

Laminated and finger jointed timber blanks and semi-finished profiles for non- structural uses

Part 2: Production control

ICS 79.080

National foreword

This Draft for Development is the UK implementation of CEN/TS 13307-2:2009.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature. It should be applied on this provisional basis, so that information and experience of its practical application can be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the international organization responsible for its conversion to an international standard. A review of this publication will be initiated not later than 3 years after its publication by the international organization so that a decision can be taken on its status. Notification of the start of the review period will be made in an announcement in the appropriate issue of Update Standards.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into an international Standard, to extend the life of the Technical Specification or to withdraw it. Comments should be sent to the Secretary of the responsible BSI Technical Committee at British Standards House, 389 Chiswick High Road, London W4 4AL.

The UK participation in its preparation was entrusted to Technical Committee B/543, Round and sawn timber.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This Draft for Development was published under the authority of the Standards Policy and Strategy Committee on 31 March 2010

© BSI 2010

ISBN 978 0 580 67152 4

Amendments/corrigenda issued since publication

| Date | Comments |
|------|----------|
| | |
| | |
| | |
| | |
| | |

TECHNICAL SPECIFICATION
SPÉCIFICATION TECHNIQUE
TECHNISCHE SPEZIFIKATION

CEN/TS 13307-2

December 2009

ICS 79.080

English Version

**Laminated and finger jointed timber blanks and semi-finished
profiles for non-structural uses - Part 2: Production control**

Ebauches et profilés semi-finis en bois lamellé-collés et
assemblés par enture multiples pour usages non
structuraux - Partie 2: Contrôle de production

Holzkanteln und Halbfertigprofile für nicht tragende
Anwendungen - Teil 2: Produktionskontrolle

This Technical Specification (CEN/TS) was approved by CEN on 1 September 2009 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

| | |
|---|----|
| Foreword..... | 4 |
| Introduction | 5 |
| 1 Scope | 6 |
| 2 Normative references | 6 |
| 3 Terms and definitions | 6 |
| 4 Material requirements | 7 |
| 4.1 Timber | 7 |
| 4.1.1 General..... | 7 |
| 4.1.2 Moisture content..... | 7 |
| 4.2 Adhesive..... | 8 |
| 5 Manufacturing | 8 |
| 6 Sampling and testing | 8 |
| 6.1 General..... | 8 |
| 6.2 Initial type testing | 9 |
| 6.3 Factory production control tests | 9 |
| 6.3.1 Sampling..... | 9 |
| 7 Testing requirements | 10 |
| 7.1 Conditioning chambers..... | 10 |
| Air conditioning chamber requirements | 11 |
| Climate classification | 11 |
| Air temperature and Relative Humidity conditions | 11 |
| 7.2 Water tank..... | 11 |
| 7.3 Loading machine | 11 |
| 7.4 Ancillary equipment | 12 |
| 8 Sampling conditioning | 12 |
| 8.1 Sequences | 12 |
| 8.2 Pre-conditioning | 12 |
| 8.3 Conditioning sequences | 13 |
| 8.3.1 Service Class 1..... | 13 |
| 8.3.2 Service Class 2..... | 13 |
| 8.3.3 Service Class 3..... | 13 |
| 9 Lamella glue line assessment | 13 |
| 9.1 Moisture resistance | 13 |
| 9.1.1 Conditioning requirements..... | 13 |
| 9.1.2 Delamination | 13 |
| 9.2 Shear assessment | 14 |
| 9.3 Chisel/wedge assessment (FPC only) | 14 |
| 9.4 Penetration test (FPC only)..... | 14 |
| 9.5 Calculation of results | 14 |
| 10 Finger joint assessment..... | 14 |
| 10.1 Bending..... | 14 |
| 10.2 Water tightness assessment (Service Class 3) | 15 |
| 10.3 Iodine test..... | 15 |
| 10.4 Penetration test (coloured water test) | 16 |
| 10.5 Calculation of results | 16 |

