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Timber structures — Solid timber finger-jointing — Production requirements

Structures en bois — Aboutages à entures multiples de bois massif — Exigences de fabrication

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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10983 was prepared by Technical Committee ISO/TC 165, *Timber structures.*

Annexes A and B of this International Standard are for information only.

Introduction

This International Standard is based on European Standard EN 385:1995, *Finger-jointed structural timber — Performance requirements and minimum production requirements,* but has been modified for international use. In particular, the requirements for external control of production by an external independent organization have been omitted, as this is regarded as the responsibility of national regulatory bodies and not a matter for inclusion in an International Standard. However, TC 165 is not prepared to recommend the use of finger joints in structural timber components where the manufacturing process is not described by a works' quality manual for the following reasons.

a) Structural properties can only be assigned to a finger joint which is clearly defined. Such definition requires a clear statement, within the works' quality manual, which details the raw material inputs (wood and adhesive) and the manufacturing process.

b) Processes which are not written in a works' quality manual and promulgated to the personnel responsible for manufacturing the finger joint are unlikely, over lengthy periods of time, to be manufactured consistently.

Other principles built into the development of this International Standard are as follows.

— This International Standard applies only to the finger-joint production and makes reference only to the maintenance of finger-joint strength. Finger joints are found in both glulam laminations and finger joints and finger-jointed timber used directly for structural applications. No attempt is made in this International Standard to relate compliance testing to the properties of either glulam or finger-jointed timber.

— Type testing is undertaken to establish characteristic strengths and thence target strengths for compliance (daily quality control) testing. The precise test configurations are not specified in this International Standard, which permits the use of a wide variety test equipment. However, it is a requirement that the same equipment and configuration used for type testing also be used for compliance testing. Both bend and tension tests are provided for compliance testing.

Timber structures — Solid timber finger-jointing — Production requirements

1 Scope

This International Standard specifies requirements for bonded finger joints and minimum requirements for the manufacture of cut, interlocking, bonded finger joints in structural timber members.

Although most finger joints are produced in coniferous species, this International Standard also applies to broad-leaved species where information is available to enable them to be satisfactorily bonded.

It does not cover impressed (die-formed) joints. In the case of glued laminated timber it applies only to individual laminations. Large finger joints in glued laminated timber are not covered by this International Standard.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

EN 301, *Adhesives for load bearing timber structures — Phenolic and amino-plastic — Classification and performance requirements*.

3 Terms and definitions

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

3.1
finger joint
self-locating end joint formed by machining a number of similar, tapered, symmetrical fingers in the ends of timber members which are then bonded together

See Figure 1.

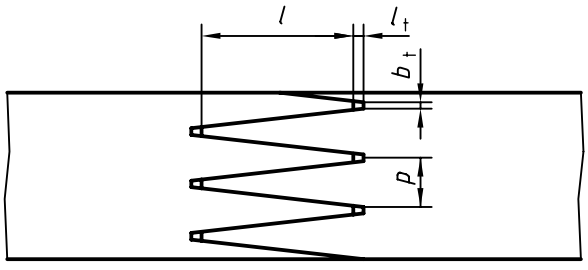

Figure 1 — Typical profile of finger joint showing finger length l, pitch p, tip width b_t, and tip gap l_t

3.2
finger length
distance between the finger base and the tip of the finger, measured along the centreline of the finger

3.3
pitch
centre-to-centre distance between fingers

3.4
production batch
joints, all of which have the same profile, are manufactured from the same species of timber, have the same nominal cross-section, are bonded with the same adhesive and are made during a continuous run on one production line

3.5
service class 1
service class characterized by a moisture content of the material corresponding to a temperature of 20 °C and a relative humidity of the surrounding air exceeding 65 % only for a few weeks per year

NOTE In service class 1, the average equilibrium moisture content in most timbers does not exceed 12 %.

3.6
service class 2
service class characterized by a moisture content of the material corresponding to a temperature of 20 °C and a relative humidity of the surrounding air exceeding 85 % only for a few weeks per year

NOTE In service class 2, the average equilibrium moisture content in most timbers does not exceed 20 %.

3.7
service class 3
service class characterized by climatic conditions leading to higher moisture contents than service class 2

3.8
tip gap
distance between finger tip and slot base in a bonded finger joint

3.9
tip width
distance between finger faces, measured at the tip of the finger

4 Symbols

b	width of cross-section, in millimetres
b_t	tip width, in millimetres
f_m	finger-joint bending strength, in megapascals
$f_{m,k}$	finger-joint characteristic bending strength, in megapascals
$f_{m,15}$	5^{th} percentile finger-joint bending strength of last 15 specimens tested, in megapascals
$f_{m,dc,k}$	finger-joint bending strength declared by the manufacturer, in megapascals
$f_{m,target}$	target finger-joint bending strength to be met in compliance testing, in megapascals
f_t	finger-joint tension strength, in megapascals
$f_{t,k}$	finger-joint characteristic tension strength, in megapascals
$f_{t,15}$	5^{th} percentile finger-joint tension strength of last 15 specimens tested, in megapascals

$f_{t,dc,k}$ finger-joint tension strength declared by the manufacturer, in megapascals

$f_{t,target}$ target finger-joint tension strength to be met in compliance testing, in megapascals

h depth of cross-section, in millimetres

k_{15} statistical factor, see 7.1.4

l finger length, in millimetres

l_t tip gap, in millimetres

m mean value

p pitch, in millimetres

s standard deviation

5 Requirements

5.1 General

The cutting and the bonding operations of finger joints shall result in reliable and durable bonds of the required strength.

