



**SLOVENSKI STANDARD**  
**SIST EN 16784:2016**  
**01-september-2016**

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**Lesene konstrukcije - Preskusne metode - Ugotavljanje dolgoročnega obnašanja premazanih in nepremazanih paličastih veznih sredstev**

Timber structures - Test methods - Determination of the long term behaviour of coated and uncoated dowel-type fasteners

Holzbauwerke - Prüfverfahren - Bestimmung des Langzeitverhaltens beschichteter und unbeschichteter stiftförmiger Verbindungsmittel

Structures en bois - Méthodes d'essai - Détermination du comportement à long terme des éléments de fixation de type tige, revêtus ou non

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**Ta slovenski standard je istoveten z: EN 16784:2016**

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**ICS:**

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EUROPEAN STANDARD

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## Timber structures - Test methods - Determination of the long term behaviour of coated and uncoated dowel-type fasteners

Structures en bois - Méthodes d'essai - Détermination du comportement à long terme des éléments de fixation de type tige, revêtus ou non

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (EN 16784:2016) has been prepared by Technical Committee CEN/TC 124 “Timber Structures”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by December 2016, and conflicting national standards shall be withdrawn at the latest by December 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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## EN 16784:2016 (E)

## 1 Scope

This European Standard specifies a test method for the determination of the long duration withdrawal strength of coated and uncoated dowel-type fasteners in structural timber and timber products and wood based products for structural application.

The method applies to all types of nails, screws and staples.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1382, *Timber Structures — Test methods — Withdrawal capacity of timber fasteners*

EN 26891:1991, *Timber structures — Joints made with mechanical fasteners — General principles for the determination of strength and deformation characteristics (ISO 6891:1983)*

EN ISO 8970, *Timber structures — Testing of joints made with mechanical fasteners — Requirements for wood density (ISO 8970)*

ISO 13061-1, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 1: Determination of moisture content for physical and mechanical tests*

ISO 13061-2, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 2: Determination of density for physical and mechanical tests*

## 3 Terms and definitions

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

### 3.1

#### reference withdrawal strength

mean (50 % fractile) withdrawal strength of the tests carried out in accordance with EN 1382

### 3.2

#### load level

percentage of the reference withdrawal strength

## 4 Symbols and abbreviations

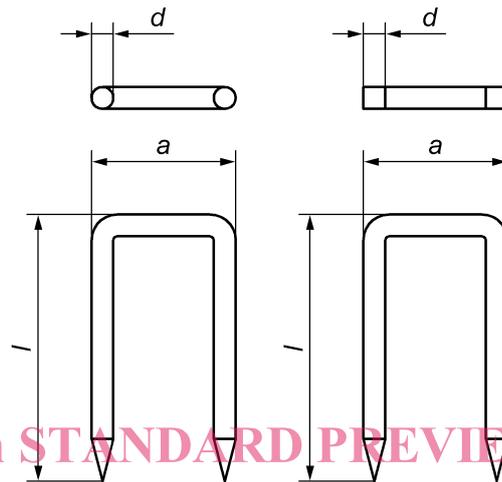
- $a$  staple crown width, in millimetres (see Figure 1)
- $d$  is the outer thread diameter for screws, the diameter of the smooth plain part of a round nail or for staples the diameter of the wire (transformed to a round cross-section) (see EN 14592)
- $F_{\max}$  maximum withdrawal load, in newtons
- $k_{d,T}$  duration of load factor for withdrawal load
- $l_p$  the effective depth of penetration of fastener, in millimetres. For smooth nails and staples this includes the point. For profiled nails and screws only the penetration depth of the profiled part. In the case of partly or completely resin coated fasteners only the depth of penetration of the coated

part.

$\alpha_{\text{cm}}$  angle between the direction of a staple crown and the grain direction or the main direction of the timber or wood based products, respectively, in degrees (see Figure 2)

$T_f$  elapsed time to failure in minutes for a certain test specimen

$T$  time to failure



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Figure 1 — Staple dimensions

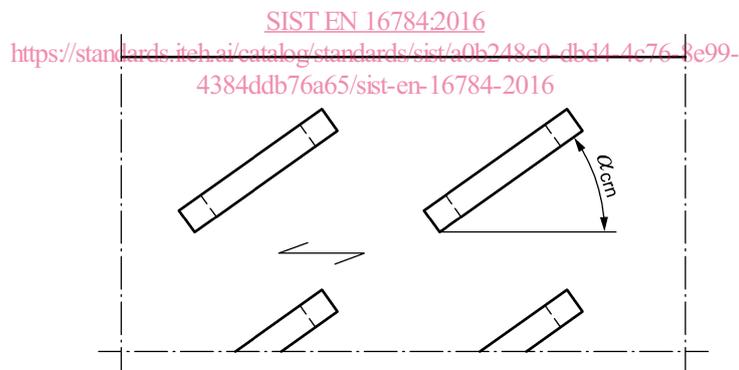


Figure 2 — Angle between the staple direction and the grain direction

## 5 Sampling

### 5.1 Timber

The range of density of the test pieces shall be representative of the density of the mechanical class or range of product to which they belong.