| | | |
|---|---|----|
| 11 | Requirements | 16 |
| 11.1 | General | 16 |
| 11.2 | Laminate glue line | 16 |
| 11.2.1 | Moisture resistance | 16 |
| 11.2.2 | Chisel test | 17 |
| 11.2.3 | Penetration test | 17 |
| 11.3 | Finger joints | 17 |
| 11.3.1 | Bending | 17 |
| 11.3.2 | Bending (Service Class 3) | 17 |
| 11.4 | Water tightness | 17 |
| 11.5 | Penetration test (Coloured Water test) | 17 |
| 12 | Records | 18 |
| Annex A (informative) Classification of adhesives | | 19 |
| Annex B (informative) Manufacturing recommendations | | 20 |
| B.1 | Premises | 20 |
| B.2 | Storage | 20 |
| B.2.1 | Timber | 20 |
| B.2.2 | Adhesive | 20 |
| B.2.3 | Finished products | 20 |
| B.3 | Equipment | 20 |
| B.4 | Tolerance | 20 |
| B.5 | Moisture content | 21 |
| Annex C (informative) Calculation of results for laminated profiles | | 22 |
| C.1 | Calculation of de-lamination quality of the glue line | 22 |
| C.2 | Calculation of the shear strength of the glue line | 22 |
| Annex D (informative) Calculation of results for finger joints | | 24 |
| D.1 | Calculation of finger joints strength under bending | 24 |
| D.2 | Calculation of strength ratio under bending for moisture resistance | 25 |

Foreword

This document (CEN/TS 13307-2:2009) has been prepared by Technical Committee CEN/TC 175 "Round and sawn timber", the secretariat of which is held by AFNOR.

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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The production requirements and control described in this Technical Specification are designed so as to obtain a reliable and durable bond between the lamellae, in order that the bonds in the glued laminated blanks will maintain their integrity throughout their intended service life. Such blanks are not intended to be used as load-bearing members.

1 Scope

This Technical Specification specifies the method of control and tests for glue bond performance of lamination and finger jointing processes employed in the production of timber blanks and semi-finished profiles (products) for joinery applications.

The methods of control are set out to ensure the durability of the glue line according to the service class.

The specific requirements for dimensions, stability and moisture content are given in EN 13307-1.

2 Normative references

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

EN 204, *Classification of thermoplastic wood adhesives for non-structural applications*

EN 301, *Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements*

EN 392, *Glued laminated timber — Shear test of glue lines*

EN 408, *Timber structures — Structural timber and glued laminated timber — Determination of some physical and mechanical properties*

EN 12765, *Classification of thermosetting wood adhesives for non-structural applications*

EN 13183-1, *Moisture content of a piece of sawn timber — Part 1: Determination by oven dry method*

EN 13183-2, *Moisture content of a piece of sawn timber — Part 2: Estimation by electrical resistance method*

EN 13183-3, *Moisture content of a piece of sawn timber — Part 3: Estimation by capacitance method*

EN 13307-1, *Timber blanks and semi-finished profiles for non-structural uses — Part 1 : Requirements*

EN 13354, *Solid wood panels (SWP) — Bonding quality — Test method*

EN 14220, *Timber and wood-based materials in external windows, external door leaves and external doorframes — Requirements and specifications*

EN 14221, *Timber and wood-based materials in internal windows, internal door leaves and internal doorframes — Requirements and specifications*

EN 14257, *Adhesives — Wood adhesives — Determination of tensile strength of lap joints at elevated temperature (WATT '91)*

EN 14298, *Sawn timber — Assessment of drying quality*

3 Terms and definitions

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

3.1

adhesive failure

failure of the glue bond, where an adhesive film, free of wood particles, may be detected on the opposing sheared wood surfaces

3.2

wood failure

failure of the glue line which is not an adhesive failure, where wood fibres remain firmly adhered to opposing surfaces of the sheared glue line

3.3

wood failure percentage

percentage of the wood failure area in relation to the total sheared area

3.4

service classes 1, 2 and 3

classification system which indicates the average equilibrium moisture content of wood in service, described in EN 13307-1

3.5

batch

profiles with same lay-up prepared within the same time period in same production line

3.6

profile type

profile defined by:

- a) the wood species or combination of wood species;
- b) the glue;
- c) the intended service class;
- d) the type of connection between the timber elements including the profile, laminating, edge-jointing and end-jointing and the cross section of the lamella;
- e) profile shape

3.7

thermoplastic adhesive

adhesive capable of being softened by heat and hardened by cooling

NOTE "Hardened" as opposed to "chemically cured".

3.8

thermosetting adhesive

cross-linked adhesive which has undergone a chemical reaction by the action of e.g. heat, catalysts, ultraviolet light, etc., leading to a relatively infusible state

4 Material requirements

4.1 Timber

4.1.1 General

All the requirements for timber are given in EN 13307-1.

