Acclimatisation of solid T&G flooring

Australian timber flooring association

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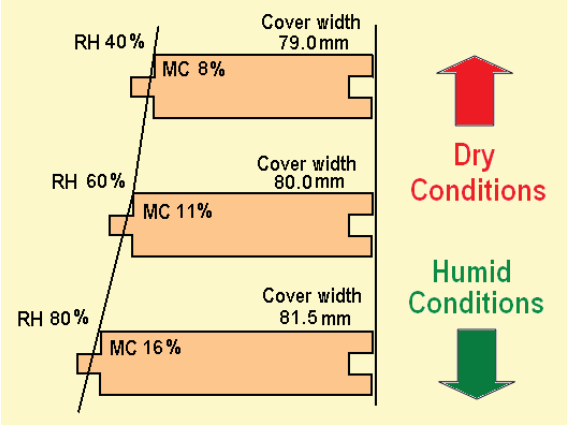
Introduction

Timber is a natural product and is hygroscopic in nature. That is, it responds to changes in weather conditions by taking up or giving off moisture so that its moisture content is in equilibrium with its surroundings. During the life of a timber floor, the boards generally take up and lose a little moisture in a cyclical way as the changing seasons and heating and cooling systems influence the relative humidity and temperature in the local area and within the building. As a result, boards expand and shrink a little. The amount of expansion and shrinkage is generally small and often not noticeable. However, longer periods of hot dry weather or wet weather may give rise to some noticeable shrinkage or expansion in the width of the boards. Similarly, heating and cooling systems will also bring about changes.



As such, timber flooring will adjust its moisture content to be in equilibrium with the humidity and temperature conditions within a building. That is the flooring will adjust to the Equilibrium Moisture Contents (EMC's) of the environment inside the lived-in house or building. The adjacent diagram shows the general relationship between moisture content, relative humidity (RH) and board width. At 25ºC and 60% RH the EMC is 11% and at 25 ºC and 80% RH the EMC is 16%. If the moisture content of the floorboards at the time of installation is higher or lower than the in-service EMC, then the floorboards will either lose or take on moisture and when this occurs there will be either shrinkage or swelling after installation as indicated in the diagram by a change in board width. Acclimatisation is simply a process of getting the moisture content of the flooring closer to its expected in-service moisture content so that shrinkage or swelling of the floorboards will be less after installation.

Changing practices and techniques

In years gone by, both the understanding of the drying process and the techniques available, were not as advanced as those of today. In some instances, flooring was supplied unseasoned or partly seasoned. There was an expectation that the floorboards would be cut in upside down and used as a work platform and that during the time that they were upside down, they would acclimatise to their surroundings. Flooring

that was supplied as seasoned, often had a range of moisture contents within the pack that was wider than would be acceptable today. Again, there was an expectation that if the floorboards were cut in upside down, they would acclimatise. In any event, it was thought that they were likely to be closer to the expected in-service EMC than they would be if they were not acclimatised at the site.

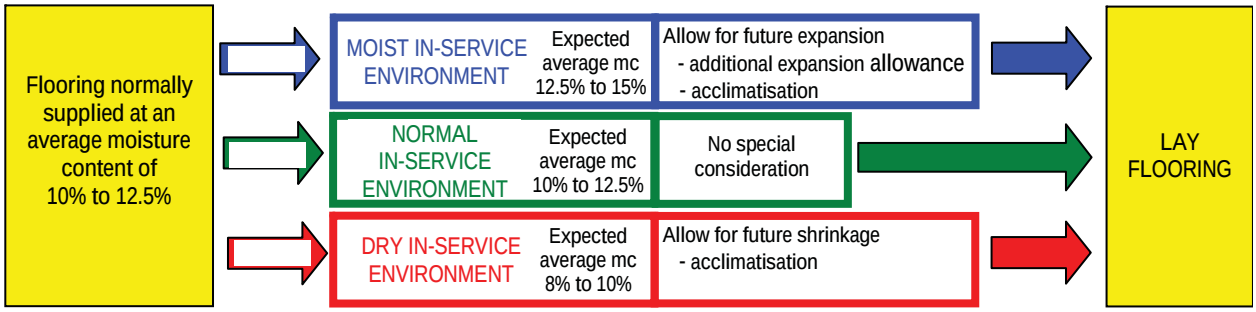
Acclimatisation was nearly always recommended although many suppliers and installers did not really understand all of the aspects of the process. Suppliers could however claim in those instances where the floor did not meet expectations that the floorboards were not properly acclimatised. It should be noted that perhaps the expectations of yesteryear were not as exacting as those of today. With improved drying practices and greater knowledge of the drying process, floorboards can now be supplied at a moisture content that is predictable and reasonably uniform. Australian flooring is generally dried to be in the range from 9% to 14% as set out in Australian standards covering the manufacture of the product. Within this range it is normally supplied at an average moisture content between 10% and 12.5% and often toward the lower end of this range. However, in high humidity locations an average moisture content toward the higher end of this range is desirable. For this reason acclimatisation and provision of additional expansion allowance particularly needs due consideration when lower moisture content flooring is installed in more humid environments.