The sampling of test pieces shall be done in accordance with EN ISO 8970.

### 5.2 Fasteners

The technical specification of the nails, screws and staples shall be established.

## 6 Test method

### 6.1 General

The moisture content and density of the timber at test shall be determined as specified in ISO 13061-1 and ISO 13061-2 as appropriate.

### 6.2 Conditioning

The test pieces shall be manufactured with the timber products at an equilibrium moisture content corresponding to  $(20 \pm 2) ^\circ\text{C}$  and  $(80 \pm 5) \%$  relative humidity. The material is conditioned when it attains constant mass. Constant mass is considered to be attained when the results of two successive weightings, carried out at an interval of 6 h, do not differ by more than 0,1 % of the mass of the material.

For certain investigations, other moisture conditioning can be appropriate and shall be reported.

NOTE The high moisture content reflects the worst design situation where wet timber is installed that dries out in service.

### 6.3 Fabrication of the specimens

#### 6.3.1 Fastener axis perpendicular to the grain

The axis of the fastener shall be perpendicular to the timber surface. The insertion of fasteners shall follow normal preparation (e.g. pre-boring) and practice. The position of the fastener is such that no eccentricities occur in transferring the load to the timber.

The width and depth of the test piece in the direction of insertion of the fastener shall be equal and at least  $l_p + 5d$  for nails and screws (see Figure 3), and for staples at least  $10d$ .

Where the test pieces are of solid timber or glued laminated timber, the fasteners shall be inserted irrespective of the direction of the growth rings. In addition for staples, half of the tests shall be carried out with  $\alpha_{crn} = 0^\circ$  and the other half with  $\alpha_{crn} = 90^\circ$ .

