# MOISTURE MEASUREMENT IN BUILDINGS

## WOOD-MOISTURE-EQUIVALENT OR % MOISTURE CONTENT?

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The moisture meter with its accessories is to the engineer; the architect and the surveyor what the stethoscope is to the doctor: it is a tool giving indications that cannot be gained from the unaided senses. Of course, it requires understanding for correct diagnosis.

### Dampness is hazardous before you can see it.

It is important to note that materials do not become visibly damp, and do not feel damp to the touch, until they are quite dangerously damp. Wood, for example, does not feel damp below 30% moisture content (at around 97 or 98 per cent relative humidity), although rot will develop at 20% moisture content and above. Dampness is hazardous long before it can be detected by the unaided senses. This is why it is so essential to use a moisture meter when surveying for damp, and making judgements about its severity.

### Relative Humidity

Since moisture content is a poor measure of the dampness in buildings, what alternative is there? The theoretical ideal is to cover the suspect damp area with a waterproof tent of polythene, or foil, or with a box, and have a humidity-measuring device under it. Water evaporating from the wall, into the small amount of air trapped in the tent or box, will raise its relative humidity until it is in equilibrium. Then by measuring the relative humidity it is possible to say exactly how damp the wall is, regardless of the humidity in the room as a whole.

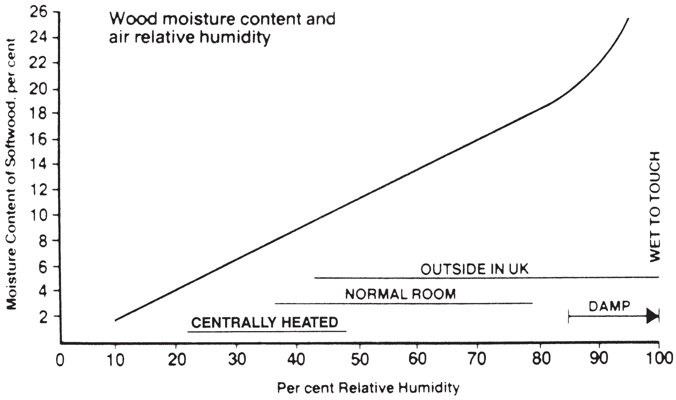
Obviously this is an impossibly labourious process for surveying a building, for it would take several hours at each point. Fortunately this is not the only method. The relative readings of a Protimeter moisture meter measure only the free water in a material; therefore they closely indicate the relative dampness of different materials. Although they do not measure relative humidity, their indications are a fairly close representation of it. A high reading on such a meter (in the absence of contaminating salts or carbonaceous materials) **indicates** a damp condition of approximately equal significance in wood, brick, plaster or wallboard, regardless of their very different moisture contents.

Carbonaceous materials are present in some breezeblocks and in the black colouring of some wallpaper: They conduct electricity and will give readings on a moisture meter. But the very absurdity of high readings obtained all over a wall or in black areas only of some wallpaper will at once show that the instrument is not measuring moisture.

### Wood-Moisture-Equivalent

The instrument measures moisture in wood and wood-moisture-equivalent (WME) in building materials other than wood. It is possible, therefore, to mark on the scale of a Protimeter indications of 'safe', 'intermediate' and 'danger' which correspond reasonably well with the humidity equilibria of most non-metallic or non-carbonaceous materials on which they may be used. The instruments do this by a colour code: green indicates the safe' condition in an ordinary indoor, inhabited environment. Red indicates humidity equilibrium in excess of about 85% and the amber area indicates the region between.

Wood Moisture Equivalency is the moisture level in any building material *as if* it were in **close contact** and in **moisture equilibrium** with wood expressed as a % moisture content of wood. In practice materials do not have to be in contact with wood. Readings on the Protimeter wood scale merely *assume* they are.