Acclimatisation will not correct poor drying practices

Poor drying practices result in a wide moisture content distribution. Poorly dried boards will have been produced with a fairly uniform cover width at manufacture, however there may be significant variation in board moisture contents. Therefore with acclimatisation, the moisture content range of poorly dried boards will be reduced but the cover width variation will be increased. Because of the increased variation in cover width, the floor will be difficult to lay. If not acclimatisation, the moisture content range of poorly dried boards will still be reduced and the cover width variation will still be increased, but this will occur after installation as the boards adjust to the in-service EMC's. It follows that poorly dried floorboards are not conducive to an attractive feature floor irrespective of whether they have been acclimatised or not.

Installation moisture content and acclimatisation

Acclimatisation of floorboards prior to installation is not necessary when the average supplied moisture content of the flooring is near the expected average in-service moisture content. Unnecessary acclimatisation can cause problems especially if the floorboards are acclimatised to a building site environment that is somewhat different from the expected in-service environment. This chart provides a guide as to when acclimatisation should be considered.



Successful acclimatisation relies on a number of factors

- Determining the expected in-service EMC's within the dwelling.
- Ensuring acclimatisation is to the desired in-service moisture content rather than to the EMC of the building site environment.
- Estimating the moisture content of the flooring prior to installation. This requires the proper use of resistance moisture meters as outlined in ATFA Information Sheet 8 – Resistance Moisture Meters. Species corrections for common flooring species is contained in that information sheet and corrections figures for other species may be found in AS 1080.1.

- Determining how wide the expected in-service EMC variation is throughout the year.
- Assessing the moisture content change required (e.g. from 10% to 13%).
- Evaluating the time necessary for adequate acclimatisation. The time depends on the moisture content change required and the response time of the particular species. Some species have a fairly quick response time while some have quite a slow response time.

The expected in-service environment is influenced by a number of factors, including-

- Heating which has the effect of lowering the EMC in the house. In cool temperate climates this can create quite a dry internal environment. The environment in the upper level of a heated two storey house is often drier than the lower storey.
- Refrigerated air-conditioning if used continuously can dramatically reduce the general moisture content within the house.
- Shutting a house up when away on holidays for long periods can create abnormal humidity conditions and therefore some ventilation may need to be considered depending on the time of the year.
- Full length windows, large glass areas and skylights which admit direct sunlight can create sunroom conditions with high temperatures and low moisture conditions causing flooring to shrink.
- Proximity to bodies of water such as the ocean, a river, lake, dam or wet lands.
- Prevailing winds that are either moist or dry.
- Climatic variation throughout the seasons.
- Local environment e.g. leafy gully, rural residential areas or generally treeless area.

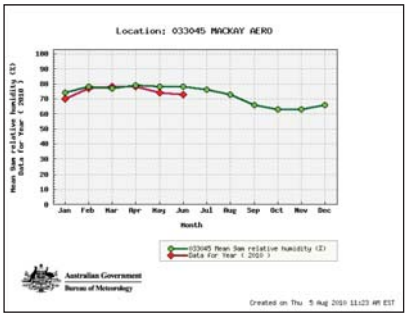
If the environment inside a lived-in house has an EMC variation from summer to winter of no more than about 3%, there is not likely to be a very noticeable difference in the floor as it adjusts to the changing EMC. However if that environment has an EMC variation from summer to winter above 3%, there is likely to be more noticeable difference. A general rule of thumb is that for every 3% change in moisture content, the dimensional change of the timber will be about 1%. A 3% change in moisture content will cause a change in width of up to about 0.8 mm in a board with a cover width of 80 mm. A 3% change in moisture content will cause a change in width of up to about 1.80 mm in a board with a cover width of 180 mm.

Methods of acclimatising 19 mm thick floorboards prior to laying

Provided below is an example of acclimatising flooring to a more humid Queensland in-service environment where the intent is to raise the average moisture content of the flooring prior to installation. A similar approach is also taken when acclimatising flooring to a dry in-service environment, but in this case it is a lowering of the average moisture content prior to installation. This can be applicable to inland localities and in places such as Canberra and in the southern states where the in-service environment is of low humidity from heating systems, during periods of the year when external humidity is high.

Step 1

Determine the expected EMC range within the dwelling by use of weather data and consideration of the locality and heating or cooling systems. In a location such as Mackay weather data *(refer to www.bom.gov.au and select the applicable state, climatic averages and select the graph for 9am RH)* suggests that external EMC is likely to vary between about 12% (65% RH) and 16% (80% RH) and with an internal environment, when taking the specific locality and dwelling into consideration, we may consider that the expected in-service EMC variation is likely to be about 12% to 14%.