4.1.2 Moisture content

Timber shall be dried to a moisture content level appropriate to adhesive being used and end use application.

Guidance on the moisture content of the timber in the completed components is given in Table 1 for the particular end uses described.

Table 1 — Typical moisture content levels of timber in particular end uses

| Service classes | Expected average moisture content in service ^a | Examples of end use products | Applicable product standards |
|---|---|--|------------------------------|
| 1 | Up to about 12 % | Internal doors and windows | EN 14221 |
| 2 | Up to about 18 % | Products sheltered from rain (External doors, windows) | EN 14220 |
| 3 | Above 18 % ^b | External doors or windows | EN 14220 |
| ^a Moisture content known to occur in service under conditions of constant relative humidity and temperature. ^b At least some weeks yearly. | | | |

The same requirements apply to wood intended for finger jointing of the lamellae. Moisture content measurements made with calibrated resistance moisture meters are considered satisfactory.

The moisture content of any piece or parcel shall be estimated using the method described in EN 13183-2 or EN 13183-3. In the case of a dispute the method to be used shall be the method described in EN 13183-1 (this method is a destructive method).

The method of measuring average moisture content is given in EN 14298.

NOTE See Annex B for practical application recommendations.

4.2 Adhesive

The selected adhesive shall be capable of producing strong and durable joints so that the integrity of the bond is maintained throughout the life of the product. The minimum adhesive requirements for each of the service classes for adhesives are given in Annex A.

5 Manufacturing

The manufacturing process is critical for the production of laminated and finger jointed products. Manufacturing recommendations are provided in Annex B.

6 Sampling and testing

6.1 General

In order to ensure the integrity of the glue line of glued laminated and/or finger jointed blanks a representative sample of the product shall be tested during production (FPC). The number of samples to be selected is related to the type of test.

6.2 Initial type testing

The tests, size of test pieces and sample size required at the ITT stage are set out in Table 2. Test pieces shall be taken at least 50 mm from the end of a sampled profile. The sampling requirements are per profile type.

Table 2 — ITT sampling requirements for laminated glue line and finger tests

| ITT Sampling | | |
|--|--|---|
| Laminated profile | | |
| Test | Size of test piece | Sample size |
| Moisture resistance (Delamination and shear strength tests) (see 9.1.2 and 9.2) | Length – (50 ± 1) mm; Width – width of profile but ≤ 50 mm; Thickness – overall of laminated profile. | 60 samples by selecting 30 gluelines from at least 15 profiles, on each glue line two test pieces are cut to make two test batches. |
| | If the width of the profile exceeds 50 mm, the glue line test pieces shall be cut at random along the width of the profile (or length of the glue line along the cross section). | |
| Finger Joints | | |
| Test | Size of test piece | Sample size ^a |
| Bending (see 10.1) | Length – 15 x thickness; Width – width of profile but ≤ 100 mm; Thickness – overall of piece. | 30 samples with a finger joint and 30 without. |
| Moisture resistance (bending); (only for Service Class 3) | Thickness – 5 mm to 6 mm. ^b | 30 finger joints sampled with two test pieces created at each finger joint (one for each face). |
| Watertightness (only for Service Class 3) (see 10.2) | Length – 10 x length of fingers; Width – width of profile; Thickness – actual but ≤ 25 mm. ^c | 15 samples with a finger joint. |
| ^a The finger joint shall be in the centre of the length of the sample. Profiles without finger joints shall be defect free. ^b Thicker lamellas may be used provided the lamellas are fully wetted at the end of the immersion period. ^c Any extra thickness being sawn or planed from one face. | | |

Finger joint testing is only necessary where the finger jointed lamella(s) are to be visible on the weather exposed faces of the profiles and/or are more than 80 % of the total thickness of the profile.

Where a laminated profile includes laminates with finger joints those finger jointed lamellas shall be sampled and tested before assembly into the laminated profile.

6.3 Factory production control tests

6.3.1 Sampling

The tests, size of test pieces and sample size required during Factory Production Control (FPC) are set out in Table 3.

The number of profiles to be sampled, per property to be tested shall be related to the size of the production but shall be at least two profiles per type and per production shift.

For each test method, the length of the profile shall be consistent across all test pieces specified for a glue line.

