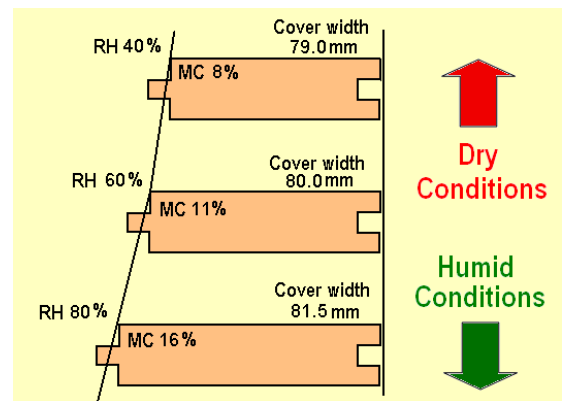


The correct use of resistance moisture meters with timber floors and how to interpret the results is of prime importance. Before going any further consider why it is necessary to determine the moisture content. As a floor installer you are often concerned about the subsequent movement that is going to occur in a floor through humidity changes. That is whether the floor is likely to gap after installation or swell, and by how much. Because we know that board cover width changes with moisture content, determining the moisture content of our flooring can assist in determining expected future movement. Therefore with timber flooring, if the cover width of the board didn't change with moisture content then we would not be as interested in taking moisture content readings. In other instances moisture meters are useful to determine moist conditions in timber flooring that may affecting floor performance.



If you are taking moisture content readings you also need to be measuring cover widths.

By simply looking at the end of a pack of flooring, it is often possible to obtain information about board moisture contents within the pack even without using a moisture meter. For example, in a three month old pack of flooring, some moisture changes are likely particularly at board ends. If the manufactured cover width was 80 mm and:-

- board widths were say 79.6 mm and 80.4 mm, then the flooring is likely to have been dried to within narrow moisture content bounds and not undergone significant change since.
- board widths were say 78 mm to 81 mm with some boards cupped, then it is indicative of flooring dried to wide moisture content bounds and if installed the floor is likely to show some wide gaps at board edges and this is particularly noticeable where board ends meet.
- board widths ranging from say 80 mm to 82 mm is often indicative of some flooring becoming wet after manufacture and would be unsuitable for laying in that state.

Moisture meters can then be used to help confirm what the measurements are indicating. Unless meters are used with knowledge of board cover widths the meter readings are going to be of much less value.



Corrected moisture meter reading is 15% and the board cover width is 78.82 mm. The higher reading and narrow cover width can indicate even higher moisture content when manufactured.

Resistance Moisture Meters

Principal of operation

The electrical resistance of timber reduces as the moisture in timber increases. These meters measure the flow of electricity between two pins where the timber acts as an electrical resistor between the pins. The scale on the moisture meter is graduated to read moisture content. Wood temperature affects the readings and for this reason wood temperature above or below 20°C, requires correction to the reading. Temperature correction if not already taken care of by the meter is applied before species correction. Species correction is necessary as two different timber species at the same moisture content may not have the same electrical resistance. Meters are generally set up relative to one species and that is Douglas Fir (Oregon) and species corrections are then applied for other species. There comes a point where the water in timber is so low that the resistance is difficult to measure accurately or on the other hand sufficiently high that the resistance does not change greatly and is prone to greater errors. These meters generally provide reliable results between 6% and 25 % moisture content.

Types of meters

A wide variety of meters are available. All have two pins that are used to penetrate the timber but the pins may vary in length from approximately 6 mm in length up to 50 mm. The longer pins are often insulated up to the pointed ends to prevent surface moisture effects from interfering with core measurements. Those with longer pins are also usually of the 'sliding hammer' type, which provides a means of driving the pins into the timber. The sophistication of the meters varies greatly in terms of features such as inbuilt temperature correction, pre-programmed species calibration and depth indication. Many of the meters now come with a calibration block.

Using resistance meters

- The calibration of the meter should be checked prior to use and this is usually done with a test block that contains electrical resistors that correspond to the moisture contents specified on the test block.
- Measurements are then taken in clear timber and where possible at least 400 mm from the ends of boards.
- In the general range being measured pin direction does not make a significant difference.
- The pins are driven to the desired depth to which the moisture content reading is required. As case and core measurements can be significantly different, use of meters with short pins may require boards to be cut and the pins inserted in the end grain to provide a better estimate. In high density timbers holes may need to be drilled for the pins.
- The pins need to be in firm contact with the timber, otherwise low readings may occur.
- Readings should be recorded to the nearest 0.5% and read shortly after penetration.
- Each reading is to be corrected for wood temperature first (provided this is not done automatically) and then for species (providing the species has not been set on the meter).
- Refer to Table 1 for temperature correction factors and species correction factors for some common commercial species. Additional temperature and species correction factors are available in AS 1080.1.

