
**Bamboo — Determination of physical and
mechanical properties —**

**Part 2:
Laboratory manual**

*Bambou — Détermination des propriétés physiques et mécaniques —
Partie 2: Manuel de laboratoire*
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Published in Switzerland

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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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 22157-2 was prepared by Technical Committee ISO/TC 165, *Timber structures*, in collaboration with INBAR, the International Network for Bamboo and Rattan.

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Introduction

In many laboratories in bamboo-growing countries all over the world, laboratory staff perform tests on the properties of bamboo. Visitors to such laboratories have seen how diligent and keen staff are on doing their work, in many cases under circumstances that are not easy. Many examples can be found of very satisfactory methods or tools, but such good information stays inside the originating laboratory, due to lack of exchange of such knowledge. One purpose of this Technical Report is to publish clever methods in order to make these available for staff all over the world. A second purpose is to give a practical “how to do” explanation on how to perform tests according to ISO 22157-1.

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Bamboo — Determination of physical and mechanical properties —

Part 2: Laboratory manual

1 Scope

This Technical Report provides informative guidelines for staff in laboratories on how to perform tests according to ISO 22157-1.

NOTE From here on, this Technical Report will only give information on subclauses of ISO 22157-1 if needed; consequently the numbering is not successive.

4.2.1 Measurement and weight

NOTE This subclause also refers to: 5.3 Felling, marking and conversion.

The values for length and weight should be taken:

- from the culms after their arrival in the lab, which means that culms have been marked already according to 5.3 of ISO 22157-1;
- from the smaller specimens immediately after they have been cut to size in the laboratory. It is wise to perform this cutting activity in such a way that confusion is avoided.

It is wise laboratory practice to design standard tables in which all data should be recorded. Figure 1 gives an example of such a table; evidently each laboratory is free to follow this example or not, provided their tables are as good or even better. In Figure 2 this table is repeated, and filled in by hand as an example of how to deal with it.

Next, it is wise to make a sketch of each culm, with its nodes, the places of the nodes, and the specimens cut from this culm and the tests for which these are to be used; see example in Figure 3.

This example shows the bottom and the middle part of a culm; from each part, two samples will be tested in compression and one in bending, provided the length is sufficient. The reports on those tests will contain more sketches with dimensions, etc. Evidently, each laboratory is free to design sketches like these, provided they are clear.

In Figure 3, the white ring as in 5.3 appears at a height of about 0,70 m from which we can guess that a piece of about 0,30 m has been left in the plantation. The mark "T", painted at breast height (5.2) appears at a height of approx. 1,20 m.

Subclause 4.2.1 of ISO 22157-1 also specifies how to determine the diameter and the wall thickness; see Figure 4 for details. (This Figure refers to 10.5.1 of ISO 22157-1.)

4.2.2 Temperature and humidity

The choice of test condition of 27 ± 2 °C and 70 ± 5 % R.H deviates from that normally adopted for testing wood products which is 20 °C and 65 % R.H. The first condition is chosen to better reflect the service environment in countries where bamboo grows. In temperate climates (like W. Europe), the national standard

for timber may be followed. If the link with other conditions is known, it is recommended to add this in the test report. See also ISO 22157-1, 5.7, last line.

NOTE This subclause is based on contributions from the Canadian and the French Standards Institutes.

Name, address, etc. of the Laboratory.

- 1 Name of species:
 - 1 a. Botanical name (if known)
 - 1 b. Local name
- 2 Name of the locality

3. Number of clumps or groups selected and given marks							
4. Number of culms cut from each clump and given marks							
5. Age of the culms in years							
6. Details about the marks on the culms							
7. Number of nodes between ground level and the ring of paint							
8. Date of felling							
9. Date of dispatch							

10. Signature and name of responsible staff member

Figure 1 — Example of a table as in 5.3 and 4.2.1

Name, address, etc. of the Laboratory.

INBAR,
P.O. BOX 777
BAMBOO - TOWN.

1 Name of species:

1.a Botanical name (if known) GUADUA A.