Table 3 — FPC sampling requirements for laminated glue lines and finger joints tests

| FPC Sampling | | |
|--|---|---|
| Laminated profile | | |
| Test | Size of test piece | Sample size |
| Chisel test (see 9.3) ^a | Length – (50 ± 1) mm; Width – width of profile; Thickness – overall of laminated profile. | Two test pieces per profile type. |
| Penetration test ^a | Length – (50 ± 1) mm; Width – width of profile; Thickness – overall of laminated profile. | Two or more adjacent test pieces cut 150 mm from the end of the selected profile. |
| Moisture resistance in relation to the service class (8.3) (Delamination and shear strength tests) | Length – (50 ± 1) mm; Width – width of profile type but ≤ 50 mm; ^b Thickness – overall of laminated profile. | Two test pieces per profile type. |
| | | |
| Finger Joints | | |
| Test | Size of test piece | Sample size |
| Bending Alternative: three-point bending | Length – 15 x thickness; Width – width of profile but ≤ 100 mm; Thickness – overall of piece. | At least one per profile type, up to 30. |
| Tension | Not necessary | Not necessary |
| Iodine test | Width – width of profile; Thickness – actual. | In beginning of shift. ^c |
| Penetration test (Coloured Water test) ^a | Length – 150 mm; Width – Width of profile; Thickness – actual. | In beginning of shift. ^c |

^a Alternative testing procedures according to the manufacturer's preference.

^b If the width of the profile exceeds 50 mm, the glue line test pieces shall be cut at random along the width of the profile (or length of the glue line along the cross section).

^c The tightness of the finger joints shall be checked regularly during the production process, at least on five finger joints at the beginning of the production shift and in case of changing settings of the machinery.

7 Testing requirements

7.1 Conditioning chambers

Air conditioning equipment capable of achieving and maintaining the various climatic conditions given in Table 4.

Table 4 — Air conditioning chamber requirements

| Air conditioning chamber requirements | | |
|---------------------------------------|---|-------------------|
| Climate classification | Air temperature and Relative Humidity conditions | |
| | Air temperature | Relative Humidity |
| Reference climate | $(20 \pm 2) ^\circ\text{C}$ | $(65 \pm 5) \%$ |
| Dry standard climate | $(23 \pm 2) ^\circ\text{C}$ | $(50 \pm 5) \%$ |
| Humid climate | $(23 \pm 2) ^\circ\text{C}$ | $(85 \pm 5) \%$ |
| Dry climate | $(23 \pm 2) ^\circ\text{C}$ | $(30 \pm 5) \%$ |
| Hot climate | A ventilated chamber with air at $(50 \pm 2) ^\circ\text{C}$. The rate of ventilation is (25 ± 5) times per hour. | |

7.2 Water tank

For Service Class 2: Water container shall be of sufficient size to take one or more of the test samples with heating element capable of providing a variable, controlled water temperature of $(20 \pm 1) ^\circ\text{C}$ and further heating its content from $20 ^\circ\text{C}$ to $(60 \pm 2) ^\circ\text{C}$ within one hour and keeping it at this temperature.

For Service Class 3: The water container shall maintain a temperature of $(20 \pm 5) ^\circ\text{C}$.

The tank shall be able to hold sufficient water to cover the test pieces.

7.3 Loading machine

The loading machine shall comprise a loading head and suitable attachments able to carry out the following functions.

- The velocity and load accuracy of the loading head shall be capable of giving consistent results.

NOTE A velocity of the loading head capable of reaching the maximum load on a test piece in (60 ± 30) s and capable of an accuracy of 1 % on the applied loads is assumed to be suitable.

- Carry out a bending test using two pairs of rollers of 30 mm diameter with a length exceeding the width of the test pieces. The span between the rollers shall be adjustable to six times the thickness of the test piece for the central pair of rollers and 18 times the thickness for outer rollers.
- If necessary it shall be capable of receiving attachments for the shear test. Suitable devices are defined in EN 392 or in EN 13354.
- If necessary it shall be capable of receiving a pair of grips fitted to the loading head to enable the tension test to be carried out.

For Factory Production Control purposes test results from simple machines or test processes are acceptable if correlated to the ITT test results.

7.4 Ancillary equipment

The following ancillary equipment is also required:

- a) Tape measure accurate to 1 mm;
- b) Callipers or gauge accurate to 1/10 mm;
- c) Scales accurate to 0,1 g;
- d) A feeler gauge of 0,2 mm x 10 mm in width and at least 65 mm in length.

