



Guidance Document:

The Use of Moisture Meters to Diagnose Dampness in Buildings

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1. INTRODUCTION

Moisture meters and other methods of determining the presence of moisture in building materials cannot differentiate between dampness from one source and that from another. It is therefore necessary to consider all potential causes of dampness before arriving at a final conclusion.

Sources of Dampness

Dampness in buildings, other than those recently constructed usually arises from one of three natural sources:

- Rain Water
- Water from the air within the building
- Water from the ground

2. RAINWATER

Direct Penetration

This most frequently occurs to walls that are exposed to the prevailing wind and the dampness may affect all or part of the wall. Such dampness is likely to be particularly apparent during or directly after periods of heavy rain.

Penetration due to Defects and Disrepair

Faulty rainwater goods i.e. gutters, and down pipes, together with the lack of an effective throating or drip to windowsill and other projections, are common causes of dampness to walls. Defects to roof coverings, pointing and external renderings etc., must also be considered and an external inspection should be included in any investigation of dampness to external walls.

3. WATER FROM THE AIR WITHIN THE BUILDING

Condensation

Condensation is usually most apparent on cold surfaces, e.g. external walls, particularly in areas with poor air flow, e.g. corners of rooms, behind large pieces of furniture etc.

Condensation is frequently misinterpreted as rising damp, but this confusion can be eliminated by establishing the moisture profile of the wall. Condensation is often accompanied by mould growth on the surface of the walls. Free standing gas heaters may cause and certainly will aggravate condensation problems. Dampness due to condensation can be difficult to eliminate but can usually be controlled by a combination of ventilation, heating, and the insulation of cold surfaces or by the use of dehumidifiers.

Hygroscopic Salts

Moisture attracting (hygroscopic) salts can draw moisture from the atmosphere and their presence can cause a significant dampness problem.

Although most commonly associated with walls that suffer, or have suffered from rising damp, hygroscopic salts may also occur on chimney breasts due to the combustion of fossil fuels.

In coastal areas the sand used in construction may be contaminated and walls some distance inland may be affected by salt spray carried by strong winds.

Localised salt problems due to contamination of building materials on the site can occur.

The presence of hygroscopic salts can be confirmed by analytical tests of samples of wall plaster, etc.

4. WATER FROM THE GROUND

Rising Damp

Rising damp is characterised by a descending moisture gradient within a wall from floor level sometimes up to a height to 5 ft. (approx. 1.5m).

N.B. This is not necessarily so when measured with an electric moisture meter. Rising damp above 5 ft. is unusual but can occur if an impermeable barrier exists to the face of the wall at low levels thus reducing the rate at which water is given off by evaporation.

Rising damp is inevitably accompanied by salt problems and frequently these are not apparent until corrective action is taken in respect of the rising damp when the salts migrate to the surface and manifest themselves as efflorescence (usually sulphate salts) or in the case of hygroscopic salts (chlorides and nitrates) as damp patches.

Lateral Penetration

Where the internal floor level is below external ground level, i.e. the wall is wholly or partially earth retaining; moisture in the ground will penetrate laterally into the walls unless blocked by a vertical damp proof membrane.

In areas where the water table is high lateral penetration of dampness may be aggravated by hydrostatic pressure.

5. METHODS OF MOISTURE DETERMINATION

The correct diagnosis of the cause of dampness is aided by an ability to map the distribution of moisture within a wall and, ideally, to quantify the degree of dampness.

There are three fundamentally different ways of determining and/or measuring moisture in brickwork and other masonry:

1. Gravimetric - Oven drying method
2. Chemical - Carbide method
3. Electrical - either *Conductivity or Capacitance*

Whilst other methods exist these are the most commonly used methods to accessing moisture within walls of buildings.

Gravimetric Method

Drilled samples are taken from the test area and are placed in securely sealed bottles. The total moisture content is then determined by oven drying in the laboratory. By using the detailed technique described in BRE Digest 245, the moisture content due to the presence of hygroscopic salts can also be determined.

Chemical Method

A sample of standard weight is mixed with calcium carbide powder in a pressure vessel, fitted with a gauge. The reaction between calcium carbide and any water in the sample gives acetylene, and the volume produced, hence its pressure, is directly proportional to the moisture content of the sample. The gauge is calibrated to give a direct reading of the moisture content of the sample.