1 b Local name —

2 Name of the locality GUAPILES

3. Number of clumps selected and given marks	3						
	A	A	B	B	B	C	C
4. Number of culms cut from each clump and given marks	2		3			2	
	A-1	A-2	B-1	B-2	B-3	C-1	C-2
5. Age of the culms in years	4	5	4	4	5	5	4
6. Details about the marks on the culms	WHITE-RING →						
7. Number of nodes between ground level and the ring of paint	3	4	3	3	4	4	3
8. Date of felling	28/1	28/1	28/1	28/1	29/1	29/1	29/1
9. Date of dispatch	30/1	30/1	30/1	31/1	31/1	31/1	31/1

10 Signature and name of responsible staff member

Julio



Figure 2 — Example of a completed table as in 5.3 and 4.3.1

- Name and address of the laboratory:
- Mark of the culm:
- Sketch of the culm, dimensions and tests to be performed:

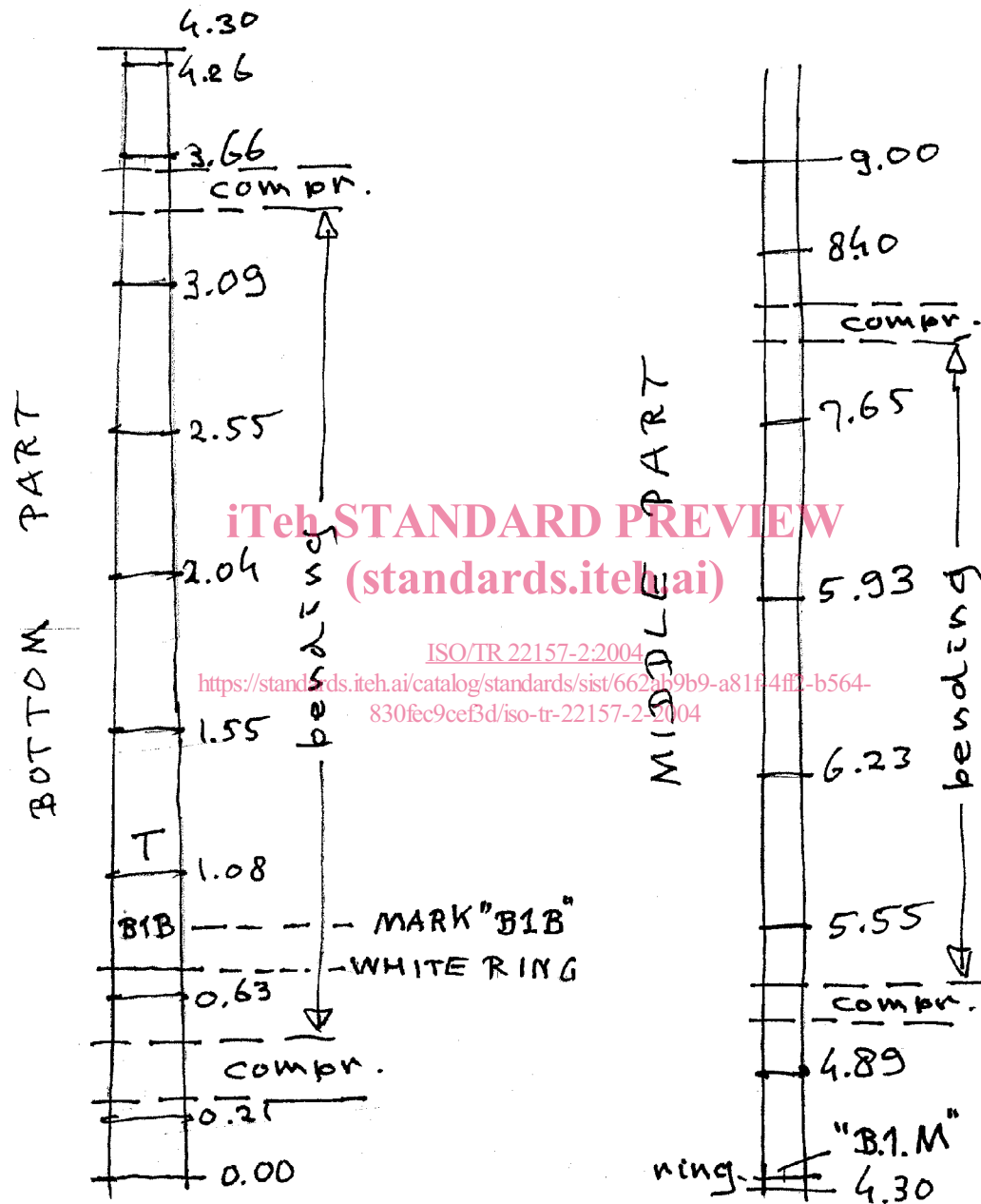


Figure 3 — Sketch of a culm (see 4.2.1 and 5.3)