Additional equipment to be used during FPC:

- e) Either a 50 mm steel chisel or steel wedge;
- f) A hammer or mallet;
- g) Iodine solution in mixture ratio 1:30.

Penetration fluid: Water/alcohol mixture at a ratio of 1:1 with one drop of detergent per 100 ml and suitable colouring agent which will provide a strong contrast to the colour of the glueline and the wood (e.g. a suitable colouring agent would be E122).

Brush: Approximately 20 mm wide paint brush (alternatively a pipette may be used).

8 Sampling conditioning

8.1 Sequences

The intended Service Class determines the conditioning sequence. The conditioning requirements and sequences given in Table 4 and in 8.2 and 8.3 are compulsory for Initial Type Testing. Specific conditioning requirements are not given for Factory Production Control testing.

Conditioning shall be included in the FPC procedures and shall be as near as possible to the conditions given for ITT or relevant to provide correlated results.

Unused test pieces and reference pieces shall be stored in the standard climate until required.

NOTE If it is necessary to transfer samples under test between chambers this operation should be carried out within (5 ± 1) min.

8.2 Pre-conditioning

All test pieces (including reference samples) shall be fully cured in accordance with the adhesive manufacturer's instructions and conditioned for at least three days in the reference climate.

Prior to carrying out the selected test sequence the width of each lamella glue line shall be measured to the nearest 0,1 mm and the length to the nearest 1 mm.

8.3 Conditioning sequences

8.3.1 Service Class 1

- a) Dry in the hot climate for 16 h;
- b) Cool in the reference climate for 1 h to 2 h.

8.3.2 Service Class 2

- a) Immerse in water at 20 °C for (180 ± 10) min;
- b) Raise the water temperature to (60 ± 2) °C within 1 h;
- c) Maintain the water temperature for (180 ± 10) min;
- d) Reduce the water temperature to 20 °C within 1 h;
- e) Maintain water temperature at 20 °C for $(16 \pm 0,25)$ h;
- f) Remove test pieces from the water and maintain at dry standard climate for 72 h.

8.3.3 Service Class 3

8.3.3.1 General test

- a) Immersion in water at 20 °C for $(16 \pm 0,5)$ h;
- b) Dry in the hot climate for $(24 \pm 1,5)$ h;
- c) Cool in the reference climate for 1 h to 2 h.

For test pieces thicker than 5 mm, for the control of finger joints to moisture, the duration shall be increased to ensure full wetting/drying is achieved.

8.3.3.2 Finger joint test for water tightness

- a) Stored in the humid climate for seven days; and then
- b) Stored in the dry climate for seven days.

9 Lamella glue line assessment

9.1 Moisture resistance

9.1.1 Conditioning requirements

Only one batch of samples is tested following one of the sequences given in 8.3 according to the intended service class.

9.1.2 Delamination

This assessment is carried out on the batch subjected to the selected test sequence. To determine the length of open joint, not the depth, the 0,2 mm feeler gauge is applied against the glue line of the cross sections of the pre-treated test piece and held at 65 mm from its free tip. If penetration exceeds 1 mm without buckling,

the joint is deemed open and its length is measured to the nearest mm. The length of open joint is the sum of all the open joints at both ends of the sample.

9.2 Shear assessment

This assessment is carried out on both test batches but is only necessary if the first sample batch fails the delamination test (see 11.2). The load is applied to each specimen using equipment as described in 7.3 until failure occurs. The failure load is recorded for each piece.

9.3 Chisel/wedge assessment (FPC only)

This assessment is only used as a tool on the production line and is carried out on un-conditioned samples.

The chisel or wedge is applied on the glue line (once grooved in case of wedge) and is struck with a hammer or mallet so as to split the lamination test piece.

Adhesion is evaluated as the ratio of fibres upon the area of the glue line.

NOTE The chisel/wedge assessment is carried out before the delamination assessment (see 9.1.2). If this assessment fails, the lot cannot be accepted. If it passes, a delamination assessment is necessary.

9.4 Penetration test (FPC only)

50 % of the test pieces shall be placed with a parallel glue line facing upwards. The penetration fluid shall be carefully applied to the glue line in copious amounts either by the brush or pipette. The process shall be repeated on the opposite face. Care shall be taken to ensure that the coloured water does not touch the end grain of the test pieces.

After 15 min, any penetration fluid remaining on the glue lines' surface shall be absorbed with a paper towel.

Each test piece shall be clearly marked to identify the sample from which it is taken.

