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Timber structures — Bending applications of I-beams —

Part 2: Component performance and manufacturing requirements

Structures en bois — Résistance à la flexion des poutres en I —

Partie 2: Performances des composants et exigences de production

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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 2.

The main task of technical committees is to prepare International Standards. 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.

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

ISO 22389-2 was prepared by Technical Committee ISO/TC 165, *Timber structures*.

ISO 22389 consists of the following parts, under the general title *Timber structures — Bending applications of I-beams*:

— *Part 1: Testing, evaluation and characterization*

— *Part 2: Component performance and manufacturing requirements*

This part of ISO 22389 is based, with permission of ASTM International, on ASTM D5055, *Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists*, copyright ASTM International.

Introduction

Prefabricated wood-based I-beams are being produced in many different countries under different national standards and these products are being exported from one country to another. While the national standards have many similarities there are also many areas of dissimilarity. Thus, there is a need for the development of an International Standard to establish consistency between these national standards to ensure the suitability of prefabricated wood-based I-beams for end use applications, regardless of country of manufacture or country of end use. This part of ISO 22389 will be of benefit to industry, consumers, governments and distributors.

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Timber structures — Bending applications of I-beams —

Part 2: Component performance and manufacturing requirements

1 Scope

This part of ISO 22389 specifies the component performance and manufacturing requirements for prefabricated wood-based I-beams used as structural members in bending applications. It does not cover fire performance, formaldehyde requirements and biological durability.

This part of ISO 22389 gives requirements for manufacturing, in-house quality assurance and periodic reevaluation of prefabricated wood-based I-beams.

Wood-based I-beams tested according to this part of ISO 22389 are intended for use in covered conditions and utilize components that are able to resist the effects of moisture on structural performance due to construction delays or other conditions of similar severity, but not permanently exposed to the weather.

NOTE The service conditions are similar to “Service class 2” as defined in ISO 20152-1.

Testing, evaluation, and performance characterization requirements for prefabricated wood-based I-beams are covered in ISO 22389-1.

This part of ISO 22389 does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this part of ISO 22389 to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

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.

ISO 20152-1, *Timber structures — Bond performance of adhesives — Part 1: Basic requirements*

ISO 22389-1:2010, *Timber structures — Bending strength of I-beams — Part 1: Testing, evaluation and characterization*

EN 789, *Timber structures — Test methods — Determination of mechanical properties of wood based panels*

ASTM D5456, *Standard Specification for Evaluation of Structural Composite Lumber Products*

3 Terms and definitions

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

3.1
prefabricated wood-based I-beam
structural member manufactured using sawn or structural composite lumber flanges and structural panel webs, forming an “I” cross-sectional shape, bonded together with a structural wood adhesive that possesses the moisture resistance suitable for the conditions specified

[ISO 22389-1:2010, definition 3.1]

NOTE 1 These members are primarily used as joists in floor and roof construction.

NOTE 2 The service conditions are similar to “Service class 2” as defined in ISO 20152-1.

3.2
structural composite lumber
composite of wood elements bonded with a structural wood adhesive that possesses the moisture resistance suitable for the conditions specified and intended for structural use in dry service conditions

[ISO 22389-1:2010, definition 3.3]

NOTE 1 The service conditions are similar to “Service class 2” as defined in ISO 20152-1.

NOTE 2 Examples of wood elements include wood strands, strips, veneer sheets or a combination thereof.

4 Component requirements

4.1 Flange stock

All flange material shall conform to the requirements of national standards or governing codes. In addition, when the flange material is structural composite lumber, the following properties shall be determined in accordance with ASTM D5456 or EN 789: modulus of elasticity, tension parallel to grain, and compression parallel and perpendicular to grain. End joints in purchased flange stock are permitted provided the joints conform to the general requirements of this part of ISO 22389 and 5.8 of ISO 22389-1:2010.

4.2 Web material

Web materials shall conform to manufacturing or performance standards of wood-based panels recognized by the national standards or governing codes. Web materials covered by this part of ISO 22389 shall be able to resist the effects of moisture on structural performance due to construction delays or other conditions of similar severity.

