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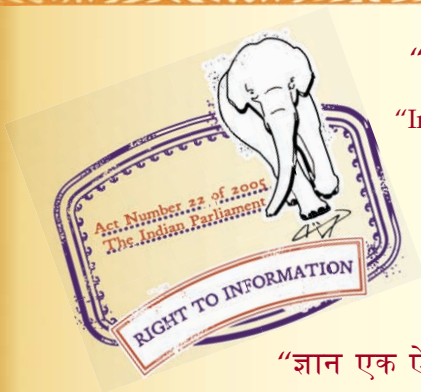
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IS 11215 (1991): Moisture content of timber and timber products- Methods for determination [CED 9: Timber and Timber Stores]



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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

इमारती लकड़ी तथा इमारती लकड़ी के उत्पादों में
नमी अंश — ज्ञात करने की पद्धतियाँ

(पहला पुनरीक्षण)

Indian Standard

MOISTURE CONTENT OF TIMBER AND
TIMBER PRODUCTS — METHODS FOR
DETERMINATION

(*First Revision*)

UDC 674.543.812

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Timber Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in 1985. Based on the experience gained in the use of this standard, this revision has been brought out. The major changes include modification in sampling clause and incorporation of clause on species correction when the moisture content is determined by electrical moisture meter method.

This standard lays down the procedures to determine the moisture in timber and timber products by the laboratory and field tests and is intended to be used in conjunction with IS 287 : 1991 'Recommendations for permissible moisture content of timber used for different purposes (third revision)'.

There are a number of methods for testing moisture content of sawn timber and timber products, and a choice of method has to be made according to the conditions under which testing is done, the precision desired, and sometimes even the particular species of timber to be tested. The precision achieved by any method depends, besides the correct selection of a statistically representative sample, upon the apparatus used and the operator as much as upon the method. No distinction is, therefore, sought to be made in this regard in the status of the three methods of moisture content determination laid down in this standard, namely, the oven-drying, the electrical moisture meter and the distillation methods.

Considering the present level of development of indigenous electrical moisture meters and lack of species and temperature correction data, it is recommended for reliability to always support moisture meter measurements made in field with limited oven-drying measurements in the laboratory. At the same time, it is to be recognized that under the conditions in wood-working factories where the history of the raw material or product at different production stages is usually known; and particularly for finished products, there is no better substitute for the electrical method for quick non-destructive checking of moisture content. Certain wood species like deodar, containing volatile oils, do not give reliable results by the oven-drying method. These call for determination by the distillation method for reliable data. Electrical moisture meter offers the practical alternative if used with correction figures determined against the distillation method for such species.

The methods described herein are intended specifically for testing of timber and timber products. With the exception of the distillation method, the methods described in this standard do not require elaborate apparatus or technical skill. These are suitable where moisture content testing is a routine practice, for example, in timber depots, wood-working factories, kiln drying establishments and timber processing industries.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'.

Indian Standard

MOISTURE CONTENT OF TIMBER AND TIMBER PRODUCTS — METHODS FOR DETERMINATION

(*First Revision*)

1 SCOPE

1.1 This standard covers the following methods for determination of moisture content of timber and timber products:

- a) Oven-drying method,
- b) Electrical moisture meter method, and
- c) Distillation method.

2 REFERENCES

2.1 The following Indian Standards are the necessary adjuncts to this standard:

IS No.	Title
707 : 1976	Glossary of terms applicable to timber technology and utilization (<i>second revision</i>)
1839 : 1961	Specification for toluene, reagent grade
4905 : 1968	Methods of random sampling

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 707 : 1976 shall apply.

4 DETERMINATION OF MOISTURE CONTENT BY OVEN-DRYING METHOD

4.1 General

4.1.1 The oven-drying method is the most reliable for determining the moisture content of timber and timber products, except where certain timber species containing volatile oils (like deodar) are involved. The method is, however, time consuming and requires cutting of the timber to be tested.

4.2 Sampling

4.2.1 Test samples shall be selected which are representative of the species, dimensions, quality and moisture contents in the lot. The number of samples to be tested depends upon the size of the lot and the variations that are, or are likely to be present in its composition, quality and moisture content between the individual pieces. For random sampling method IS 4905 : 1968 may be referred to. The samples shall be selected as follows.

