STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

METHODS OF TESTING TIMBER

AS 1080.3
DETERMINATION OF DENSITY

FOREWORD

The method described in this standard takes cognizance of ISO 3131, ASTM D2395 and BS 373.

The methods of determining density described herein do not require especially elaborate apparatus nor appreciable technical skill.

The density of wood gives a measure of the amount of wood substance present in a piece of timber. The term 'specific gravity', which is deprecated, is the ratio of the density of a substance to the density of water at a standard temperature, but current practice is to express density in kilograms per cubic metre.

Density is highly correlated with many of the various strength properties of wood. It varies between species, between trees of the same species and within a tree. Density may be used in the selection of a timber or individual piece of timber for a specific end use.

The mass of wood in a given volume changes with the shrinkage and swelling caused by changes in moisture content and the term density is indefinite unless the conditions under which it is determined are specified. The most common density values determined for timber are basic density and air-dry density. Basic density is determined when the moisture content of the sample is at or above the fibre saturation point and is based on the volume of the test piece when tested and the mass when oven-dried; ISO 3131 refers to this as 'conventional density'. Air-dry density is determined when the moisture content of the test piece is below fibre saturation point and in Australia is normally quoted for a standard moisture content of 12 percent using shrinkage values published* for the species.

Air-dry density is based on the volume at the time of testing and the mass at 12 percent moisture content. For more precise evaluation of air-dry density, the volume should be corrected to the volume at 12 percent moisture content, particularly for species having high shrinkage, from a knowledge of the volumetric shrinkage of the test piece. However, for practical purposes this correction is small and may be ignored, as in most parts of Australia the equilibrium moisture content of timber in normal atmospheric conditions is close to 12 percent.

This standard makes reference to the following standards:

AS 1080	Methods of Test for Timber Part 1— Moisture Content
AS O1	Glossary of Terms Used in Timber Standards
ISO 3131	Wood—Determination of Density for Physical and Mechanical Tests
ASTM D2395	Tests for Specific Gravity of Wood and Wood-base Materials
BS 373	Testing Small Clear Specimens of Timber

* KINGSTON, R.S.T., and RISDON, C. June E., Shrinkage and Density of Australia and Other South-west Pacific Woods. CSIRO, DFP Technological Paper No 13, 1961.

METHOD

1 SCOPE. This standard sets out the method for determining the density of timber and timber articles, untreated with preservatives.

NOTE: For determination of density of particleboard, see AS 1859.
For determination of density of plywood see AS 2098.7.
For determination of density of fibre building boards, see AS 2457.3.

2 DEFINITIONS. For the purpose of this standard, the definitions given in AS O1 and the following apply:

Basic density—the density of timber calculated from the green (or fully saturated) volume of the test piece and the mass of the test piece when oven-dry.

Air-dry density—an expression of the mass of timber at equilibrium moisture content, standardized at 12 percent, per unit volume of timber at the equilibrium moisture content.

Unit shrinkage—shrinkage per 1 percent change in moisture content below fibre saturation point.

3 PRINCIPLE. The mass of the test piece is determined and then its volume is determined by linear measurement and subsequent calculation or by displacement, according to its shape. The moisture content is then determined. The base density and the air-dry density are then calculated.

NOTE: The oven-dry mass is derived by weighing the test piece, determining the moisture content and making the appropriate calculations. The test piece is generally not oven-dried; however, if the test piece is to be oven-dried, care must be taken that it is first weighed and the volume determined before drying.

4 APPARATUS. The following apparatus is required:

(a) A weighing device capable of weighing to an accuracy of 0.01 g.

(b) (i) A linear measuring device capable of measuring to the following accuracy:

Dimension mm	*Accuracy* mm
≤ 5	0.005
> 5 ≤ 20	0.01
> 20 ≤ 100	0.1
> 100 ≤ 250	0.5
> 250 ≤ 500	1
> 500	1

OR

(ii) Vessels suitable for measurement of the volume of the test piece by displacement of water to an accuracy of ±0.3 percent.

NOTES:

1. The size, shape and calibration will vary according to the size and shape of the test piece.
2. It is difficult to achieve high accuracy with the displacement method. The test piece should fill the measuring vessel as nearly as possible. Accuracy can often be improved by filling a displacement vessel. e.g. eureka can, with water and catching and measuring or weighing the displaced water.

5 TEST PIECE. The test piece may consist of the whole of the article or a section of the article depending on its size and shape.

If a sectional test piece is taken from the article, it shall be cut as follows:

(a) If the test piece can be weighed immediately, it shall be cut at a distance not less than 0.5 m from an end of the piece of timber.

(b) If the test piece cannot be weighed immediately, a test specimen 0.3 m long shall be cut at a distance not less than 0.5 m from an end of the piece of timber. This specimen shall be protected from changes in moisture content by being completely and tightly wrapped in waxed paper, aluminium foil or polyethylene sheeting and stored in a cool, dry place. Within 24 h a test piece as described in (a) above shall be cut from the centre of the test specimen.

NOTE: If the article is very large, it may be advisable to take two or more test pieces so that a fully representative value of the density may be obtained by averaging the individual values.

6 PROCEDURE.

6.1 Prismatic Test Pieces. The procedure shall be as follows:

(a) Determine the mass of the test piece to an accuracy of 0.01 g.