

# Timber structures — Test methods — Joints made with punched metal plate fasteners

The European Standard EN 1075:1999 has the status of a  
British Standard

ICS 21.060.99; 91.080.20

---

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

**BSI**  
Documents

**AVA**

Document Sharing Hub

# National foreword

This British Standard is the official English language version of EN 1075:1999. It supersedes the tests for Category C fasteners given in BS 6948:1989.

Further information on the application of this standard in the United Kingdom can be found in “Procedures for the derivation of design values for punched metal plate fasteners for timber structures”, available from Trada<sup>1)</sup>.

The UK participation in its preparation was entrusted by Technical Committee B/518, Structural timber, to Subcommittee B/518/1, Test methods, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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 Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

## Compliance with a British Standard does not of itself confer immunity from legal obligations.

<sup>1)</sup> Trada Technology Ltd, Stocking Lane, Hughendedn Valley, High Wycombe, Buckinghamshire, HP14 4ND.

## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 21 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Sector Committee for Building and Civil Engineering, was published under the authority of the Standards Committee and comes into effect on 15 May 2000

© BSI 05-2000

ISBN 0 580 34946 2

## Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |

English version

## Timber structures - Test methods - Joints made with punched metal plate fasteners

Structures en bois - Méthodes d'essai - Assemblages réalisés avec des connecteurs métalliques à plaque emboutie

Holzbauwerke - Prüfverfahren - Verbindungen mit Nagelplatten

This European Standard was approved by CEN on 21 August 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat 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.



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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

**Contents**

|                                                                                                                         | <b>Page</b> |
|-------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Foreword</b> .....                                                                                                   | <b>3</b>    |
| <b>1 Scope</b> .....                                                                                                    | <b>3</b>    |
| <b>2 Normative references</b> .....                                                                                     | <b>4</b>    |
| <b>3 Definitions</b> .....                                                                                              | <b>4</b>    |
| <b>4 Symbols</b> .....                                                                                                  | <b>5</b>    |
| <b>5 Materials</b> .....                                                                                                | <b>6</b>    |
| 5.1 Timber.....                                                                                                         | 6           |
| 5.2 Fasteners .....                                                                                                     | 6           |
| <b>6 Test methods</b> .....                                                                                             | <b>6</b>    |
| 6.1 General.....                                                                                                        | 6           |
| 6.2 Conditioning .....                                                                                                  | 6           |
| 6.3 Fabrication of test pieces .....                                                                                    | 7           |
| 6.4 Preparation of test pieces .....                                                                                    | 7           |
| 6.5 Procedure .....                                                                                                     | 11          |
| 6.6 Expression of results .....                                                                                         | 12          |
| 6.7 Test report.....                                                                                                    | 14          |
| <b>Annex A (normative) Nail root test</b> .....                                                                         | <b>15</b>   |
| <b>Annex B (Informative) Derivation of rotational stiffness of the contact surface of the fastener and timber</b> ..... | <b>17</b>   |
| <b>Annex C (Informative) Examples of properly located transducers</b> .....                                             | <b>19</b>   |
| <b>Annex D (Informative) Examples of loading arrangement</b> .....                                                      | <b>20</b>   |

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 124, Timber structures, 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 March 2000, and conflicting national standards shall be withdrawn at the latest by March 2000.

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.

This standard is one of a series of standards for test methods for building materials and components. It was prepared by a working group under the convenorship of National Standards Authority of Ireland (NSAI).

The standard includes a normative annex giving a method for the testing of nail root in alternate bending and three informative annexes dealing respectively with 1) the derivation of the rotational stiffness of the contact surface of the fastener and timber; 2) examples of properly located transducers and 3) examples of loading arrangement for fastener shear capacity determination.

