TECHNICIAN'S ADVISORY

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The Technicians' Advisory column is intended to add to a technician's existing knowledge base and offer alternative solutions to specific issues.

It is not intended as a definitive tutorial, nor to imply the recommendation of a particular methodology, since all situations must be assessed individually and any action taken is entirely the responsibility of the technician or organisation involved.

MEASURING MOISTURE USING ELECTROMAGNETIC FIELDS

It is great that we have a variety of different tools we can use to measure moisture. Most provide results in a quick and easy way, but they all require interpretation and an understanding of their limitations.

... all electromagnetic field meters are very responsive to changes in moisture content

In the last issue (R18/3) we discussed some of the challenges of using Equilibrium Relative Humidity (ERH) measurements. If those challenges can be overcome the ERH measurement is very valuable as it is independent of the substrate being measured.

Consider that you have a surface floor covering material that has a requirement for moisture levels of 75% ERH. When you have an ERH reading of 75% within a sand and cement screed OR an anhydrite (gypsum) screed you have reached that target. Even though the actual percentage of the moisture content of the materials will be different.

Let's now look at a potentially even simpler measuring system. This one uses an electromagnetic field to assess the moisture content within materials. We are familiar with these meters known as "radio" meters or "non-destruct meters". In many ways they are simpler to use, although its important to understand their limits!

HOW DO THEY WORK?

They create an electromagnetic field around the instrument to a distance of typically between 2 cm and 5 cm depending on manufacturer's specification – some meters have an adjustable depth range.

An electromagnetic field is an energy field that exists in space around the meter. The meter has two electrodes and measures the time taken for the transmission of the electric impulse between the two electrodes via this field.

Materials within that field disrupt the field. This slows the rate of transmission between the electrodes. When the meter is placed onto a floor surface the field is disrupted not only by the material of the floor but also by the moisture within the floor.

Materials vary in the way they disrupt the electromagnetic field. This property is known as the material's relative permittivity. A material with a low permittivity has less influence on the electromagnetic field produced by the meter. Materials with a high permittivity have a bigger influence.

The reason these types of meters work so well with moisture is that concrete and other building materials have a relatively low permittivity value of less than 5. On the other hand water has a much higher permittivity of around 80. So even a small amount of moisture can significantly disrupt the meter's electromagnetic field.

These meters respond well to small amounts of moisture content in the material being measured. As the amount of water reduces over time, while the floor is drying, the influence of the water on the electromagnetic field decreases. The meter reveals this change with a lower reading for moisture content.

Even though all building materials have fairly low relative permittivity values compared, with water, they do differ. For this reason some of these meters have a choice of scales you can select, to adapt the meter reading to different materials. The advantage for us is that we have a meter that can be used on a wider range of different materials more accurately.

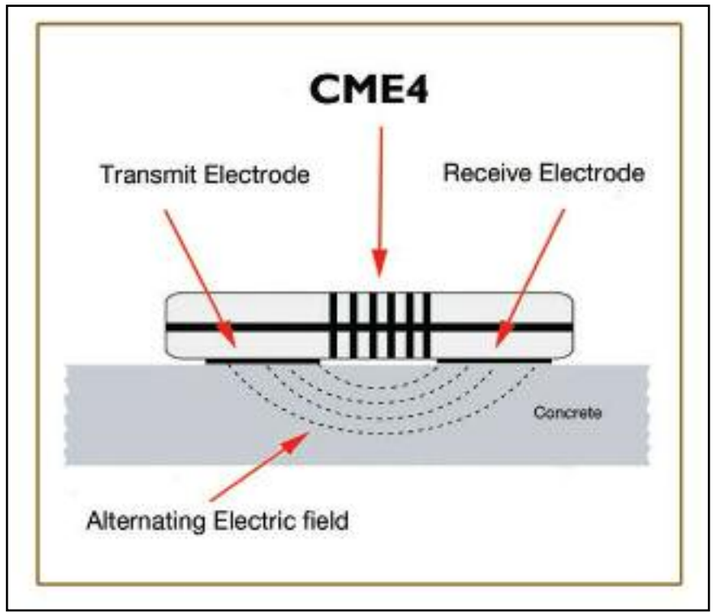
TYPES OF READINGS

All manufacturers of these type of electromagnetic field meters provide a relative scale for moisture. With these you can compare one area of a material with another area, and discover where there are elevated moisture levels. This is a valuable way to quickly survey a water damaged property. You may compare a known dry area of a material with a suspected damp area. In the damp area you will have a higher reading indicating higher moisture levels.

... even a small amount of moisture can significantly disrupt the meter's electromagnetic field

The limitation is that the readings can be influenced by materials beneath the surface that you cannot see. These may produce higher readings if they have a higher permittivity value. You can often avoid mistaking this for moisture if you make comparisons with other areas.

Some of the manufacturers also have instruments that are designed to work with specific types of materials. An example is the CME range which is designed specifically for concrete and screeds. This meter does have a relative scale but it is also calibrated to a scale of percentage moisture content.



Where the CME range of meters show a value on the concrete scale it is moisture content by weight for concrete. It is intended to be equivalent to drying a sample in an oven at 100ºC.

It's important to recognise that this concrete scale is not equivalent to a reading from a Carbide Meter. Some of the CME meters do have a Carbide Equivalent scale (called CM Equiv) which should give a reading comparable to the Carbide Meter. It is equivalent to drying a sample in an oven at 60ºC. So it will always be a lower value than the concrete scale.

Note that the "Gypsum" scale on the CME meter is a relative scale and cannot be read as a % moisture content.

The limitation of the concrete scale is that it can be influenced by surface moisture. Make sure the surface is dry. It can also produce incorrect results if surface coatings such as levelling compounds are present. If present these should be removed before taking readings.

When using moisture content by weight with a floor screed, you would need to know whether you were measuring a sand & cement screed or an anhydrite (gypsum) screed. This is because in the situation above where both materials were at 75% ERH the sand & cement screed would have a moisture content of around 3% and the anhydrite screed less than 1%. This is because they have different isotherm curves. [See Technicians Advisory in *Recovery* R18/3]

... they (moisture meters) all require interpretation and an understanding of their limitations

Remember that all the electromagnetic field meters are very responsive to changes in moisture content. They will confirm drying is progressing. In some cases they can confirm that your target has been reached. You will find them quick and easy to use. A valuable tool for the water damage technician.