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Dimensional stability of hardboard

Stabilité dimensionnelle des panneaux durs

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This document, which is for information purposes, was drawn up by Working Group 4, *Dimensional stability*, of Technical Committee ISO/TC 89, *Fibre building boards*, and approved by the latter. In view of the usefulness of the information which it contains, the ISO Council has decided to publish it as a reference document.

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Dimensional stability of hardboard

1 Hardboard is of interest as a construction material because it possesses great strength over short periods of loading while being moderately priced. However, tests involving long periods of loading show that both strength and strain are very dependent on time. In practice, only 15 % of the strength, as measured by the tests of short loading duration, can be used (Lundgren 1956, 1957, 1958, 1959, 1960). Figures 1 to 3 show the effect of increasing relative humidity of air on modulus of elasticity, bending strength and linear expansion.

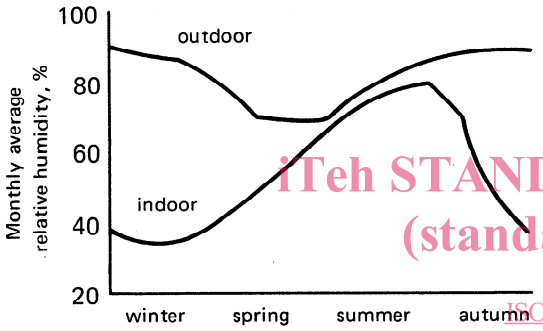

FIGURE 1 — **Seasonal variations in relative humidity**

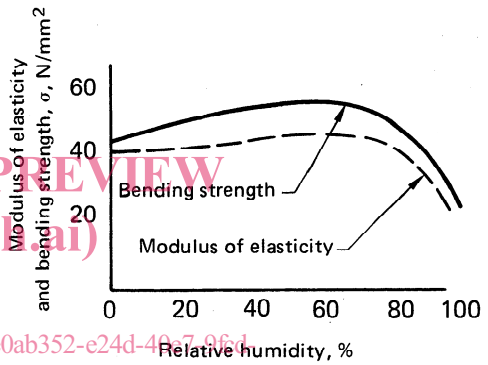

FIGURE 2 — **Variation of modulus of elasticity and bending strength with relative humidity**

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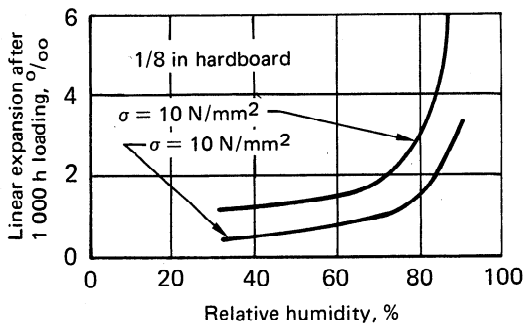

FIGURE 3 — **Variation of linear expansion with relative humidity**

2 Dimensional stability is defined in terms of the smallest possible changes in

a) thickness;

b) width and length;

c) edge squareness (straightness);

d) squareness.

All the above points are dealt with in document 89 N 232 E, 1972-12-31, which was prepared by ISO/TC 89/WG 6, "Fibre building boards — Dimensions and tolerances", and in ISO 766, *Fibre building boards — Determination of dimensions of test pieces.*

The determination of water absorption and of swelling in thickness after immersion in water are dealt with in ISO 769; the dimensions of fibre building boards are dealt with by document 89 N 225 E, p. 15.

3 The report in document 89 N 225 E, pp. 19-20, submitted by Professor Kollmann, may be summarized as follows :

a) Variations in thickness and length were measured following the conditioning of test pieces in various atmospheric conditions (i.e. 20 °C, 33 % relative humidity and 20 °C, 90 % relative humidity), permanent and reversible changes in dimensions being calculated after several cycles.

b) Test pieces used were 25 mm wide and 200 mm long.

c) Standard conditioning to 20 °C and 65 % relative humidity was achieved over 4 days.

d) Test pieces were stored for three cycles each lasting 3 days at 20 °C and 33 % relative humidity (apparently too short) and 4 days at 20 °C and 90 % relative humidity, and finally dried at 103 ± 2 °C. Measurements and calculations were carried out.

e) For comparison purposes, test pieces 100 mm × 100 mm and 20 mm × 200 mm were used.

f) The variation in length depends on the shape of the test piece and different values were obtained throughout the test period (600 h).

g) The results of tests on square test pieces corresponded more closely to those observed in practice.

h) In the case of wooden fibre-board, it is assumed that the orientation of fibre bundles plays a part in the variation in length (see figure 4).