NOTE The service conditions are similar to “Service class 2” as defined in ISO 20152-1.

4.3 Adhesives

Adhesives used to fabricate components as well as the finished products shall conform to ISO 20152-1 and the requirements specified by the national standards or governing codes.

5 Manufacturing requirements

5.1 General

Wood-based I-beams shall be manufactured with components and adhesives that support the properties of the I-beams that are evaluated in accordance with ISO 22389-1.

5.2 Dimensional tolerances

The tolerances permitted at the time of manufacture shall be as follows.

a) **Flange width**: +3,0 mm or −1,0 mm.

b) **Flange thickness**: −1,5 mm.

c) **I-beam depth**: +0 mm or −3,5 mm.

6 In-house quality assurance

6.1 Manufacturing standard

6.1.1 General

A manufacturing standard shall be written and maintained for each product and each production facility and shall be the basis for the quality assurance at that location. As a minimum, it shall include the following:

a) material specifications, including incoming material inspection and acceptance requirements, and specifications for regrading flange stock, when applicable;

b) process controls for each operation in the production of the product;

c) quality control, inspection and testing procedures, and frequencies;

d) finished product identification, handling, protection, and shipping requirements;

e) when applicable, the minimum permitted flange end joint spacing.

6.1.2 Inspection personnel

All in-house persons responsible for quality control shall demonstrate that they have adequate knowledge of the manufacturing process, of the inspection and test procedures used to control the process, of the operation and calibration of the recording and test equipment used, and of the maintenance and interpretation of quality control records.

6.1.3 Record keeping

All pertinent records shall be maintained on a current basis and be available for review. As a minimum, such records shall include:

a) all inspection reports and records of test equipment calibration,

b) all test data, including retests and data associated with rejected production, and

c) details of any corrective actions taken and the disposition of any rejected production, resulting from tests or inspections.

6.1.4 Testing equipment

Testing equipment is to be properly maintained, calibrated, and evaluated for accuracy and adequacy in accordance with a national standard or International Standard, at a frequency satisfactory to the authority.

6.2 I-beam quality control testing

6.2.1 Objectives

The following objectives are to be met simultaneously by the quality-control testing programme:

a) provide test data for use in maintaining and updating characteristic values, and

b) verify production process and material quality on a daily basis.

NOTE A characteristic value is a value of a property taken to represent the property of a designated population using a process of sampling, testing and evaluation. Characteristic values for strength and stiffness are described in and determined by the requirements of ISO 22389-1.

6.2.2 Initial quality control

When plant qualification is based on no more than the minimum testing required in this part of ISO 22389, the producer shall initiate higher daily test frequencies and retest levels.

NOTE All new producers are advised to intensify quality control in early production.

6.2.3 Required tests

The following shall be the scope of a minimum testing programme.

a) Test methods shall be identical to those specified in ISO 22389-1.

b) The shear strength test described in ISO 22389-1 shall be used for quality control of shear strength.

c) If flanges contain end joints qualified in accordance with ISO 22389-1, daily tension tests of full-section joints shall be conducted and failure loads recorded. The manufacturing standard shall include the characteristic joint spacing that will be maintained in production. Durability tests of such joints are required only at such frequency as required to verify adhesive performance in accordance with ISO 22389-1.

d) When flange material is qualified by test in accordance with A.1 b) or A.1 c) of ISO 22389-1:2010, the testing of that section shall be included in daily quality control tests. In all cases, quality assurance provisions shall be established to maintain qualification strength.

e) When moment capacity is determined empirically, the test detailed in 5.4.1 of ISO 22389-1:2010 shall be conducted as part of the daily quality-control programme. All depths produced shall be tested in this programme, and the tests shall include deflection measurement.

f) When the flange material does not have a modulus of elasticity assigned by the national standards or governing codes, stiffness measurement of the material shall be part of the quality-control programme.