The test pieces are then split at each glue line. The glue line in every test piece is split from the cross-cut end using the chisel described in 7.4 above.

NOTE The penetration test is carried out before the delamination assessment (see 9.1.2). If this assessment fails, the lot cannot be accepted. If it passes, a delamination assessment is necessary.

9.5 Calculation of results

The method of calculation of results is given in Annex C.

10 Finger joint assessment

10.1 Bending

The purpose of this assessment is to evaluate the strength of finger joint pieces compared to solid wood pieces. This assessment is carried out on pieces with and without finger-joints which have not been subject to the test sequences in 8.3.

NOTE It may not be necessary to test any or all of the solid wood samples if the strength of the wood is known.

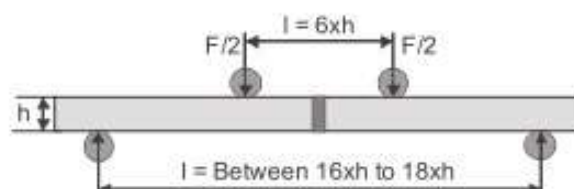
Prior to assessment, the width and thickness of the piece at the mid point shall be measured to the nearest 0,1 mm.

The pieces shall be placed on the rollers of the test equipment such that the rollers of the upper part shall be not closer to the lower rollers than by six times the thickness (or depth) of the test piece, measured to the nearest 1 mm.

The pieces with finger joints shall be positioned so that the joint is in the central span. Fingers shall be visible on the upper face.

Load shall be applied until failure occurs and the maximum load recorded for each piece.

Bending test results obtained using the test procedure in EN 408 may be used (see Figure 1).



Key

h thickness (or depth)

l top value for the span between the mid rollers and bottom values span between the end rollers

F cumulated load

Figure 1 — Bending test

As alternative three-point bending as factory production control is possible.

10.2 Water tightness assessment (Service Class 3)

The purpose of this assessment is to determine the water tightness of the finger joint. The surface of the joint shall be lightly planed to remove any excess adhesive and to expose the outline of the fingers. A box shall be formed (for example with plywood) around the sample so as to create a chamber, which can hold a minimum of 60 mm of water above the planed surface. The internal joint between the sample and the box shall be sealed to reduce leakage around the sample.

The boxed assessment pieces are put horizontally on an open grid.

The "tanks" are filled with cold water to a depth of (60 ± 1) mm and the test pieces left for (60 ± 1) min. At the end of the assessment period the underside of the test pieces are checked for any signs of leakage through the finger joints. Any leaks are recorded including identifying the location.

Leaks occurring through other areas of the samples shall be ignored.

This procedure is carried out on all the test pieces.

10.3 Iodine test

The finger joint has to be planed for testing with iodine solution. Solution is applied on planed surface, test piece is taken from production, according to the factory production control. Evaluation is done after 5 min time; a continuous coloured line denotes full glue presence.

Gaps and cracks are not allowed. Magnifying glass may be used.

10.4 Penetration test (coloured water test)

The surface of the joint shall be lightly planed to remove any excess adhesive and to expose the outline of the fingers. The finger joint shall be painted with the solution according to 7.4 and the sample left for 15 min.

10.5 Calculation of results

The method of calculation of results is given in Annex D.

11 Requirements

11.1 General

The requirements defined here apply to profiles with fully cured glue-lines. If not so in the factory, correlations shall have to be established by FPC operators. See Annexes C and D for notation descriptions.

11.2 Laminate glue line

11.2.1 Moisture resistance

11.2.1.1 Delamination (for all Service Classes)

Bonding is satisfactory if:

$$D_{ml} \leq \left(\left(33 \times \frac{MV}{1\,000} \right) - 7 \right) \%$$

where

D_{ml} is the upper estimate of average delamination rate of the test pieces;

MV is the average volumic mass of the batch, in kilograms per cubic metre (kg/m³).

If not, a shear test may be carried out.

11.2.1.2 Shear test (for all Services Classes)

Bonding is satisfactory if:

- a) Variability (CVs) within the lot of fresh test pieces is $\leq 15 \%$;

NOTE If a shear test is used for FPC without reference pieces, an internal specification is recommended on the variability within the assessed pieces. The variability should not exceed 25 %.

- b) Residual strength fulfils the following requirement:

$$R_s \geq \left(114 - \left(66 \times \frac{MV}{1\,000} \right) \right) \%$$

If one of these conditions is not met then bonding is rejected and the production batch from which test samples have been taken is rejected.