These general requirements shall be considered satisfied if both the requirements in this clause and the minimum production requirements in clause 6 are fulfilled.

5.2 Timber

5.2.1 Species

Sufficient information on the timber species shall be available to enable the timber to be satisfactorily bonded.

5.2.2 Growth and processing characteristics

The incidence of growth and processing characteristics such as knots, fissures, grain disturbance, wane and damage in the timber shall not exceed the limits described in the work's quality manual.

5.3 Adhesives

The adhesive shall enable joints of such strength and durability to be produced such that the integrity of the bond is maintained throughout the intended lifetime of the structure.

For structures in service class 3, the adhesive used shall be of type I and shall meet the requirements for this type given in EN 301. For structures in service class 1 or 2, an adhesive of type II in accordance with EN 301 can be used, provided the temperature of the member in the structure remains below 50 °C.

NOTE 1 The adhesive should be chosen considering the climatic conditions in service, the timber species, the preservative used (if any) and the production methods.

NOTE 2 Such strength and durability can be achieved by a polycondensation adhesive of the phenolic or aminoplastic type as defined in EN 301.

5.4 Characteristic strength

5.4.1 General

The characteristic strength in bending or tension shall be determined by type testing in accordance with clause 8. The method of compliance testing (bending or tension) shall be at the discretion of the manufacturer.

5.4.2 Characteristic strength in bending

Where bend testing is used for compliance testing, the characteristic bending strength of the finger joints, $f_{m,k}$, shall be determined by type testing and statistical analysis as described in 8.5. The declared characteristic bending strength shall meet the requirement:

$$f_{m,dc,k} \leqslant f_{m,k}$$

A manufacturer may declare a characteristic bending strength lower than $f_{m,k}$.

5.4.3 Characteristic strength in tension

Where tension testing is used for compliance testing, the characteristic tension strength of the finger joints, $f_{t,k}$, shall be determined by type testing and statistical analysis as described in 8.5. The declared characteristic tension strength shall meet the requirement:

$$f_{t,dc,k} \leqslant f_{t,k}$$

A manufacturer may declare a characteristic tension strength lower than $f_{t,k}$..

6 Manufacturing requirements

6.1 Production conditions

The premises shall meet the requirements of air temperature and relative humidity to ensure a satisfactory production environment. Necessary machinery and equipment for the production process shall be available.

6.2 Timber

The moisture content shall be measured either by the oven-drying method or by the use of a regularly calibrated moisture meter.

At assembly, the timber at the joint shall have a moisture content and temperature within the range specified by the adhesive manufacturer.

6.3 Adhesive application

The application method shall ensure that all finger surfaces in the assembled joint are covered with the adhesive.

NOTE This requirement may be assumed to be met if the adhesive is squeezed-out on all four surfaces of the joint when the end pressure is applied.

6.4 Assembly and end pressure

6.4.1 Assembly

Joints shall be bonded as soon as possible, and not later than 24 h, after cutting. Between cutting and assembly, care shall be taken to keep the cut surfaces of the fingers clean. The members shall not be stored in conditions likely to lead to distortion.

The advice of the adhesive manufacturers shall be sought and observed with respect to the following:

a) mixing;

b) use of fillers;

c) preheating of the timber (by high frequency, infrared or other methods);

d) application;

e) open and closed assembly times;

f) curing;

g) temperature of the air and the timber before and during curing.

6.4.2 End pressure

The application of end pressure shall be adequate to enable the jointed timber to be moved with reasonable care to the curing stage prior to any subsequent machining. Initial curing of the adhesive shall be completed before further processing, unless it is proved that the finger joints will have sufficient and reliable strength to allow this.

6.5 Preservative and fire retardant treatment

The advice of the preservative and adhesive manufacturer shall be sought and followed with regard to the compatibility of any proposed treatment.

7 Quality control

7.1 Factory production control

7.1.1 General

To ensure that the produced finger joints conform to this International Standard, the manufacturer shall establish and maintain documented internal factory production control.

The documented factory production control shall be efficiently implemented by means of procedures and instructions.

If all finger joints are proof-loaded according to a harmonized technical specification, then the sampling and testing may be omitted.

7.1.2 Sampling of finger joints

7.1.2.1 A representative sample of finger joints shall be drawn at random from each work shift and each production line.

7.1.2.2 At least three sample joints shall be taken for testing from the production of each shift, as far as possible evenly distributed in time and timber sizes over the shift. At least one specimen shall be drawn from each production batch.

7.1.2.3 The specimens shall contain a finger joint at mid-length.

7.1.3 Compliance testing of finger joints

7.1.3.1 Where possible, the whole jointed cross-section shall be tested. However, test specimens not covering the full cross-section of the jointed timber may be used provided that two specimens, each covering at least one-third of the cross-section, are tested. In bend tests, these specimens shall include the edges of the original cross-section and these edges shall be on the tension side of the specimen in the bending test. Only the lower test result shall be considered.

7.1.3.2 Compliance testing of finger joints shall be conducted at the same time after manufacture as used to determine the characteristic strength during type testing.

As far as is practicable, the moisture condition of the timber at the time of manufacture shall be maintained. The surface finish of the specimens at test shall be the same as that of the jointed timber normally supplied by the manufacturer.

NOTE After manufacture, adhesives continue to gain strength with time. Ideally, type and compliance testing should be undertaken following similar curing times.