## 1 Scope

This European Standard specifies the test methods for determining the strength capacity and stiffness of joints made with punched metal plate fasteners in load bearing timber structures, being used to join two or more pieces of timber of the same thickness in the same plane. The properties measured are:

- load-slip characteristics and maximum load resulting from the lateral resistance of the embedded projections, at various angles between the direction of the applied force and:

the axis of the fastener (load-fastener angle  $\alpha$ );

the direction of the grain of the timber (load-grain angle  $\beta$ );

- the tension capacity of the fastener at various angles  $\alpha$ ;
- the compression capacity of the fastener at various angles  $\alpha$ ;
- the shear capacity of the fastener at various angles  $\alpha$ .

A nail root test method is shown in annex A.

## 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.

|          |                                                                                                                                                  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| EN 336   | Structural timber - Coniferous and poplar - Sizes, permissible deviations                                                                        |
| EN 26891 | Timber structures - Joints made with mechanical fasteners - General principles for the determination of strength and deformation characteristics |
| EN 28970 | Timber structures - Testing of joints made with mechanical fasteners - Requirements for wood density.                                            |

## 3 Definitions

For the purposes of this standard, the following definitions apply.

**3.1 punched metal plate fastener:** fastener made of metal plate of nominal thickness not less than 0,9 mm and not more than 2,5 mm, having integral projections punched out in one direction and bent perpendicular to the base of the metal plate

**3.2 major axis of fastener:** direction giving the highest tension capacity per unit width of the fastener (In many cases the punching pattern of the fastener gives rise to two main directions, perpendicular to each other, with different capacity properties)

**3.3 effective area of fastener:** the contact area of fastener and timber member reduced by 5 mm from the edges and by 10 mm in the grain direction from the end of the timber member (see Figure 1)

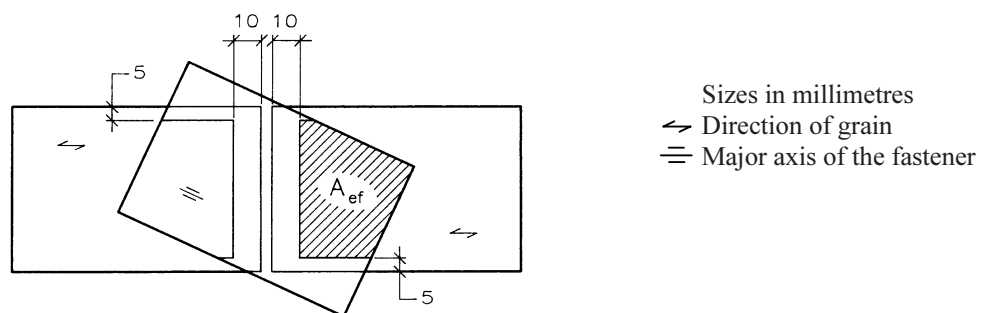


Figure 1: Definition of effective area of fastener

**3.4 anchorage capacity per unit area:** the maximum load resisted by the joint per effective unit area of the fastener

**3.5 characteristic density:** the population 5-percentile value with the mass and volume corresponding to equilibrium moisture content at a temperature of 20 °C and a relative humidity of 65 %

**3.6 design core thickness of fastener:** nominal thickness of the fastener, reduced by the thickness of the coating and further reduced by the minus tolerance of the core thickness