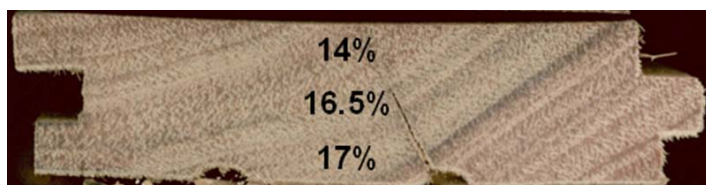
Meter accuracy and precautions using resistance meters

When using meters a common sense approach is necessary and each reading should be evaluated and if not as expected, then the reasons for this should be considered. The meters generally provide a reasonable estimate of the moisture content to $\pm 2\%$ accuracy in the measuring range from 8% to 25% and as stated above readings

should be recorded to the nearest 0.5%. There are a number of factors that are known to affect meter readings and these are:-

- Measurement necessitates damaging the surface of the timber
- The method is conducive to only taking a relatively small number of sample readings
- Readings near the board surface can be significantly different from the core or lower case
- Low battery can cause low readings in high moisture content material
- Uncertainty over species can make species corrections difficult
- Species such as Brush Box have very high species correction factors and are prone to greater error
- Use for extended periods in high humidity environments can raise meter readings
- Meters only read the wettest part that the exposed surfaces of the pins are in contact with
- Surface moisture can provide artificially high readings not reflecting wood moisture content
- Salt water or any preservative treatment salts can affect meter readings and will usually raise them
- Electrical wiring in walls can affect the readings

If meter readings are not in line with what is expected, then this may necessitate oven dry testing to more accurately determine the moisture content. But note that oven dry testing of a section is providing average moisture content and therefore may not distinguish say high moisture content in the lower surface of the board.



This board has taken up moisture from beneath resulting in higher moisture content toward the lower surface of the board. Consequently it has cupped and its cover wider over 81 mm.

Assessing packs of flooring

Where there are up to five packs of flooring provided to a job, twenty five readings should be taken with a near equal number from each pack. That is if you have three packs there would be readings in eight boards from two of the packs and nine from the third pack. The moisture meter should penetrate to about 1/3 the thickness of the board and the results recorded remembering to apply temperature and species corrections. Along with these readings the cover width should also be checked and recorded.

Example

Species: Blackbutt

Date inspected: 14/8/08

Pack No: Q1354		Pack No: Q1349		Pack No: Q2013	
Date manufactured: 6/3/08		Date manufactured: 6/3/08		Date manufactured: 14/6/08	
Corrected Moisture Meter reading	Cover Width	Corrected Moisture Meter reading	Cover Width	Corrected Moisture Meter reading	Cover Width
11 %	80.0 mm	11 %	80.0 mm	14 %	79.2 mm
11 %	80.1 mm	11 %	79.7 mm	12 %	80.1 mm
10 %	79.7 mm	11 %	80.3 mm	13 %	79.5 mm
11 %	80.2 mm	11 %	79.9 mm	11 %	80.2 mm
11 %	79.9 mm	12 %	79.7 mm	13 %	80.1 mm
11 %	79.6 mm	12 %	79.8 mm	15 %	78.2 mm
12 %	79.9 mm	11 %	79.8 mm	12 %	79.9 mm
12 %	79.7 mm	10 %	79.9 mm	13 %	79.6 mm
11 %	80.0 mm				

In this example the first two packs are manufactured on the same date and both the moisture meter readings and cover widths are as expected and no issues would be expected in laying such a floor. The third pack manufactured at a different date has some boards with higher readings and narrower cover widths which can be indicative of some flooring being high in moisture content when machined. In such an instance further sampling and investigation is necessary. If going back to the supplier or manufacturer it is necessary to provide them with all test results.

Temperature and Species Corrections

Table 1 - Temperature correction factors for resistance moisture meters. (Note: This is wood temperature not air temperature)

Meter reading %	8 %	10%	12%	14%	16%	18%	20%	22%	24%
Wood Temperature	Temperature correction to be added to or subtracted from meter reading before applying the species correction factor								
15 °C	Nil	Nil	+1	+1	+1	+1	+2	-	-
20 °C	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	-
25 °C	-1	-1	-1	-1	-1	-1	-1	-1	-
30 °C	-1	-1	-1	-2	-2	-2	-2	-2	-2

Table 2 - Species correction factors for resistance moisture meters.

