Moisture Content-1

Almost all construction materials contain moisture, in some materials the moisture content will be higher than others. In the making of plaster or mortar for example water is added as a ratio, this water starts a chemical reaction with the cement or gypsum then the material 'sets' into a solid hard material.

Moisture is present in bricks or building blocks, water in used in the manufacture of these materials. Timber also contains Moisture this is not added to the material, it is natural Moisture from the growth of trees.

Moisture in Construction has to be carefully monitored, as excess within the building will damage the structure. Metal's will start to corrode, plaster will decay and crumble, timber will swell causing doors will stick, floors to deform and then timber decay, mould will form on surfaces, and people will be affected by high Moisture levels or if you like 'damp'.

Moisture in building is unavoidable? We get Moisture from living, breathing contains moisture, cooking, washing, a damp cold day's all add to the moisture level within the property.

So what in the correct moisture level?

There is no definitive answer.

The first thing we need to do is keep out the obvious causes of Moisture.

- Rain, via the roof, tiling or slating, the flashings or leadwork, the walls penetration and saturation poor quality bricks, render or pointing.
- Ground water, via absorption lack of DPC or DPM (rising damp)
- Inappropriate construction for the location of the property, rendered walls combined with fully filled cavities, incorrect roof coverings, in severe exposed areas, wrong materials in coastal areas.

There are many more examples how Moisture enters buildings, but how do we control it?

- With new properties the solution is easy good design, good quality materials, good building practice and good workmanship. The correct building in the right place.
- Heat and ventilation are also necessary within the correct balance, we don't want to spend vast sums of money heating the property to then expel it all! Extract Moisture where necessary bathrooms, shower rooms, kitchens, other rooms must have a small amount of trickle ventilation for healthy living. If a room has a fire, ventilation is required for health and safety to stop a build up of fumes, fires also give off Moisture during combustion.
- Below floors and in roof spaces we control Moisture with natural ventilation this is very important, if timber exceeds a 20% Moisture level then timber can start to decay in various forms, the types of decay depend on the level of Moisture. Also the mechanical fixing ie nails, screws etc can start to corrode leaving the structure un-safe.

Moisture Content-2.

How do we measure it in the various materials?

There are all types of measuring equipment used by Labourites and scientists what use is that to the ordinary person without the knowledge and equipment. If we say the moisture content of timber is not to exceed 20% timber how can we work this out.

- *Moisture Content Determination by The Oven Drying Method*

  The oven drying method is the standard way of determining wood moisture content. With this method a piece of wood is initially weighed and then dried in an oven at 90°C ± 2°C. The timber can be assessed in stages as the drying process is carried out and recorded. Drying is continued until the piece is completely dry (when no further weight loss occurs) and this oven dry weight recorded. The loss in weight during drying indicates how much water was originally present in the piece and the moisture content can be calculated simply, as follows:

  $$\text{Initial moisture content (\%)} = \frac{\text{Initial (wet) weight - Dry weight}}{\text{Dry weight}} \times 100$$

  For example, if the initial weight of the piece was 345g and its dry weight 300g, then the difference of 45g is the weight of moisture initially in the piece and its initial moisture content would be:

  ((345g – 300g)/300g) x 100 = 15%

  45g of moisture have been lost during the drying process, making this 15%

  Alternatively the formula can be written:

  Moisture content (%) = [(Initial weight/Dry weight) - 1] x 100

  So that only the division sum needs to be carried out:

  [(345/300) - 1] x 100 = 0.15 x 100 = 15.0 %

  When a particular piece of wood is oven dried, the moisture content value obtained (as above) is an average moisture content for that piece and it is important to emphasise that actual moisture contents at different locations within this piece may vary considerably from the average value.

Most building materials are calculated using the same method, if we concentrate on timber for the remainder of the exercise.

If timber is to dry (Moisture content to low) the timber will shrink, crack, joints become loose and twist so the type of timber and it's Moisture content has to be correct for the 'end use'.

We do not make furniture with a Moisture content of 18-20%, this has to much Moisture, we do not want carpentry timbers @ 8-10% this is to low, the carpentry timber (white wood), will at this low Moisture content split, shake and twist, once in position will swell loosening the joints.

Moisture Content-3.

So how do we measure the Moisture content in materials?

We use electricity and a Moisture meter the wetter the material the easier the electrical current will flow (less resistance).

- *Moisture Content Determination be Electrical Moisture Meters*

  Moisture meters are available which can give an instant indication of the moisture content of a piece of wood by measuring one of its electrical properties. The electrical resistance of wood increases rapidly with decreasing moisture content once this is below about 25 to 30 %, whilst the capacitance and dielectric loss both decrease with a fall in moisture content at all levels.

  Most commercial moisture meters measure the electrical resistance between two electrodes, which are driven into the wood. The electrical resistance of the wood is then converted into percentage moisture content and displayed on the meter. The following sections are concerned with the use of this type of meter.

  To avoid artificially high moisture content readings, it is important to maintain good electrode contact with the wood as the measurements are taken. With short needle or blade electrodes this can usually be achieved by applying a controlled pressure to the electrode holder; with long insulated electrodes, the hammer action, by which they are driven into the wood, ensures good electrode contact.

- *Moisture gradient*

  During drying the average and core moisture contents in thick pieces will be significantly higher than those in the outer layers. Meters with short electrodes may therefore consistently underestimate the overall moisture content - they may also give inaccurately high results if, for example, the surfaces of the timber under test have been exposed to an unusually damp atmosphere or to rain.

  

  With equipment having long insulated probes these problems are largely overcome, and the electrodes can be driven in to provide moisture content readings at considerable depths.

  It is also possible to obtain a rough indication of the moisture gradient within a piece because the resistance between the exposed electrode tips can be recorded at various depths as the electrode is driven into the piece.

Moisture content-4.

- *Advantages of Moisture Meters.*

For many uses, frequent moisture content readings can be taken without loss in value of the timber (oven drying results in a small loss in value).

Many readings can be obtained quickly and with minimal effort (oven drying is a slower process and more labour intensive).

Recommended practice is to monitor moisture content and moisture distribution during drying with the oven method. For each load several samples of wood should be monitored and care is needed to select and position these so that the progression of drying can be monitored and controlled accurately. Once the wood is below fibre saturation point, moisture meters can be used to give estimates of the moisture gradients along a piece and to confirm that the pieces being monitored by the oven method are indeed representative of the load.

So much for the technical stuff.

How do we take care of our construction material…….. timber.

- Joinery timber should be dried to the required Moisture content prior to manufacture, delivered and kept dry.
- Carpentry timbers need to be kept dry and covered until installation, then installed as quickly as possible to keep dry.

What have we learnt so far.

- Most construction materials have a Moisture content.
- Materials with Moisture can shrink if the Moisture content reduces and swell if the Moisture content increases.
- Materials can decay with to high Moisture content.
- Different materials have different Moisture contents.
- Timber in different locations within a property has different Moisture content.
- How to check Moisture content in timber.
- The probe uses Moisture to measure the % of Moisture in the material by an electric current passing between two pins in the material.
- Different timbers have different Moisture levels.
- Large timbers may have high variations in Moisture levels from the central core to external surface.
- Benefits of ventilation.