## 4 Symbols

|                             |                                                                                                                                |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| $A_{\text{ef}}$             | effective area of fastener, in square millimetres                                                                              |
| $b$                         | width of fastener perpendicular to the major axis of the fastener, in millimetres                                              |
| $f_{\text{a},\alpha,\beta}$ | fastener anchorage capacity, in newtons per square millimetre                                                                  |
| $f_{\text{c},\alpha}$       | fastener compression capacity, in newtons per millimetre                                                                       |
| $f_{\text{t},\alpha}$       | fastener tension capacity, in newtons per millimetre                                                                           |
| $f_{\text{t,act}}$          | actual tension strength of the fastener material, in newtons per square millimetre                                             |
| $f_{\text{t,k}}$            | characteristic tension strength of the fastener material, in newtons per square millimetre                                     |
| $f_{\text{v},\alpha}$       | fastener shear capacity, in newtons per millimetre                                                                             |
| $f_{\text{y,act}}$          | actual yield stress of the fastener material in newtons per square millimetre                                                  |
| $f_{\text{y,k}}$            | characteristic yield stress of the fastener material in newtons per square millimetre                                          |
| $F$                         | load, in newtons                                                                                                               |
| $F_{\text{max}}$            | maximum load, in newtons                                                                                                       |
| $F_{\text{max,est}}$        | estimated maximum load, in newtons                                                                                             |
| $h$                         | depth of timber, in millimetres                                                                                                |
| $l$                         | length of fastener parallel to the major axis of the fastener, in millimetres                                                  |
| $l_1, l_2$                  | lengths of area covered by the fastener (see Figure 3), in millimetres                                                         |
| $l_j$                       | length of the fastener in the joint line, in millimetres                                                                       |
| $t$                         | thickness of timber test piece, in millimetres                                                                                 |
| $t_{\text{cor,d}}$          | design core thickness of fastener, in millimetres                                                                              |
| $t_{\text{act}}$            | actual core thickness of fastener, in millimetres                                                                              |
| $\alpha$                    | angle between the direction of the applied force and the major axis of the fastener, in degrees                                |
| $\beta$                     | angle between the direction of the applied force and the direction of the grain of the timber, in degrees                      |
| $\theta$                    | angle between the gap line and the line through the load point and the centre point of the fastener (see Figure 6), in degrees |

|          |                                                                                                                                |
|----------|--------------------------------------------------------------------------------------------------------------------------------|
| $\rho$   | density of the timber member in which the failure took place, in kilograms per cubic metre                                     |
| $\rho_k$ | characteristic density of the timber or timber grade, to which the test results shall be applied, in kilograms per cubic metre |

## 5 Materials

### 5.1 Timber

The timber shall be selected in accordance with either of the methods given in EN 28970 (see also 6.6.1).

### 5.2 Fasteners

The fastener specification, including the relevant characteristic mechanical properties (e.g. tensile strength, yield stress and elongation) of the steel used to manufacture the fasteners, determined using standard test procedures, shall be recorded. For the purpose of verifying such records, material shall be available which has been taken from the coil used in the manufacture of the fasteners.

The ductility of the fasteners at the root position of the projections shall be determined in accordance with annex A.

NOTE: The sizes (length and width) of fastener to be used for the various tests should be selected in such a way that capacity values for the complete range of sizes normally produced by the fastener manufacturer may be obtained by interpolation or extrapolation with adequate reliability.

## 6 Test methods

### 6.1 General

For the determination of the fastener tension capacity, the timber shall be sufficiently strong for failure to occur in the fastener. The timber used shall have a target size, see EN 336, of not less than 35 mm or twice the length of the projections plus 5 mm, whichever is the greater.

NOTE 1: In the tests specified in 6.4.1 and 6.4.2 the minimum timber thickness should be limited to that proposed for use in service.

NOTE 2: Test data of anchorage capacity should not be applied to joints with members thinner than those tested, but may be applied to joints with thicker members.

NOTE 3: Examples of properly located transducers are given in annex C (Informative).

If there are no special requirements, the timber shall be planed; the difference in thickness between adjoining pieces shall not exceed 0,5 mm. For each test piece, the two individual members to be joined shall be cut from adjacent positions on the same plank to ensure a test piece of balanced density. In each group of similar test pieces, the timber for each test piece shall be cut from a different plank.

Timber members for the test pieces shall be cut so that the areas to which the fasteners are embedded are free from knots, local grain disturbance, fissures and wane. Elsewhere the members shall be free from characteristics which could lead to premature failure in the timber.

The moisture content of the timber and its density shall be determined.

### 6.2 Conditioning

The test pieces shall be manufactured with the timber at an equilibrium moisture content corresponding to  $(20 \pm 2)^\circ\text{C}$  and  $(85 \pm 5)\%$  relative humidity and shall afterwards be conditioned for at least one week at  $(20 \pm 2)^\circ\text{C}$  and  $(65 \pm 5)\%$  relative humidity. The timber material is conditioned when it attains constant