4.2.2 In case of timber of uniform species and cross-section, the number of samples selected shall be as follows:

- a) At least 3 samples from lots of volume up to 5 m³,
- b) At least 2 samples for every 5 m³ lots of volume ranging above 5 m³ and up to 50 m³, and
- c) At least 20 samples per each 50 m³ but not more than 100 m³ out of each lot, from the lots of volume more than 50 m³.

NOTE — For timber in stacks, sampling shall preferably be done evenly along the solid diagonal of the stacks, otherwise random sampling shall be done. The number of samples selected in either case shall be the same as specified in 4.2.2.

4.2.3 In case of timber products to be tested by oven-drying method, samples shall be selected as follows:

- a) At least 3 samples from lots containing up to 200 pieces,
- b) At least 2 samples for each 200 pieces from lots containing over 200 and up to 1 000 pieces, and
- c) At least 10 samples per each 1 000 pieces but not more than 50 out of each lot from lots containing more than 1 000 pieces.

4.3 Apparatus

- a) Scales with weighing accuracy of 10 mg,
- b) Ventilated and preferably thermostatically controlled oven for drying timber at $103 \pm 2^\circ\text{C}$,
- c) Desiccators with anhydrous calcium chloride (CaCl₂) or phosphorus pentoxide, and
- d) Sealable weighing bottles.

4.4 Test Specimens

4.4.1 Test specimens consisting of a cross-section, 15 mm to 20 mm long in the direction of the grain, free from all defects, shall be cut from each sample selected for tests in accordance with 4.4.2 to 4.4.5. In case of timber products, the test specimen shall be cut from the portion of the maximum cross-section.

4.4.2 If weighing can be done immediately, the test specimens shall be cut from a point at least 450 mm from one end of the sample or from its centre.

4.4.3 If weighing cannot be done immediately, a piece of 300 mm long shall be cut at a distance, not less than 450 mm from one end of the sample or from its centre. This piece shall be protected from changes in moisture content by wrapping in waxed paper, polythene sheeting or aluminium foil and stored in a cool and dry place. Within 24 hours the test specimen as given in 4.4.1 shall be cut from the centre of this piece.

4.4.4 If the samples are less than 1 m long, the test specimens shall be cut from their centre.

4.4.5 In case the timber sample is more than 75 mm in thickness, the full piece as cut in accordance with 4.4.1 should be further cut into three pieces and moisture content of these three pieces, taking them as a single unit, shall be taken.

4.5 Procedure

4.5.1 Immediately after each test specimen is cut and loose splinters and saw dust are removed by brushing or scraping, it shall be weighed correct to 0.01 g if its mass is less than 50 g and 0.1 g if the mass is 50 g or over. If immediate weighing is not possible, each test specimen shall be stored in a separate, pre-weighed, sealed weighing bottle, and weighing completed within an hour of storage.

4.5.2 The weighed test specimens shall be oven-dried at $103 \pm 2^\circ\text{C}$ for a sufficient period, usually 12-18 hours and two or three control pieces shall then be weighed and returned to the oven for further drying. Successive mass of these control pieces shall then be taken after every 2-3 hours. When changes in successive mass cease to be less than 0.02 g for test specimens having initial mass less than 50 g, and less than 0.1 g for test specimens with initial mass over or equal to 50 g, all the test specimens shall be considered to have been completely oven-dried. The oven-dry mass of all the test specimens, shall now be determined directly after removing from the oven, or after cooling them in desiccators to near room temperature if better accuracy is desired. The precision of weighing prescribed under 4.5.1 shall be observed for oven-dry masses also.

4.5.3 No fresh test specimens belonging to another lot shall be loaded into the drying oven when test specimens from the lot being tested are nearly dry and ready for determination of their oven-dry masses.

4.5.4 Great care shall be taken to prevent any change in moisture content between the cutting

of the test specimen and the first weighing, and between the removal from the oven and subsequent weighings.

4.5.5 Timber species containing excessive amounts of volatile oils shall be tested by the distillation method described in 6.

4.6 Borings

In case, cutting of specimen from the selected samples is not possible, the moisture content in the whole sample may be determined by collecting borings to a depth of half the thickness of each sample (obtained by means of an auger) in preweighed weighing bottles. The borings shall be obtained from a distance of at least 450 mm from either end of the samples or from their centre. If the samples are less than 1 m long, the borings shall be collected from their centre. The mass of borings from a sample shall not be less than 10 g. If it is less, 2 or 3 borings from an identical location in a sample shall be collected in the same weighing bottle. The procedure for weighing and oven-drying of borings shall be the same as described under 4.5.