(Note that this only contains some common species – refer to AS 1080.1 and FWPRDC report PN01.1306 for a more complete list. The tabled figure are based on the Deltron Moisture Meter. Figures may differ for other meters - refer FWPRDC report PN01.1306).

Meter reading %	8 %	10%	12%	14%	16%	18%	20%	22%	24%	Density
Species	Resistance meters are generally calibrated to Oregon (Douglas Fir). Apply the following species corrections after temperature correction.									At 12% MC
Oregon (Douglas Fir)	0	0	0	0	0	0	0	0	0	550
Australian Hardwoods										
Yellow Stringybark (NSW)	+4	+4	+3	+3	+2	+2	+1	+1	0	900
Red Ironbark Broad Leaved & Red (NSW)	+4	+3	+3	+3	+2	+2	+2	+1	+1	1100
Grey Ironbark (Qld)	+3	+2	+2	+2	+2	+2	+2	+2	+1	1105
Forest Red Gum - Blue Gum (Qld)	+3	+2	+2	+2	+2	+1	+1	+1	0	1000
White Mahogany – Honey Mahog. (Qld)	+2	+2	+2	+2	+2	+2	+2	+2	+2	1000
River Red Gum (Vic regrowth)	+2	+2	+2	+2	+2	+2	+2	No data	No data	900
Rose Gum - Flooded Gum (Qld & NSW)	+2	+2	+2	+1	+1	0	0	0	0	750
Sydney Blue Gum (NSW)	+2	+2	+1	+1	0	0	-1	-1	-1	850
Blackbutt (Qld & NSW)	+1	+1	+1	+1	+1	+1	+1	+1	+1	900
Turpentine (Qld & NSW)	+1	+1	+1	+1	+1	+1	+1	+1	0	950
Blackbutt (NSW regrowth)	+1	+1	+1	+1	+1	0	0	0	No data	900
Grey Ironbark (NSW)	+1	+1	+1	+1	0	0	0	0	0	1100
Red Ironbark Narrow Leaved (Qld)	+1	+1	+1	0	0	0	0	0	0	1090
Blackwood (Tas)	+1	+1	0	0	0	-1	-1	-2	-2	640
Myrtle (Tas)	+1	+1	0	0	-1	-1	-2	-2	-2	700
Spotted Gum (Qld Citridora)	+1	0	-1	-1	-2	-3	-3	-4	-5	1100
Shining Gum (Vic)	+1	0	0	0	0	0	0	-1	-1	700
Jarraah (WA regrowth)	0	0	+1	+1	+1	+1	+1	+1	No data	780
Grey Gum (Qld & NSW)	0	0	0	0	0	0	0	0	0	1050
Tallowood (Qld & NSW)	0	0	0	0	0	0	0	0	0	1000
Alpine Ash (Vic & Tas regrowth)	0	0	0	0	0	0	-1	-1	No data	650
Mountain Ash (Vic & Tas regrowth)	0	0	0	0	0	0	-1	-1	No data	650
Messmate (Vic & Tas regrowth)	0	0	0	0	-1	-1	-1	-1	-2	750
Southern Blue Gum (SA plantation)	0	0	-1	-1	-1	-2	-2	-3	-3	700
Spotted Gum (NSW Regrowth Maculata)	0	-1	-1	-2	-3	-4	-5	-5	-6	1100
Brush Box (Qld & NSW)	0	-1	-2	-3	-4	-5	-6	-8	-9	900
Manna Gum - Satin Ash (NSW)	-1	-1	-1	-1	-2	-2	-2	-2	-3	800
Imported Hardwoods										
European Beech	+3	+3	+3	No data	No data	No data	No data	No data	No data	690
Kwila / Merbau (Malaysia)	+2	+2	+2	+2	+1	+1	+1	+1	+1	850
Sugar Maple (Nth America)	-1	0	+1	+1	+1	+1	+1	+1	No data	740

Softwoods										
Araucaria - Hoop Pine (Qld & NSW)	+3	+2	+2	+2	+1	+1	+1	0	0	550
Radiata Pine (Vic)	+2	+2	+2	+2	+2	+2	+2	+2	+2	550
Cypress (Qld & NSW)	+2	+1	+1	+1	+1	+1	+1	0	0	700

Note:- No correction factors are published for Gympie Messmate, New England Blackbutt or Northern Box.
Oven dry testing is the preferred method for Brush Box.