International Standard 6891

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Timber structures — Joints made with mechanical fasteners — General principles for the determination of strength and deformation characteristics

Structures en bois — Assemblages réalisés avec des éléments mécaniques de fixation — Principes généraux pour la détermination des caractéristiques de résistance et de déformation

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6891 was developed by Technical Committee ISO/TC 165, *Timber structures*, and was circulated to the member bodies in January 1982.

It has been approved by the member bodies of the following countries :

Australia	Egypt, Arab Rep. of	Norway
Austria	France	Portugal
Belgium	Germany, F. R.	Romania
China	India	South Africa, Rep. of
Czechoslovakia	Ireland	Sweden
Denmark	New Zealand	United Kingdom

The member body of the following country expressed disapproval of the document on technical grounds :

Canada

Printed in Switzerland

Timber structures — Joints made with mechanical fasteners — General principles for the determination of strength and deformation characteristics

0 Introduction

Developments in the field of load-bearing timber structures require that joints made with mechanical fasteners be tested to obtain information about their strength and deformation (slip) characteristics.

This International Standard lays down general principles which should be followed in order to achieve comparability of results from investigations carried out in different laboratories. Standard rules for the determination of characteristic strengths for particular types of mechanical fasteners will be given in separate International Standards.

This International Standard is based on Joint Recommendations from Working commission W18, Timber Structures, of CIB[1)] and Committee 3TT, Timber Testing, of RILEM[2)], who will also prepare the basis for the above-mentioned supplementary International Standards.

1 Scope

This International Standard lays down general principles for the determination of the strength and deformation (slip) characteristics of joints made with mechanical fasteners.

2 Field of application

This International Standard is applicable to joints made with mechanical fasteners used in statically loaded timber structures.

Detailed procedures appropriate to joints made with specific fasteners will be given in separate International Standards.

The principles can also be used for the testing of other joints.

It is recognized that for some special types of joints not covered by International Standards, modification of the test procedure may be necessary.

3 Reference

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications.*

1) International Council for Building Research, Studies and Documentation.

2) International Union of Testing and Research Laboratories for Materials and Structures.

4 Symbols

F : applied load, in newtons

F_{est} : estimated maximum load, in newtons

F_{max} : maximum load, in newtons

k : slip modulus, in newtons per millimetre

v : joint slip, in millimetres

Subscripts for the joint slip, v, relate to load points in figure 2 and are defined in clause 8.

5 Conditioning of test specimens

Attention should be paid to the conditioning of the timber before the manufacture of the joint and also to the conditioning of the joints as a whole before testing.

The conditioning should be conducted in such a way that the test conditions correspond in a realistic manner to the conditions in joints in structures as regards the influence of the moisture content on the strength properties of the timber and the occurrence of gaps, etc., through shrinkage.

Detailed requirements for specimens made with specific types of fasteners will be given in separate International Standards.[1)]

Where the purpose of testing is to compare joints under similar conditions, the standard atmosphere 20/65 according to ISO 554 should be used for conditioning.

6 Form and dimensions of test specimens

The test joints shall be of such realistic form and dimensions that the necessary information about the strength and deformation of joints in service can be obtained.

Detailed information about the form and dimensions of the test specimens suitable for different types of mechanical fasteners will be given in separate International Standards.

7 Apparatus

In addition to equipment for measuring the geometry of the test specimens, moisture content, etc., the following shall be available :

a) a testing machine able to apply and record load with an accuracy of ± 1 % of F_{est} or better;

b) equipment to measure joint slip under load with an accuracy of ± 1 % or better, or for slips of less than 2 mm with an accuracy of ± 0,02 mm. The equipment shall ensure that eccentricities, twist, etc. have no influence on the measurements.[2)]

8 Loading procedure

8.1 Estimation of maximum load

The estimated maximum load, F_{est}, for the type of joint to be tested shall be determined on the basis of experience, calculation or preliminary tests, and should be adjusted as required in 8.6.

8.2 Application of load

The loading procedure shown in figure 1 should generally be followed.