11.2.2 Chisel test

Evaluation shall be by visual inspection of the area of wood failure of each piece. The area of wood failure shall be evaluated to within 10 %. The mean wood failure for each sample blank shall be above 90 % with no single glue line test piece below 75 %.

11.2.3 Penetration test

The area of wood failure is assessed as in 11.2.2 and the same requirements apply.

The glue line tightness shall be evaluated by observing the depth of penetration of the coloured penetrating fluid across the glue line. Failure shall be deemed to have occurred if the depth of the penetrating fluid is more than 1 mm at any point.

NOTE Local, isolated, visible penetration of the colouring agent solution into the glue line should be noted. It may be tolerated if it occurs in test pieces taken from the ends of the sampled blank. However, if a systematic tightness failure (5.4.1) is detected within the same sample and at the same glue line location, this indicates that the glue line tightness is not being achieved.

11.3 Finger joints

11.3.1 Bending

11.3.1.1 Bending for preconditioned test pieces

Bonding is satisfactory if the following three requirements are complied with:

- a) $R_b \leq 2$;
- b) $f_{m05} \geq 17 \text{ N/mm}^2$;
- c) The variability within the batch of test pieces is not greater than 20 % - Only failure occurring in the finger-joint is considered.

11.3.2 Bending (Service Class 3)

11.3.2.1 Bending for moisture resistance control of finger joints

Bonding is satisfactory if:

- a) Variability (CVt) within the unconditioned assessed pieces shall be $\leq 15 \%$; and
- b) Strength requirement $R_s \geq \left(114 - 66 \times \frac{MV}{1000} \right) \%$.

11.4 Water tightness

No leakage at the finger joint is allowed.

11.5 Penetration test (Coloured Water test)

The opposite surface shall be examined to ensure the coloured solution has not passed through. If there is no sign of the presence of the solution, the original surface shall be planed to reduce the thickness by 25 mm. If the coloured solution is observed at any point, the joint shall be deemed to have failed.

12 Records

The manufacturer shall keep a record of the tests carried out and the results against the batch identification.

NOTE It is recommended that these records be kept for a minimum of ten years.

Annex A (informative)

Classification of adhesives

Table A.1 — Classification of adhesives according to Service Classes and Use Classes

| Service Class | Use Class EN 335-1 | Wood moisture content and temperature while in service | Requirements |
|---------------|--------------------|---|---|
| 1 | 1 | Internal use. The average wood moisture content shall not exceed 12 %. | Class D2, EN 204; or Class C2, EN 12765. |
| | 1 | Internal use. The average wood moisture content shall not exceed 20 %. | Class D3, EN 204; or Class C3, EN 12765. |
| 2 | 2 | Surface temperatures may exceed 50 °C for only a few weeks a year. External, weather protected use. | |
| 3 | 3 | The average wood moisture content shall not exceed 20 %. Surface temperatures may exceed 50 °C for longer periods. External, weather protected use. | Class D4, EN 204; or Class C4, EN 12765. Minimum shear strength of 7 N/mm ² after testing to EN 14257. |
| | 4 | Climatic conditions leading to higher average moisture contents than in Use Class 3. Only in exceptional cases would weather protected blanks be considered to belong to Use Class 4. Surface temperatures may exceed 50 °C for longer periods. External, unprotected use. | Type I, EN 301; Type I, EN 15425. |

B.5 Moisture content

Recommended maximum moisture content differential between adjacent lamellae is 4 %. It can also be agreed upon between partners. Moisture content in every lamella shall also be in the range identified by the adhesive manufacturer.

NOTE 1 It is important that the moisture content differential between adjacent lamellae should be kept as small as possible. But recognising the accuracy of presently available moisture content measurement equipment the recommendation given above, which to ensure satisfactory performance of products in service should not be exceeded, provides for realistic manufacturing processes and procedures and as such should be possible to achieve.

NOTE 2 Between any two adjacent lamellae in the same profile percentage moisture content should not differ by more than ± 2 % for 95 % confidence level.

Annex C (informative)

Calculation of results for laminated profiles

C.1 Calculation of de-lamination quality of the glue line

The de-lamination rate of the i^{th} test piece D_i is given by:

$$D_i = 100 \times \frac{\sum J_{0i}}{\sum J_i}$$

where

$\sum J_{0i}$ is the cumulated length of open joints on the two cross sections of the i^{th} test piece;

$\sum J_i$ is the cumulated length of glue lines on the two cross sections of the i^{th} test piece.

