1. SCOPE

This NORDTEST method describes a procedure for measuring the moisture content in wood by means of electrical moisture meters. The method is based on the observation that the electrical resistance between two electrodes punched into a piece of wood is a function of the moisture content in the wood.

2. FIELD OF APPLICATION

The test method is applicable to different wood species as well as to wood based sheet materials, provided that proper calibration procedures are carried out.

In practice, the use of the method is limited to measurement of moisture contents in the range of approx. 7-28% (percent weight) in wood. At lower moisture content leakage currents (due to imperfect insulation of leads, plugs, etc.) become dominant - at higher moisture content the interelectrode resistance varies only little with moisture content.
REFERENCES

ASTM D 4444-84 Use and calibration of handheld moisture meters.

ISO 3130 Wood - Determination of moisture content for physical and mechanical tests.

DEFINITIONS

The moisture content w (as a percentage by mass) is defined as

\[ w = \frac{m_w - m_0}{m_0} \times 100 \]

where \( m_w \) is the mass, in grams of the sample in the moist state and \( m_0 \) is the mass, in grams of the sample in dry state.

The dry state is defined as the state when the wood sample has been dried in an oven at 103 °C ± 2 °C for such a duration that repeated weighings of the sample, at intervals of six hours, show a maximum difference in the dry mass of only 0.5 per cent. (ISO 3130).

SAMPLING

The measurements may be carried out on wood constructions in buildings in use, as well as on pieces of wood under laboratory conditions.

The measurements should be carried out, if possible, in five places representative of the volume in which the moisture content is requested.

METHOD OF TEST

6.1 Principle

The electrical resistance between two insulated electrodes punched into the woods is measured by means of an ohmmeter. Its scale is often calibrated to read directly in moisture content for a particular calibration specimen.
6.2 Apparatus

The instrument consists of two electrodes and an ohmmeter. The electrodes having a fixed distance of approx. 25 mm are insulated so that only the electrical resistance between the ends of the electrodes is measured. Some instruments have electrodes which are not insulated. These should not be used since it entails the risk that the reading will correspond to the moisture content in the surface or upper layers of the wood.

The meter shows directly on a scale the moisture content in the wood or the electrical resistance which then must be converted to a moisture content. Note that the value observed at the reading may need to be corrected due to different characteristics of the wood species and the temperature level. This is further explained below.

6.3 Calibration

If other wood species or wood based materials shall be measured than those for which calibration has been carried out from the factory, renewed calibration will be necessary.

The instrument should be calibrated by using a drying/weighing procedure as described above in order to obtain reliable readings.

The calibration should normally be carried out with wood samples that have been conditioned at 20 °C and RH’s of e.g. 50, 65 and 80 per cent or at climate conditions according to the task in question. The samples should be conditioned to an equilibrium state as defined above.

Calibration diagrams showing the real moisture content as a function of the actual reading on the moisture meter may then be worked out.

6.4 Preparation of test samples

In case it is the actual moisture content in a construction which is to be measured, no preparation is necessary.

In case it is the average moisture content which is to be measured,
the sample should be conditioned to a steady state in order to avoid a moisture gradient in the material. During the period of conditioning the test specimen should be kept e.g. in a plastic bag in order to prevent exchange of moisture with the surroundings.

6.5 Procedure

The two electrodes are punched into the wood in such a way that the electrical current will run parallel to the fibres in the wood. Measurements can be carried out at different depths, but the maximum depth for most instruments is 30 mm.

In most cases, when measurements of moisture content are carried out in buildings in use, there is a moisture gradient in the material. In this case, readings should be taken at different depths under the surface, to establish the variation in moisture content.

6.6 Correction

a) Temperature. The electric moisture meters are in most cases calibrated at 20 °C. For every 6 °C the temperature in the wood exceeds 20 °C, the meter will give readings which show the moisture content to be approx. 1 per cent higher than it actually is. For every 6 °C the temperature is below 20 °C, the meter will correspondingly give readings which are approx. 1 per cent too low. The temperature correction should always be made before the species correction.

b) Wood species. If the instrument has been calibrated for a wood specimen which is different from the material in question, corrections must be made according to the calibration diagram mentioned in 6.3.

6.7 Accuracy

The accuracy of the measurements depends on a great number of factors, the most important are the following:

a) Density of the wood. If the instrument has been calibrated for wood of medium density, more dense wood will give too high
readings, whereas less dense wood will give too low readings.

b) Soluble salts in the wood. Wood specimens with a high content of water soluble salts will tend to give too high readings on the meter.

c) The contact between electrodes and wood. A poor contact between the electrodes and the wood will result in increased electrical resistance. The electrodes should consequently be punched so firmly into the wood that a good contact is secured.

d) Positioning of the electrodes. The electrodes must preferably be placed so that the current runs in the direction of the fibres. Measurements perpendicular to the fibres will give readings which are slightly too low. Furthermore, positions for the electrodes should not be chosen near discontinuities in the wood such as e.g. knots.

e) Presence of preservatives. Water-borne preservatives lower the electrical resistance of the wood, causing the meter to read higher for treated timber than for untreated timber of the same true moisture content. The extent of this effect depends upon the type and amount of preservative present. Oily preservatives such as creosote cause the meter to give too low readings.

In general it is advised to check the validity of measurements carried out in impregnated wood.

f) Wood based sheet materials. Electrical moisture meters can be used for measurements of moisture content in e.g. wood chip board and plywood provided the results presented are referred to a special calibration procedure.

6.8 Precision

For a single meter reading corrected for temperature and specimens, the 95% confidence interval for predicting the true moisture content between the electrode tips is approx. 7% relative error (± 0.5 to 2% moisture content), depending on the specimens.
6.9 **Expression of results**

The readings shall be expressed to the nearest half of one per cent. When five readings have been taken, the average of these readings is indicated as the result of the measurements. The result shall be given without decimals.

6.10 **Report presenting the results of the measurements**

The test report shall include the following information, if relevant:

a) Name and address of the testing laboratory

b) Identification number of the test report

c) Name and address of the organization or the person who ordered the test

d) Purpose of the test

e) Choice of points of measurements and other circumstances (date and person responsible for the sampling)

f) Address of the building in which the measurement is carried out (if not in a laboratory)

g) A detailed description of the locus where the measurement has been carried out

h) Description of the object on which the measurement has been carried out

i) Date of ordering of the measurement

j) Date of the measurement

k) Test method

l) Conditioning of the sample, ambient conditions during the measurement (temperature, RH, etc.)

m) Identification of the equipment used for the measurement (product and model)

n) Any deviations from the method of the measurement

o) Results of the measurements

p) Inaccuracy or uncertainty of the measurement

q) Date and signature.
Fig. 1. Simplified drawing showing how two insulated electrodes are punched into a piece of wood. The electrical resistance between the electrodes may be read on a scale, which in most cases directly gives the result in percent moisture.