies relationships for the determination of load-carrying capacities of connector joints in timber structures and appertaining reference conditions.

It also gives recommendations for characteristic values for slip moduli for joints in solid timber (in accordance with EN 338) or glued laminated timber (in accordance with EN 1194).

**2 Normative references**

This European Standard 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 (including amendments).

EN 338, *Structural timber – Strength classes.*

EN 912, *Timber fasteners – Specifications for connectors for timber.*

EN 1194, *Timber structures – Glued laminated timber – Strength classes and determination of characteristic values.*

EN 26891, *Timber structures – Joints made with mechanical fasteners – General principles for the determination of strength and deformation characteristics (ISO 6891:1983).*

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

**3 Terms and definitions**

For the purposes of this European Standard the following term and definition apply.

- 3.1 connector unit**
- one ring connector with its bolt in single shear in a timber-to-timber joint, or
  - two plate connectors used back-to-back with the bolt in single shear in a timber-to-timber joint, or
  - one double-sided toothed-plate connector or two single-sided toothed-plate connectors used back-to-back with the bolt in single shear in a timber-to-timber joint

**4 Symbols and abbreviations**

$R_{b,0,k}$	characteristic load-carrying capacity of the bolt for $\alpha = 0^\circ$ , in newtons
$R_{b,\alpha,k}$	characteristic load-carrying capacity of the bolt for $\alpha \neq 0^\circ$ , in newtons
$R_{c,k}$	characteristic load-carrying capacity of one toothed-plate connector, in newtons
$R_{c,0,k}$	characteristic load-carrying capacity of a ring or shear plate connector joint per connector unit for $\alpha = 0^\circ$ , in newtons
$R_{j,0,k}$	characteristic load-carrying capacity of a toothed-plate connector joint per connector unit for $\alpha = 0^\circ$ , in newtons

$R_{j, \alpha, k}$	characteristic load-carrying capacity of a toothed plate connector joint per connector unit for $\alpha \neq 0^\circ$ , in newtons
$a_{3,t}$	loaded end distance, in millimetres
$a_{3,c}$	unloaded end distance, in millimetres
$a_4$	edge distance (loaded or unloaded), in millimetres
$a_{4,t}$	loaded edge distance, in millimetres
$a_{4,c}$	unloaded edge distance, in millimetres
$d_b$	bolt diameter, in millimetres
$d_c$	connector diameter, in millimeters
$d_1$	hole diameter of connector, in millimeters
$h_e$	depth of the connector embedment or tooth penetration depth, respectively, in millimeters
$t_1$	side member thickness, in millimeters
$t_2$	middle member thickness, in millimeters
$k_s$	slip modulus according to EN 26891, in newtons per millimeter
$k_{a3}$	modification factor $a_{3,t}$
$k_t$	modification factor for $t_1$ and for $t_2$
$k_\alpha$	modification factor for $\alpha$
$k_p$	modification factor for $\rho_k$
$\alpha$	angle between load and grain direction, in degrees
$\rho_k$	characteristic density of the timber strength class, in kilogram per cubic metre

## 5 Ring and shear plate connector joints

### 5.1 Connector types

The following recommendations relate to connector joints with connectors of type A and type B as specified in EN 912.

### 5.2 Characteristic load-carrying capacities

The characteristic load-carrying capacity of a ring or shear plate connector unit is related to the following reference conditions:

$$\alpha = 0^\circ \quad (1a)$$

$$a_{3,t} = 2 d_c \quad (1b)$$

$$a_4 = 0,6 d_c \quad (1c)$$

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$$t_1 = 3 h_e \tag{1d}$$

$$t_2 = 5 h_e \tag{1e}$$

$$\rho_k = 350 \text{ kg/m}^3 \tag{1f}$$

The characteristic load-carrying capacity per connector unit is given by

$$R_{c,o,k} = \min \begin{cases} 35d_c^{1,5} \\ 31,5d_c \cdot h_e \end{cases} \tag{2a}$$

$$\tag{2b}$$

with  $R_{c,o,k}$  in N,  $d_c$  and  $h_e$  in mm.

Other conditions than those given in equations (1a to 1f) according to annex A.

**5.3 Additional reference conditions**

The characteristic load-carrying capacities given in equations (2a and 2b) are related to connector units with bolts according to Table 1.

**Table 1 - Requirements for the bolts in ring and shear plate connector joints**

Type of connector	$d_c$  mm	$d_b$	
		min. mm	max. mm
A1 to A 5	$\leq 130$	12	24
A 1, A4, A5	$> 130$	$0,1 d_c$	24
B		$d_1 - 1$	$d_1$

Washers with a side length or a diameter of at least  $3 d_b$  and a thickness of at least  $0,3 d_b$  should be used under the head and nut. Washers should have a full bearing area.

**5.4 Characteristic slip moduli**

The characteristic slip modulus  $k_s$  is given by

$$k_s = 0,6 d_c \rho_k \tag{3}$$

with  $k_s$  in N/ mm,  $d_c$  in mm and  $\rho_k$  in  $\text{kg/m}^3$ .