For the set of test pieces, the upper estimate of the average de-lamination rate is calculated according to:

$$D_{ml} = D_m + k \times S_D$$

where

D_{ml} is the upper estimate of the average;

D_m is the average delamination rate of the test pieces;

S_D is the standard deviation;

k equals to 0,310 for 30 test pieces (ITT) and to 0,580 for 10 test pieces (FPC).

C.2 Calculation of the shear strength of the glue line

The strength of the glue line is calculated according to:

$$f_{si} = \frac{F_i}{l_i \times b_i}$$

where

f_{si} is the strength of the i^{th} test piece, in Newtons per square millimetre (N/mm²);

F_i is the maximum load of the i^{th} test piece, in Newtons (N);

l_i is the length of the glue line of the i^{th} test piece, in millimetres (mm);

b_i is the width of the glue line of the i^{th} test piece, in millimetres (mm).

The two sets of the test pieces and the reference ones are assessed.

For each set, the following values are calculated:

- a) mean value of the strength m ;
- b) coefficient of variation of the strength ($CV_s = 100 \times \frac{s}{m}$)

where

s is the standard deviation;

m is the mean value of the set.

A comparison is made between the two sets of results.

The ratio is R_s and calculated as follows:

$$R_s = \frac{m_p}{m_r}$$

where

m_p is the average strength of the set of the test pieces;

m_r is the average strength of the set of reference pieces.

Annex D (informative)

Calculation of results for finger joints

D.1 Calculation of finger joints strength under bending

a) The strength of each (the i^{th}) test piece is calculated according to:

$$f_{mi} = \frac{F_i \times L_i}{b_i \times t_i^2}$$

where

- f_m is the strength, in Newtons per square millimetre (N/mm²);
- F is the maximum load, in Newtons (N);
- L is the span between the roller (18 times the depth), in millimetres (mm);
- b is the width of the cross section of the test piece, in millimetres (mm);
- t is the thickness or depth of the test piece, in millimetres (mm);
- i is the index for the i^{th} test piece.

NOTE This formula is valid only with the set up of the rollers defined in 7.3 and 10.1.

b) Finger-jointed batch

For an ITT sample of 30 test pieces, the following parameters shall be calculated for the finger-jointed batch:

- 1) mean value;
- 2) standard deviation and coefficient of variation CVb;
- 3) fifth percentile value according to:

$$f_{m05} = \overline{f_m} - 1,70 \times S_{fm}$$

where

- f_{m05} is the fifth percentile value of strength, in Newtons per square millimetre (N/mm²);
- $\overline{f_m}$ is the mean value of strength, in Newtons per square millimetre (N/mm²);
- S_{fm} is the standard deviation, in Newtons per square millimetre (N/mm²).

NOTE A normal distribution is assumed.

- c) Non-finger-jointed batch. For an ITT sample of 30 test pieces, the following parameters shall be calculated for non-finger-jointed batch:
- 1) mean value f_{mr} ;
 - 2) standard deviation;
 - 3) coefficient of variation.
- d) Ratio of mean values

The following ratio between the two batches is calculated as follows:

$$Rb = \frac{f_{av}}{f_w}$$

D.2 Calculation of strength ratio under bending for moisture resistance

For each test piece, the strength is calculated according to:

$$f_s = \frac{F_i}{b_i \cdot t_i}$$

where

- f_i is the tension strength, in Newtons per square millimetre (N/mm²);
- F_i is the maximum load applied on each (the i) test piece, in Newtons (N);
- b_i and t_i are the cross section dimensions of the test piece, in millimetres (mm).

For each batch of test pieces, the following parameters shall be calculated:

- a) mean value m_p of the test pieces and m_r of reference ones, in Newtons per square millimetre (N/mm²);
- b) coefficient of variation CV_i , in percent (%);
- c) the ratio $R_i = \frac{m_p}{m_r}$.

BSI - British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000, Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001 Email: orders@bsigroup.com You may also buy directly using a debit/credit card from the BSI Shop on the Website <http://www.bsigroup.com/shop>

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact Information Centre. Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048 Email: info@bsigroup.com

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001 Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsigroup.com/BSOL>

Further information about BSI is available on the BSI website at <http://www.bsigroup.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright and Licensing Manager. Tel: +44 (0)20 8996 7070 Email: copyright@bsigroup.com