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Bamboo structures — Grading of bamboo culms — Basic principles and procedures

Structures en bambou — Classement des tiges de bambou

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by ISO Technical Committee 165, *Timber structures*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The general principle of this document is that any type of grading procedure is acceptable, provided it is defined, controlled, and documented to the extent required to achieve the degree of reliability intended for the structural application of the product. This document specifies procedures that conform to this principle. The grading procedures outlined in this document require visual, dimensional and mechanical stages to ensure conformity.

Annex A provides an example conformance standard reflecting the requirements of this document.

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Bamboo structures — Grading of bamboo culms — Basic principles and procedures

1 Scope

This document specifies grading procedures for visually and mechanically sorting round, or pole, bamboo for structural applications using such fundamental elements. Visual sorting is based on observable characteristics of the piece(s). Mechanical sorting is based on non-destructive measurement of properties known to correlate to characteristic values defining a grade.

The grading procedures in this document can be used in a quality acceptance regime, although this document does not define or address acceptance criteria.

This document is applicable only for bamboo that is graded in the seasoned state.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 22156, *Bamboo — Structural design*

ISO 22157-1, *Bamboo — Determination of physical and mechanical properties — Part 1: Requirements*

ISO 12122-1, *Timber structures — Determination of characteristic values — Part 1: Basic requirements*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
bamboo culm
single shoot of bamboo

Note 1 to entry: A culm is comprised of the entire unaltered bamboo cross section and is usually a hollow cylinder except at nodes.

3.2
bow
measure of variation of culm from straight condition, reported as the ratio of greatest transverse variation to reference length of culm

3.3
dry bamboo
seasoned bamboo
bamboo that has been subjected to a drying process and with moisture content of 19 % or less

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3.4
fissure
longitudinally oriented separation or split of the bamboo wall running parallel to the fibres at the end of a culm or at any internode of the piece that may or may not penetrate through the entire wall thickness

Note 1 to entry: An example of a fissure is shown in Figure 1.

3.5
geometric property
measurable dimensional property of bamboo piece, generally used in reference to diameter, wall thickness, length and internode length

3.6
grade-determining property
GDP
mechanical, geometric or physical property for which a particular value should be achieved for the material to be assigned to that grade

3.7
indicating property
IP
measurement or combination of measurements made during grading, which are related to one or more of the grade-determining properties

3.8
initial evaluation
process prior to grading during which the geometric, physical and mechanical properties for bamboo originating from a source region will be assessed with the aim of developing reliable selection criteria

3.9
internode
usually hollow region of bamboo culm between two nodes at which diameter and wall thickness are defined

3.10
longitudinal indentation
longitudinal depression running parallel to the fibres that may indicate the presence of an internal fissure that is not visible externally

Note 1 to entry: An example of a longitudinal indentation is shown in Figure 2.

3.11
mechanical property
measurable property of bamboo associated with both culm geometry and bamboo material properties that describes behaviour under the effects of applied load or stress, generally used in reference to member or section strength or stiffness

3.12
moisture content
portion of culm weight consisting of water expressed as percentage of oven-dry weight

3.13
node
transverse diaphragm region located along length of culm separating adjacent internodes

Note 1 to entry: The separation between nodes varies along the culm. When alive, nodes are locations of leaf and branch growth.

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3.14
ovality
degree of variation of culm cross section from circular, reported as the ratio of the greatest to least diametric measurement at a specific location

3.15
physical property
measureable or observable property of bamboo that describes its behaviour to external influences other than stress or strain, generally used in reference to density, moisture content, etc.

3.16
producer
supplier
organization responsible for the grading process, which usually would be the same organization responsible for drying and preserving the bamboo culms

3.17
proof testing
non-destructive structural testing protocol involving loading the culm (or structural assembly) to a predetermined value to assess its ability to carry this load

Note 1 to entry: Not addressed by this document.

3.18
source region
geographical location from which the bamboo resource originates

3.19
structural capacity
load carrying capacity of a culm which is a function of mechanical, geometric and physical properties of the culm

Note 1 to entry: Usually expressed in kiloNewtons (force) or kiloNewtons-metre (moment).

3.20
taper
degree of change of outer diameter (external taper), internal diameter (internal taper), section area (areal taper) or other geometric property along length of culm, expressed as percentage of the length of the culm

3.22
unseasoned bamboo
bamboo with moisture content greater than 19 %

3.23
grading rules
visual set of criteria used to sort bamboo pieces during visual grading

Note 1 to entry: Grading rules should have a demonstrated link to the grades sought.

3.24
visual override
process by which bamboo pieces are excluded from machine grading, because they do not meet criteria known to be important to grading and that cannot be sensed by the machine

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