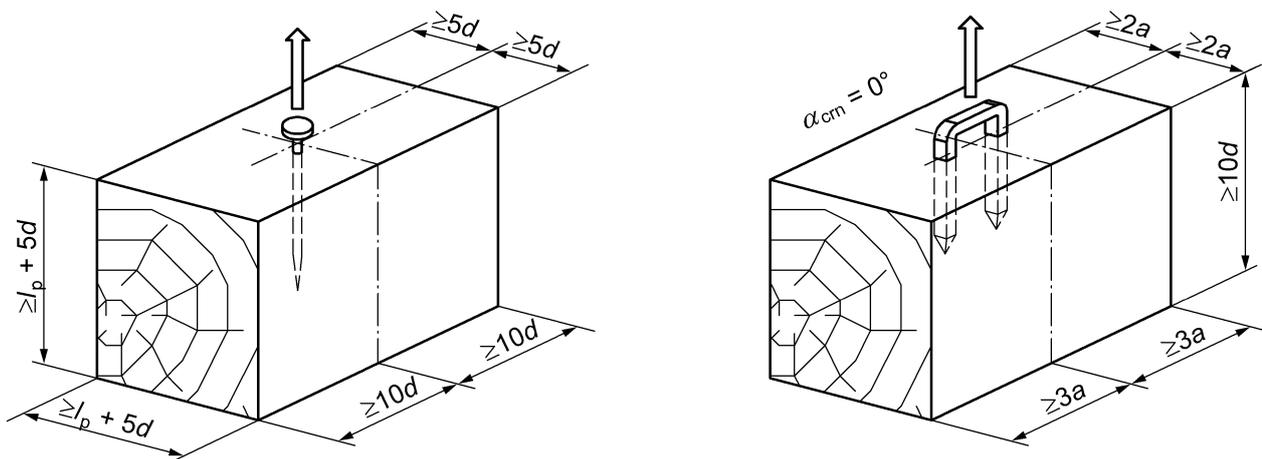


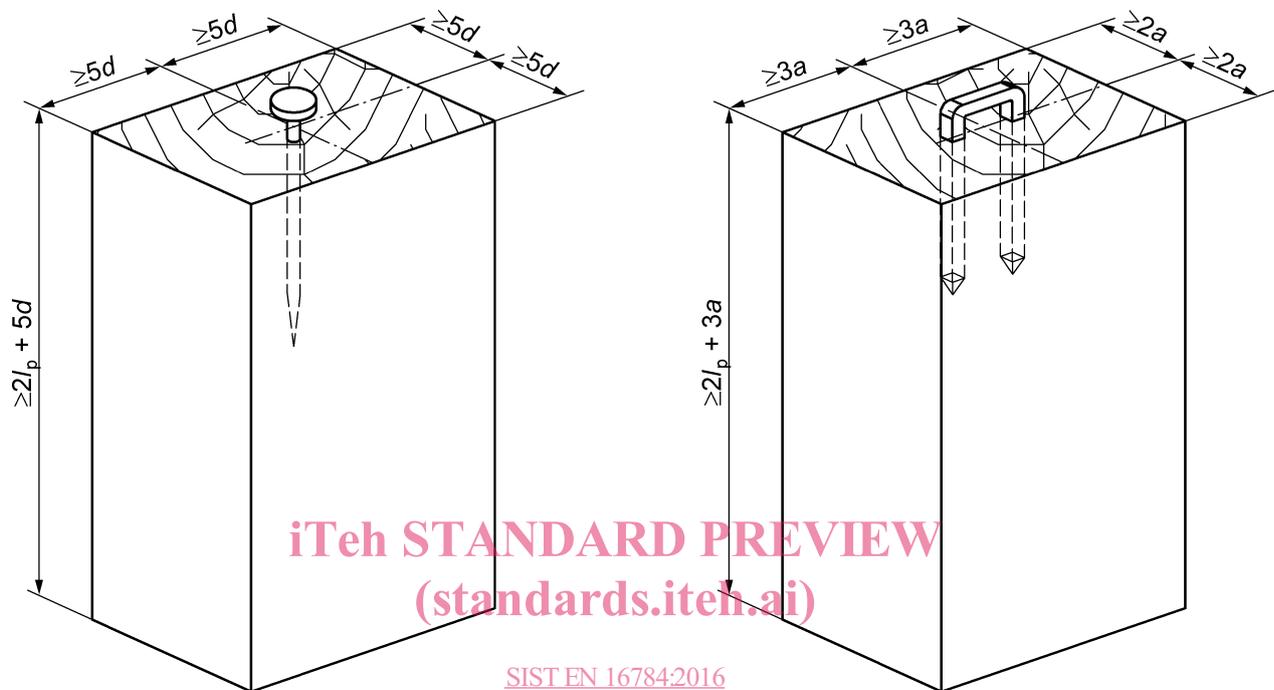
Figure 3 — Withdrawal test pieces - load perpendicular to grain

#### 6.3.2 Fastener axis parallel to the grain

The test piece shall comply with Figure 4. The fastener shall be driven into the end grain to a penetration of between  $8d$  and  $20d$  and shall be positioned in the centre line of the timber specimen as to prevent any eccentricities in the load transfer. A depth of penetration of at least  $12d$  is appropriate to fasteners of  $d$  less than 2 mm.

NOTE The range of depth penetration is given so that the depth of penetration used in the test can be decided depending on the withdrawal resistance EN 1382 and the tensile capacity of the fastener.

The cross-sectional dimensions of the test piece shall be equal and at least  $10d$  (see Figure 4). For staples, the dimensions parallel and perpendicular to the crown shall be equal and at least  $6a$  and  $4a$ , respectively (see Figure 4). The test piece dimension parallel to grain shall be at least  $2l_p + 5d$  for nails and screws, and for staples at least  $2l_p + 3a$ .



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**Figure 4 — Withdrawal test pieces - load parallel to grain**

## 6.4 Test procedure

The apparatus used shall be as required in EN 26891:1991, Clause 7.

Tests are carried out in an environment corresponding to  $(20 \pm 2) ^\circ\text{C}$  and  $(65 \pm 5) \%$  relative humidity. If these conditions are not maintained during the test, they shall be reported.

Test of thermo plastic adhesive coatings shall be performed at elevated temperatures.

NOTE 1 The design rules in EN 1995-1-1 are valid up to  $60 ^\circ\text{C}$ .

Determine the depth of the fastener penetration  $l_p$ . Place the test specimen in a device ensuring the application of the withdrawal force along the axis of the fastener or the axes of the staple legs. Any part of the supports that hold the timber test specimen shall be not closer to the axis of the fastener than  $3d$  for nails and screws and  $a$  for staple.

The loading procedure is in accordance with EN 26891 where the load shall be applied with constant increments until the required load level is attained. The required load is held constant until failure or termination of the test. The time to failure or termination of the test shall be recorded.

NOTE 2 Usually the test specimens are mounted in strings in a rig and loaded by dead load. To keep the dead load within limits a level arm can be applied. It is important that the lever arm can function with or without negligible friction at the hinges.