The load shall be applied up to 0,4 F_{est} and maintained for 30 s. The load shall then be reduced to 0,1 F_{est} and maintained for 30 s. Thereafter the load shall be increased until the ultimate load or slip of 15 mm is reached.[3)]

Below 0,7 F_{est} a constant rate of load or slip corresponding to 0,2 F_{est} per minute ± 25 % shall be used. Above 0,7 F_{est}, a constant rate of slip shall be used, so adjusted that the ultimate load or a slip of 15 mm is reached in 3 to 5 min additional testing time (total testing time about 10 to 15 min).

The test may be stopped when the ultimate load is reached, or when the slip is 15 mm. For particular tests, the preload cycle up to 0,4 F_{est} may be omitted with a corresponding adjustment to the total testing time.

8.3 Measurement of slip

The slip measurements v_{01}, v_{04}, v_{14}, v_{11}, v_{21}, v_{24}, v_{26} and v_{28} shown in figure 2 shall be recorded for each test specimen. The slip at maximum load, F_{max}, shall also be recorded. When a load/slip diagram is not available, measurements of slip should be taken at each 0,1 F_{est} increment of load (see figure 1).

8.4 Measurement of load

The load reached before or at a slip of 15 mm, shall be recorded as the maximum load, F_{max}, for each specimen.

1) Test methods for joints made with punched metal plate fasteners, nails and staples will form the subject of future International Standards.

2) Equipment that can continuously record load and slip is recommended; exceptionally, slips may be measured at chosen load levels provided the measurements can be made without significantly influencing the continuity of load application. A sufficient number of load levels should be chosen to ensure that the calculations (see 8.5) and the adjustments (see 8.6) can be made.

3) The requirement that the load be maintained constant for 30 s at 0,4 and 0,1 F_{est} is to permit adequate time for the loading to be reversed, it is not intended to provide information on creep behaviour.