4.7 Calculation

4.7.1 The moisture content of each sample shall be determined by the following formula:

$$M = \frac{W_i - W_o}{W_o} \times 100$$

where

M = moisture content (percent),

W_i = initial mass of test specimen (in g), and

W_o = oven-dry mass of test specimen (in g).

The calculated values shall be rounded off to the first place of decimal.

4.7.2 The average of moisture content of all the samples from the lot tested shall be reported correct to the nearest whole number by the following formula for checking conformity of a lot to the requirements of the relevant specification:

$$\bar{M} = \frac{\sum M}{n}$$

where

\bar{M} = average moisture content (percent),

M = moisture content of individual samples (percent), and

n = number of samples selected from the lot.

5 DETERMINATION OF MOISTURE CONTENT BY ELECTRICAL MOISTURE METER METHOD

5.1 General

5.1.1 Electrical moisture meters are a direct, quick, convenient and non-destructive means of determining moisture content of timber and timber products. These are of special value in field inspections and for checking of finished timber products. Because of the rapid measurements, and no loss of material by this method, more extensive checking is possible than permitted by the oven-drying method.

5.1.2 The electrical moisture meters are capable of reading moisture content to an accuracy of ± 2 percent absolute within the range 8 to 24 percent moisture content (which covers the range of seasoned timber) when appropriate corrections are applied for the timber species and temperature, and all necessary precautions in use are taken. These are, therefore, not as precise and fool-proof as the oven drying method, and data obtained by them on a more extensive scale may sometimes need to be supported by limited testing in the laboratory by the oven-drying method.

5.2 Types of Electrical Moisture Meters

5.2.1 Of the two types of electrical meters commercially available, namely, electrical resistance meters and capacitance meters, the resistance meters are preferable as their readings are affected to a lesser extent by the natural variation of density within the particular species being tested.

5.2.2 The resistance meters are provided with naked pin electrodes or electrodes in which the pins are covered with a hard-wearing insulation coating except at their tips. The naked pin electrodes register the maximum moisture content of timber prevailing anywhere within their depth of insertion. The insulated pin electrodes on the other hand enable spot checking of moisture content at any particular depth of insertion into the timber. Electrode pins of varying lengths are generally provided for use with timber of different range of thicknesses.

5.3 Apparatus

Resistance type meter with electrode pins of suitable lengths and with species correction and temperature correction charts for the species to be tested shall be used. The meter shall be capable of reading moisture content to an accuracy of ± 2 percent absolute when appropriate corrections and precautions are followed.

5.4 Sampling

The sample in this case shall amount to at least 5 percent of the pieces from the lot but not exceeding 50 pieces. The sample shall be taken evenly along the diagonal in case of sawn timber stored in piles, otherwise random sampling shall be done. For random sampling method, IS 4905 : 1968 may be referred to.

NOTE — For timber in stacks, sampling shall preferably be done evenly along the solid diagonal of the stack, otherwise, random sampling shall be done. The number of samples selected in either case shall be as prescribed in 5.4.

5.5 Procedure

5.5.1 The meter readings shall be taken at three sections along the length in the middle width of each face of every sample. Two sectors shall be measured at a distance of 450 mm from the ends and the third one at mid length of the sample. If the length of the sample is 1 m or less, readings shall be made at mid length only on each face.

5.5.2 For timber over 50 mm in thickness, readings shall be taken as in 5.5.1 on all the faces of each sample.

5.5.3 The timber to be tested shall not be: (a) hot, (b) surface wet, (c) taken directly from the kiln, and (d) painted or preservative treated with compounds containing inorganic substances, as under such circumstances resistance meter readings are liable to be grossly inadequate.

5.5.4 Electrode pins of adequate length shall be selected for the thickness of timber under test, that is, to probe up to a depth not less than one-fifth the thickness of timber but preferably up to half the thickness.

5.5.5 Readings at various depths into the section shall first be taken on a few samples to ascertain the presence of 'large' moisture gradients or a wet core (moisture content 20 percent or above) or a reversed moisture gradient (surface wetter than the core). Moisture gradients shall be taken to be 'large' if the difference of readings at one-fifth and half the thickness of a sample exceeds four percent absolute in timber up to 40 mm thick and seven percent absolute in timber 40 to 65 mm thick.