Electrical Methods

Conductivity Meters

An electrical circuit through the meter is completed by placing two probes on the surface, or by embedding them in the depth of the wall. The electrical resistance of the wall is influenced by the moisture content of the wall. The variations in resistance are then indicated on the meter.

Capacitance Meters

Either the meter itself (carrying adjacent conducting plates) or separate head (carrying conducting concentric rings) are placed on the surface whose moisture content is to be measured. The meter readings measure the fringe capacitance in the sensor, which is influenced by the moisture content in the wall.

Some instruments (of both types) use a flashing light, or audible tones to indicate changes in moisture content, either instead of, or as well as the conventional meter dial or digital read out.

6. USES AND LIMITATIONS OF AVAILABLE METHODS

The gravimetric or oven drying method

This is a destructive method in that drillings must be taken from the wall. It is also time consuming and obviously requires the use of laboratory facilities and therefore cannot be used on site. It is by far the most accurate method available and can be used to distinguish between ground moisture and hygroscopic moisture (see BRE Digest 245).

The Chemical Method

The use of carbide meter is also a destructive method. It can, however, be used on site and is quite rapid, taking 3-5 minutes per sample. It has good degree of accuracy but will not distinguish directly between ground moisture and hygroscopic moisture although comparison and in-depth drillings will frequently give good indication.

The Electrical Methods

These are non-destructive and readings are taken easily and quickly. In the majority of walls which are of uncertain composition, the electric method does not provide a percentage reading of the moisture content since readings may vary from material to material.

Readings are usually recorded on a relative or arbitrary scale which enables the pattern of moisture to be established.

The electrical method does not give a direct reading of moisture content and its value depends much upon the ability of the user to interpret the results obtained by its use.



In experienced hands it is a useful tool but it can give rise to confusion and incorrect diagnosis, particularly where ground salts are present or the substrate being tested is itself a conducting medium e.g. contains carbon granules or a foil backed paper has been used on the wall, or where the dampness is due to condensation.

Electrical methods are not satisfactory in order to check the efficacy of a new damp proof course in a building that has suffered from rising damp. In such cases, salts will be present, to a greater or lesser extent, whether the new damp proof course is effective or not. The presence of these salts alone can produce high readings.

7. GENERAL DIAGNOSIS AND SURVEY WORK

The electrical methods are the most acceptable for general survey work since a number of readings can be taken in a very short time without unacceptable disturbance to the decorations or wall face.

8. DISPUTES

Where the investigation is being carried out in an attempt to resolve a dispute an accurate quantitative assessment of the moisture content of the wall (s) is usually required. In this event the use of Gravimetric or Chemical methods will be necessary. Where disputes involve plastering and the possibility of contamination by hygroscopic salts the Gravimetric method is able to provide greater and more accurate information.

9. SELECTION OF SITE (S) FOR TESTING

Where several known or suspected sources of moisture ingress are present determination of the pattern of dampness and the degree of moisture present is unlikely to be conclusive. Ideally the sites selected for testing should be unambiguous, e.g. an internal wall. Where it is necessary to carry out investigations on external walls all known sources of damp should be rectified and the wall allowed a reasonable time to dry out before proceeding with the detailed tests.

10. SAMPLING

Because of the possible influence of hygroscopic salts, condensation and ambient humidity, the results of tests taken from plaster alone can be misleading. If doubts exist concerning a diagnosis or in case of dispute “in depth” drilling and sampling below and at intervals above the DPC line may be necessary, moisture contents being determined either by the oven drying method or carbide meter. Whilst the use of insulated probes with an electrical meter can help to eliminate interference from surface contaminants it must be remembered that the readings obtained can only be relative, not absolute and must, therefore, be interpreted with caution.

If samples are to be removed from the site for testing, they must be placed in airtight containers to avoid loss (or indeed, gain) of moisture in transit. It is essential to keep a careful record of sample location in order that the correct interpretation can be placed on the results.

Erroneous results can be obtained if an active electro-osmosis system of dampcoursing is present in the wall under investigation. These should be switched off before tests are taken.

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