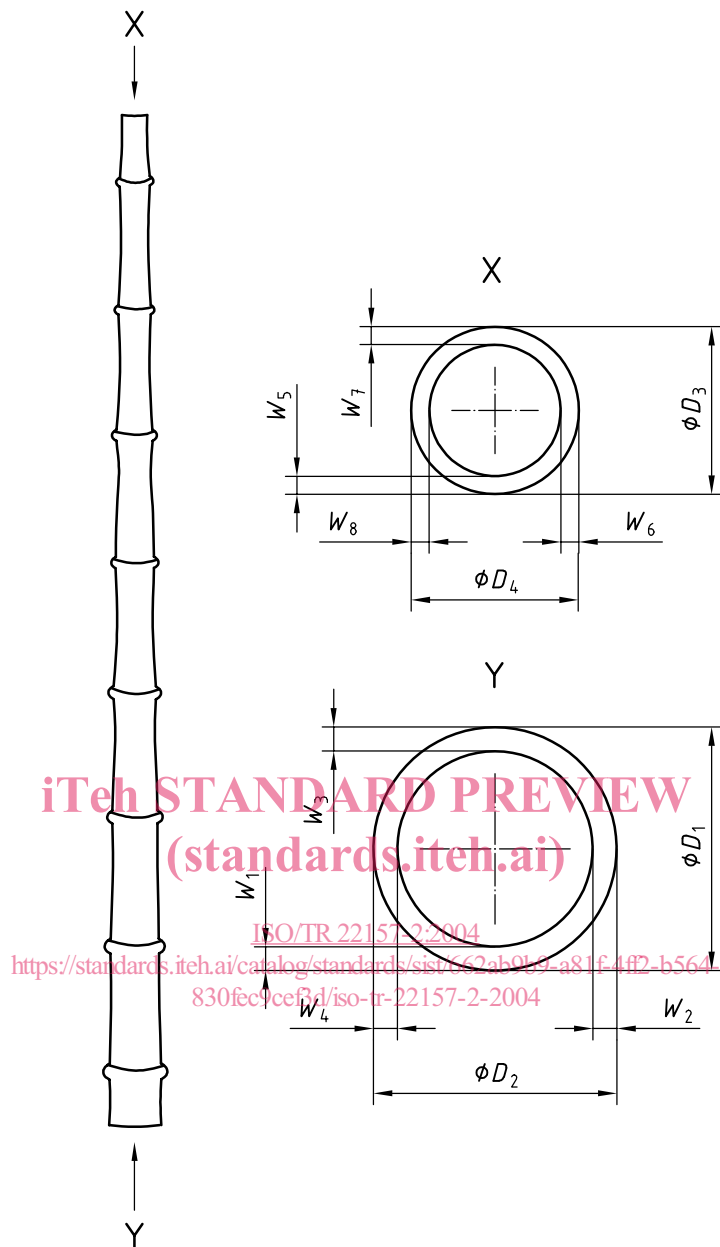


Figure 4 — Diameter and wall thickness of a culm (see 4.2.1 and 10.5.1)

5.6 Marking and conversion into test specimens

The number of specimens should be twelve: the purpose of tests is to predict a property for the whole population, with tests on one sample only. The more specimens are taken from the sample, the more reliable is the prediction, but the more expensive as well is the test series. A fair equilibrium exists when the minimum number of test specimens is twelve.

In a test series, we would like to determine the mean value μ of the population (pronounce “muu”) but we actually determine the mean value m of the sample. The formula is:

$$\mu = m - t(s/n) \quad (\text{In the original full formula “+” and “-” are both present, but here we are interested in the “-” only.})$$