5.5.6 If presence of the condition detailed in 5.5.5 is confirmed, the meter readings cannot be taken as reliable estimates of the average moisture content in the whole section, but only of the maximum moisture content prevailing within the depth of insertion of pins in case of meters provided with naked pin electrodes, or of the spot moisture content prevailing at the depth of insertion in case of meters provided with insulated pin electrodes.

5.5.7 If presence of the condition detailed under 5.5.5 is negated, readings at one-fifth thickness shall be taken as representative of the average in the whole section.

5.5.8 Species corrections, pre-determined against the oven-drying method, shall be applied to the meter readings for the species under test in order to arrive at the correct moisture contents.

5.6 Calculations

5.6.1 The average moisture content of each sample shall be calculated by the following formula:

$$M = \frac{\frac{P}{\sum m}}{P}$$

where

M = average moisture content of sample (percent),

m = corrected moisture meter reading in any sector of sample (percent), and

P = number of sectors measured.

The calculated value shall be rounded off to the nearest whole number.

5.6.2 The average of moisture content of all samples tested from a lot is calculated by the formula for checking conformity of a lot to the requirements of the relevant specification:

$$\bar{M} = \frac{\frac{n}{\sum M}}{n}$$

where

\bar{M} = averaged moisture content (percent),

M = moisture contents of individual samples (percent), and

n = number of samples selected from the lot.

5.7 Acceptance of Results

5.7.1 Where ten percent or more of the total number of samples tested show readings above the acceptable limit of maximum moisture content, such samples shall be further tested by the oven-drying or distillation methods given in 4 and 6 for conforming their moisture contents.

5.7.2 All disputes concerning the moisture content shall be decided by the oven-drying and distillation method.

6 DETERMINATION OF MOISTURE CONTENTS BY DISTILLATION METHOD

6.1 General

This method is used for species like deodar containing volatile oil or extractives. It is also used for timber impregnated with volatile or

non-volatile chemicals that are likely to interfere with the correct determination of moisture content by oven-drying or electrical moisture meter methods. The method requires elaborate laboratory equipment and technical skill.

6.2 Sampling

Sampling shall be done as prescribed under 4.2.

6.3 Test Specimens

The test specimens or borings shall be taken from the lot as prescribed under 4.4 and 4.6, and shall be reduced to chips, saw dust, or other finely divided form. These shall be kept in sealed preweighed weighing bottles.

6.4 Apparatus

- Distillation flask with indirect heating arrangement,
- Cold water-cooled condenser of the cold finger type (see Fig. 1),
- Water trap,
- Scales of accuracy 10 mg, and
- Sealable weighing bottles.

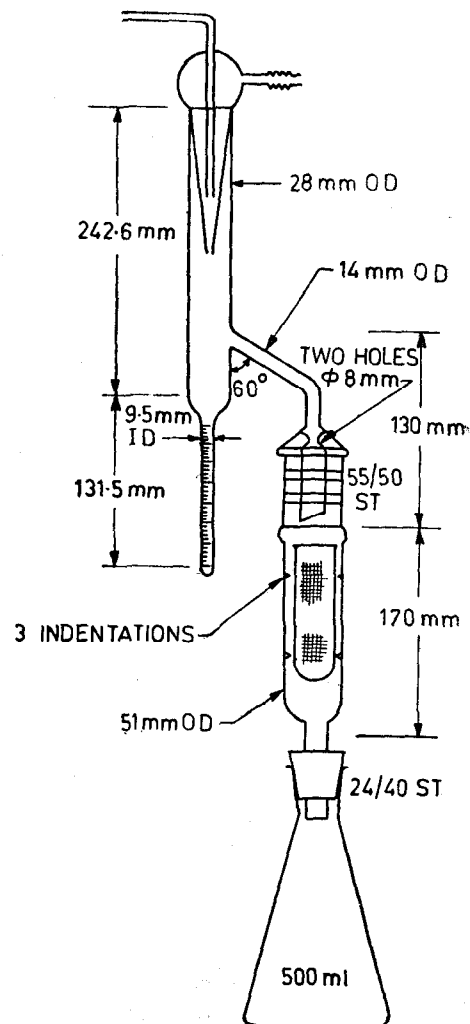


FIG. 1 DISTILLATION APPARATUS

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