6.2.4 Data collection and analysis

Test frequency, minimum test values, and rejection criteria for all tests shall be chosen to yield quality-control performance which is consistent with characteristic values assigned to the product and its intended use.

NOTE A characteristic value is a value of a property taken to represent the property of a designated population using a process of sampling, testing and evaluation. Characteristic values for strength and stiffness are described in and determined by the requirements of ISO 22389-1.

7 Qualification and quality assurance of I-beam components manufactured by others

7.1 Producer's responsibility

When the I-beam producer purchases material which would require qualification and quality control under the provisions of this part of ISO 22389, they shall be responsible for assuring that, as a minimum, such material conforms to the requirements of this part of ISO 22389.

7.2 Record keeping

The I-beam producer shall obtain and maintain records of certification from the outside producer that the components supplied conform to the requirements of this part of ISO 22389.

7.3 Identification

All such components shall be appropriately marked as agreed upon between the component and I-beam producers.

8 Periodic reevaluation of structural capacities

8.1 Reevaluation required

8.1.1 General

Each capacity monitored using the required tests of 6.2.3 shall be reevaluated on a periodic basis. As a minimum, reevaluation shall be accomplished at the end of the first six months of production by any new manufacturer and for any new product line, and thereafter each such capacity shall be reevaluated at the end of each successive year of production.

8.1.2 Reaction capacity reevaluation

A one-time reevaluation of reaction capacity shall be accomplished at the end of the first six months of production by any new manufacturer and for any new product line. The reevaluation is to be based on data from specimens selected randomly throughout the six-month period and tested when convenient. Tests are to be conducted in accordance with 5.3 of ISO 22389-1:2010.

8.1.3 Regraded solid sawn timber flanges

As a minimum, reevaluation shall be conducted every six months for regraded solid sawn timber flanges as described in A.1 of ISO 22389-1:2010. The testing shall be as specified in 6.2.3 d).

8.2 Minimum database in periodic evaluation

8.2.1 Shear and flange material tests

The minimum number of tests to be included in the analysis is that required for qualification in accordance with Clause 5 of ISO 22389-1:2010. When it becomes apparent that this requirement will not be met by the initial test frequency established, the frequency of testing shall be increased. Evaluation of test frequency shall be accomplished early in the evaluation period to ensure that test data is representative of production in the period and will be randomly accumulated at time intervals spaced throughout the period.

8.2.2 Empirical moment capacity tests

Reevaluation shall be conducted every three months and the minimum number of tests required is that used for qualifying in 5.4.3 of ISO 22389-1:2010. Test frequency in the period must be adjusted as necessary to ensure the minimum number of tests is met. If data on the full range of depths is not available, additional depths shall be selected and tested so that the data available is at least equal to that required in 5.4.3 of ISO 22389-1:2010. However, if the coefficient of determination (r^2) is at least 0,9, as described in 5.4.3.3 of ISO 22389-1:2010, the data for I-beams where the only change is depth may be combined, provided a minimum of 112 tests are conducted every 60 production days, in a period not exceeding six calendar months. Details of how suppliers are reevaluated shall be a part of the manufacturing standard.

8.3 Data analysis

8.3.1 Data requirements

Data to be included in the analysis is that developed in the latest evaluation period from the testing specified in 6.2.3. Test data which was cause for rejection of a production lot shall be excluded. Also, low test values related to any assignable and correctable cause which has been corrected shall be excluded from consideration. Analysis of the data shall be identical to that of the applicable clauses of ISO 22389-1.

8.3.2 Flange strength distributions

Flange strength data from the period, including joint strength, when applicable, shall be evaluated. If the coefficient of variation of production has increased by more than 1,5 % since the last evaluation, the evaluation described in A.2 of ISO 22389-1:2010 shall be repeated or corrective action taken.

9 Identification

The product shall be clearly and properly identified by product and company name, plant location or number, and a means of establishing the date of manufacture.

Bibliography

[1] ASTM D2915, *Standard Practice for Evaluating Allowable Properties for Grades of Structural Lumber*

[2] ASTM D5055, *Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists*

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