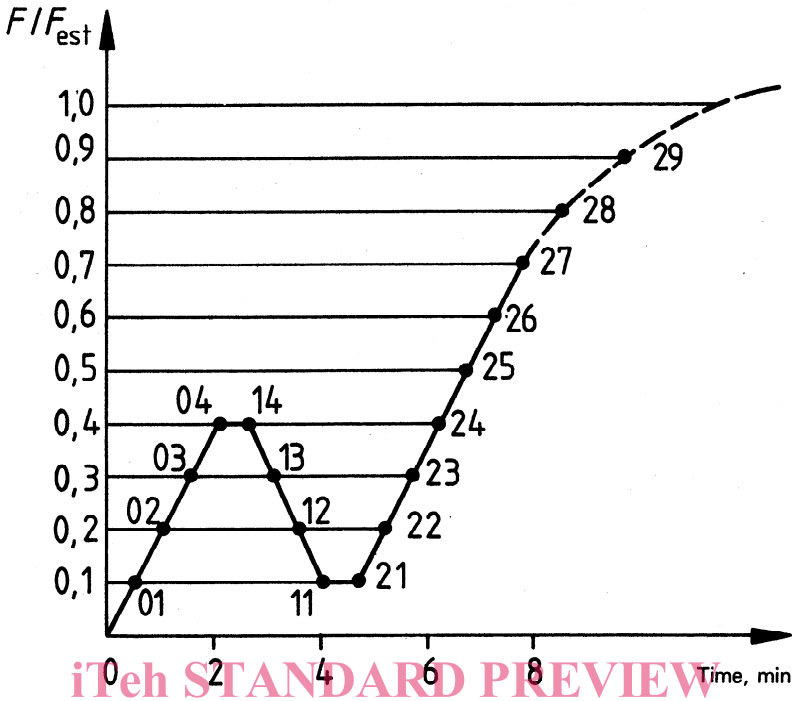

Figure 1 — Loading procedure

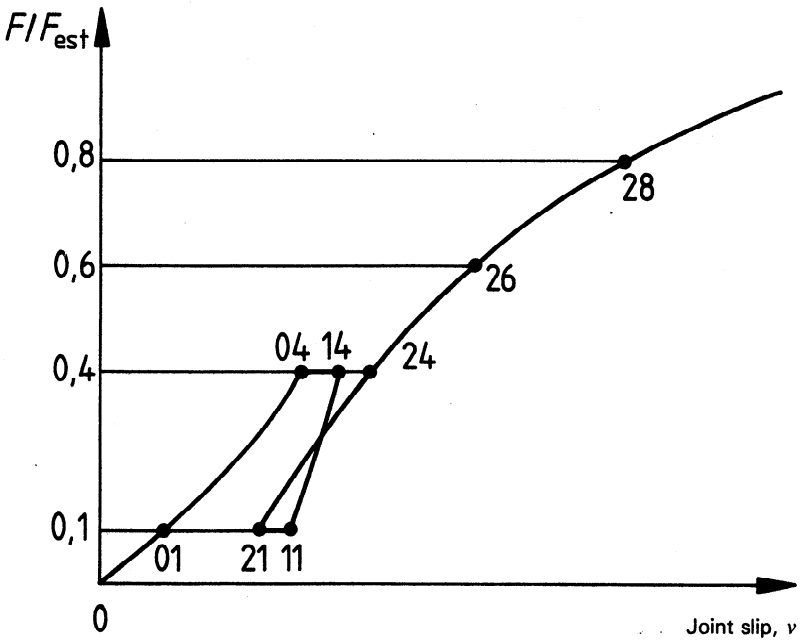

Figure 2 — Idealized load-deformation curve and measurements

8.5 Calculations

From the recorded measurements, the following values, if relevant, shall be determined for each test :

1) maximum load F_{max}

2) estimated maximum load F_{est}

3) initial slip $v_i = v_{04}$

4) modified initial slip $v_{i,mod} = \frac{4}{3}(v_{04} - v_{01})$

5) joint settlement[1] $v_s = v_i - v_{i,mod}$

6) elastic slip $v_e = \frac{2}{3}(v_{14} + v_{24} - v_{11} - v_{21})$

7) initial slip modulus $k_i = 0{,}4\, F_{est}/v_i$

8) slip modulus $k_s = 0{,}4\, F_{est}/v_{i,mod}$

9) slip at 0,6 F_{max} $v_{0,6}$

10) modified slip at 0,6 F_{max} $v_{0,6,\,mod} = v_{0,6} - v_{24} + v_{i,\,mod}$

11) slip at 0,8 F_{max} $v_{0,8}$

12) modified slip at 0,8 F_{max} $v_{0,8,\,mod} = v_{0,8} - v_{24} + v_{i,\,mod}$

If practical, the complete load/slip diagram should also be given.

NOTE — The values calculated for 9) to 12) above relate to the actual value of F_{max} for each of the tests. If a continuous load/slip diagram is available, these values may be obtained directly at the required load level. If only readings of slip at increments of F_{est} are available, the values should be obtained by interpolation.

8.6 Adjustment

If, during the execution of the tests, the mean value of the maximum load of the tests already carried out deviates by more than 20 % from the estimated value, F_{est}, then F_{est} should be adjusted correspondingly for subsequent tests. The values of maximum load already determined may be accepted without adjustment as part of the final results. In this case, the values of slip and slip moduli determined in 3) to 8) of 8.5 should be adjusted to correspond to the adjusted values of F_{est}.

9 Test report

The test report shall include the following information :

a) species, density and relevant strength properties of the timber;

b) quality, strength properties and surface finish of the materials of the fasteners (including anti-corrosive protection);

c) dimensions of the joints, size and number of fasteners, details of gaps between members;

d) conditioning of timber and test specimens before and after manufacture, moisture content of the timber at manufacture and at test, fissures etc;

e) the loading procedure used (by reference to this International Standard) and a statement of any deviations;

f) individual test results and any relevant information regarding adjustments, mean values and standard deviations, and descriptions of the modes of failure.

1) It should be noted that many load-slip curves are initially convex upwards so that v_s will be negative.

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