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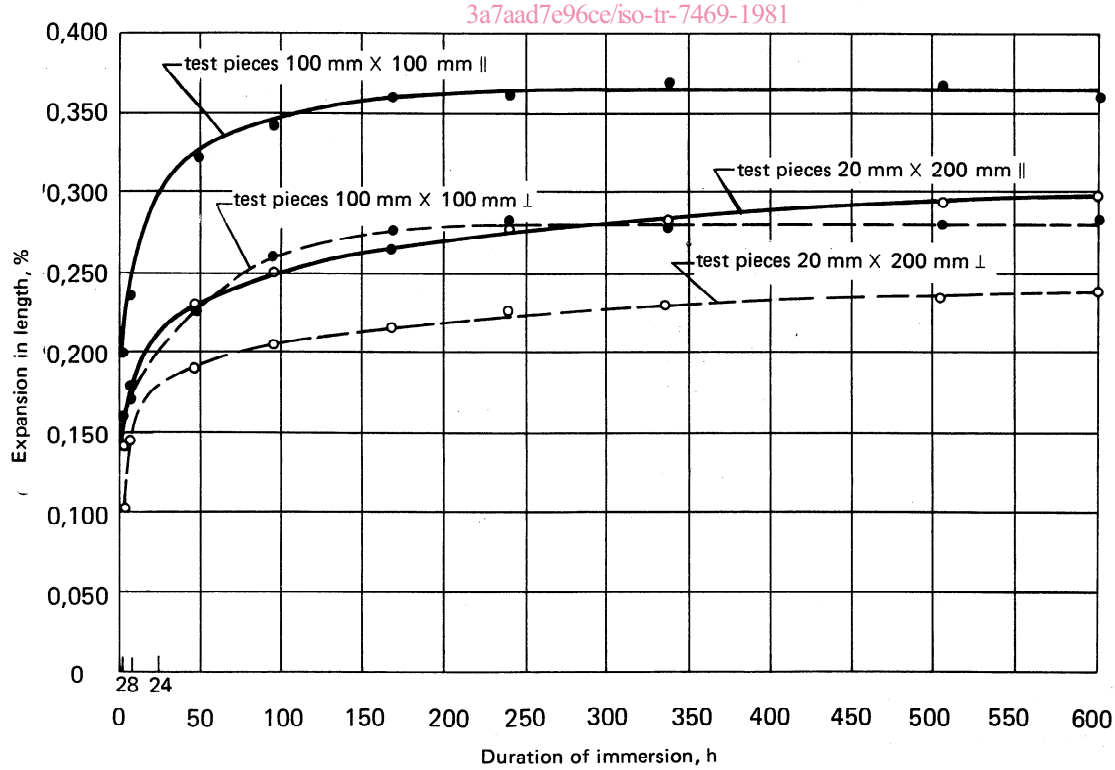

FIGURE 4 — **Variation of expansion in length of test pieces with duration of immersion**

4 The main features of the tests as indicated in document 89 N 2 E are as follows :

a) The use of test pieces 100 mm × 100 mm.

b) For the measurement of width and length, the Chairman proposes the use of a steel measuring tape capable of measuring to an accuracy of 0,1 mm.

c) Relative humidity limits : 30 % (4 days) and 90 % (4 days), at 20 °C.

d) Preconditioning at 20 °C and 65 % (7 days).

e) Number of cycles, 4 and 4, beginning at 20 °C and 30 %.

f) Sequence; dry-wet, 4 cycles, 4 × 2 = 8 cycles.

g) Calculation of reversible and permanent changes in dimensions.

5 The behaviour of building elements under various conditions of service, in practice, is a problem of dimensional stability, complemented by position (whether vertical, horizontal or inclined), type and amount of load bearing, clamping, static or oscillating loads, environmental conditions (for example climate, moderate or tropical, moisture gradient), surface protection, edge sealing, content of water repellents, etc.

6 Small tests pieces as recommended under 4 a) permit conclusions to be drawn only with respect to Nos. 2 a) to 2 d). It is doubtful that valid conclusions will be able to be drawn with respect to edge straightness.

7 Dimensional stability is obtained only if warping and twisting do not occur or if they are reduced to a minimum. For sheet-like wood-based materials, both of these phenomena are suppressed under favourable conditions.

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8 Testing for dimensional stability often proves unreliable and difficult.

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a) Small test pieces, recommended for simplicity and saving of material, do not give realistic results.

b) The main disadvantages result from the existence of a moisture content gradient. This poses the problem of the value and the period of exposure to the gradient.

c) Strips (about 20 to 50 mm wide and 300 to 500 mm long) may possibly be used to demonstrate warping. It is proposed that one end of the strip should be clamped, covered with dampened blotting paper and fixed with elastic bands for either 24 or 48 h prior to the test.

9 Other possible tests for determining warping may involve the use of

a) test pieces 100 mm × 100 mm, clamped diagonally only, with one surface covered with soaked blotting paper for 48 h in an atmosphere with temperature 20 °C and relative humidity 65 %;

b) test pieces 50 mm × 200 mm, clamped on one edge, after immersion in water (at 20 ± 2 °C) for 24 h.

The problem should be considered with the aim of producing an International Standard.

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