The graph shows the approximate relationship between the relative humidity (Rh) of air and the moisture content of typical softwoods. The horizontal lines show the typical range of humidities met in various circumstances. Wood kept in these environments will gradually come into equilibrium at the moisture content levels indicated on the vertical scale.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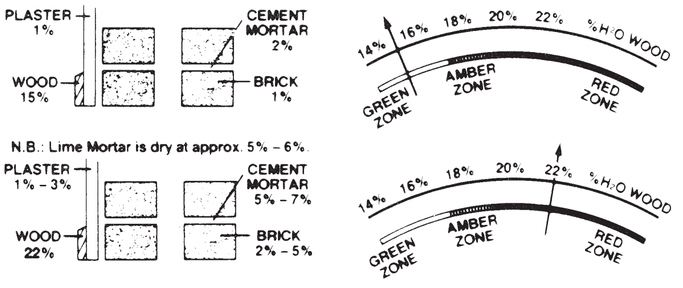
### Wood-Moisture-Equivalent (cont'd)

75% Rh is 'safe' in building materials. It is equivalent to 16-18% moisture content in wood. Graphs could also be drawn for every other building material, but the materials are so **immensely variable** that such graphs would be so different for every brick, every sample of mortar, plaster, concrete or wallboard, and all would be very different from wood. If several different materials are built into the same wall the effect of this will become obvious.



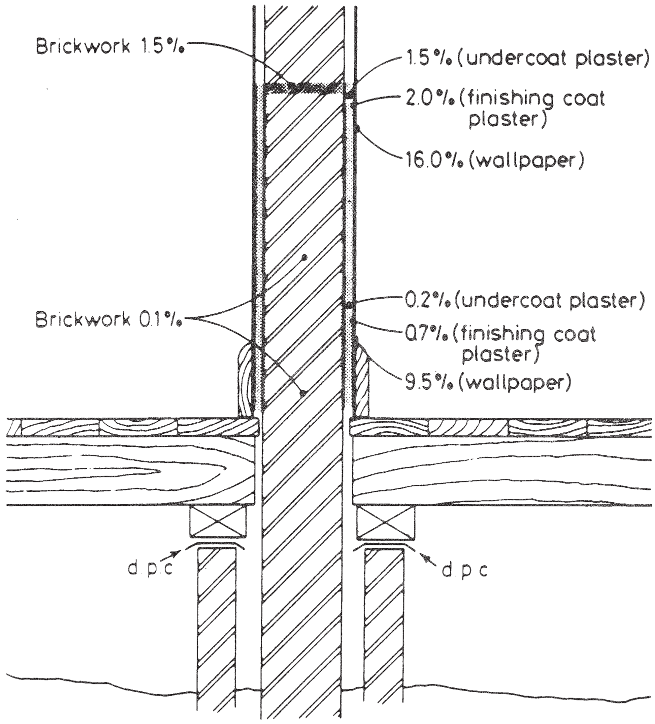

This diagram illustrates the different moisture contents of different building materials, all in moisture equilibrium. The upper example shows the air-dry (safe) condition; the lower example a wet (dangerous) condition. The figures on the right are WME readings on a moisture meter.

### A word about salts

The problem which formerly prevented a purely instrumental diagnosis of causes of damp is the effect of salts in the material: Salts left by rising damp, by penetration of water from an old flue, or by leaching out of old walls over many years can cause an electrical moisture meter to over-read the moisture level. This disadvantage can be overcome by use of a **Salts Analysis Kit**. This will tell if salts (eg due to rising damp) contaminate a surface. If not, then a high moisture meter reading means a high level of moisture.

Even if salts are present, it is possible using a Moisture meter in conjunction with **Deep Wall Probes** to obtain true moisture readings. The diagram overleaf shows why: Readings taken inside an affected wall at just above skirting level will not be significantly affected by salts.

Conversely, if the moisture meter shows the inside wall to be dry, the problem cannot be one of rising damp; indeed, it must be one of surface moisture – possibly condensation.




Concentration of salts in a wall in which rising damp has **persisted** for **80** years. The figures show the percentage by weight of chloride plus nitrate. The shaded area is heavily contaminated (redrawn from Building Research Establishment Digest No. 245, revised 1987).

Materials are infinitely variable in their composition. The weight of dry mortar will vary according to the ratio of sand and cement - so will concrete with the added distortions introduced by differing types of aggregate. The clay for brick-making varies from region to region; plaster" can be a large number of different mixes.

The % moisture content of a material is the amount of water in it divided by its weight, when dry:

$$\frac{\text{wet weight} - \text{dry weight}}{\text{dry weight}} \times 100 = \%\ \text{moisture content}$$

A heavy material has a much lower moisture content than a light material which has the same amount of water in it. It follows that for the same amount of water the greater the dry weight, the smaller the percentage of moisture. As a result, lime mortar is dry at 5%, yet cement mortar at 5% is wet. Some bricks are dry at 2%, while others are wet at 2% - and most plasters are wet at 1%.

It can be seen that knowing the percent moisture content of a building material (other than wood) does not tell you whether that material is wet or dry.



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