Temperature	Moisture content at various relative humidities																	
°C	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
0	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3
10	1.4	2.6	3.6	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.3	11.2	12.3	13.4	14.8	16.4	18.4	20.9	24.3
20	1.3	2.5	3.6	4.5	5.4	6.2	7.0	7.7	8.5	9.3	10.1	11.0	12.0	13.1	14.5	16.0	18.0	20.5	23.9
30	1.2	2.4	3.4	4.3	5.2	6.0	6.7	7.5	8.2	9.0	9.8	10.6	11.6	12.7	14.0	15.5	17.5	20.0	23.4
40	1.1	2.2	3.2	4.1	5.0	5.7	6.4	7.1	7.9	8.6	9.4	10.2	11.1	12.2	13.4	15.0	16.8	19.3	22.7

Step 2

Determine the moisture content of the flooring that has been delivered. A resistance moisture meter in most instances will provide a good estimate of board moisture contents (Refer to AFTA Information sheet No.8 Resistance moisture meters). Note that temperature and species corrections factors need to be applied to meter readings if not programmed in the meter. Ten readings should be taken from each pack of flooring and the range of estimated moisture content should be recorded. To provide an example we will assume a floor temperature of 20ºC and that Blackbutt flooring gave moisture meter readings of 8% to 10%. With applicable temperature and species corrections applied this is an estimated moisture content range of 9% to 11% and we will assume an average of 10%. Always be aware that meters provide an estimate of moisture content and if the results from this testing are not as expected then further assessment may be necessary. The ATFA provides oven dry testing on a fee for service basis that can provide actual moisture contents of flooring samples.

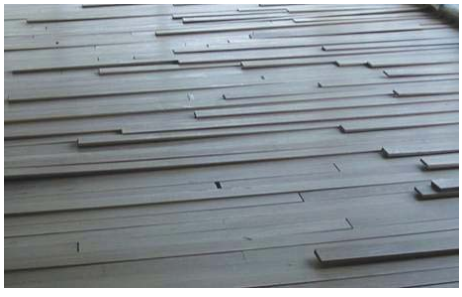
Step 3

Testing has indicated that the flooring was supplied at about 10% moisture content and the average in service moisture content is expected to be13%. Hence we would expect the floor to take up moisture from the air after installation and swell. We therefore need to consider whether the environmental conditions are suitable to raise the moisture content. Looking at the graph and table above it suggests that we will get most effect between January and July. Acclimatisation in October or November would have little benefit as the external EMC at that time averages just 11%. We will assume that it is April and we have decided to acclimatise the floor.

Step 4

The flooring is to be stacked out in the dwelling environment so that the air can pass through each layer of flooring as shown in the adjacent photo. Note that the timber separating the boards, which may be floor boards, needs to be directly above one another. Alternatively boards can be cut in and lose laid if over a structural sub-floor as shown in the second photo.

Step 5



Ten shorter boards should be fitted together and a measurement taken across them prior to the period of acclimatisation. The moisture contents of each of the boards should also be recorded and averaged. After say a week both the measurement over ten boards and moisture contents should again be checked. In our example we would be expecting both an increase in the measurement and average moisture content. From this the need for additional acclimatisation can be determined. Note that acclimatisation for a two week period will often bring a significant change. If conditions are such that desired gain in board width is not achieved then addition expansion allowance will need to be considered. Particularly, in climates that are of high humidity for a significant period of the year an effective way of achieving this is by providing small gaps of say 1.5 to 2mm every 8 to 10 boards across the floor. This method is applicable for all floor fixing methods except when a troweled bed a rigid adhesive is used. In such climates we know that the boards will increase their moisture contents and cover widths and therefore these gaps close and their location becomes difficult to discern within a period of six months or so from installation.

Some Important Points

- Where shrinkage of floorboards during service life is a potential concern, the selection of narrower boards will lessen the potential concern. Any change in cover width as a result of a given moisture content loss is much less noticeable in narrower boards than in wider boards.
- If the house is to have a controlled, constant environment, these systems should be operating while the floorboards are acclimatising.
- Acclimatisation of floorboards prior to installation is not necessary where the average supplied moisture content of the flooring is near the expected average in-service moisture content.
- Acclimatisation won't work unless the conditions are right. That is if the intention is to raise the average moisture content of the supplied flooring then suitably high humidity is needed.
- The moisture content of floorboards will be influenced by the building site conditions which include moisture given off from drying concrete slabs and/or any cement rendering, moisture from wet trades and moisture from damp soil especially following periods of rain.
- Acclimatising in dry climates does not negate the need to provide for floor expansion during periods of wet weather.
- Acclimatisation will not correct poor drying practices.

Practices with overlay boards less than19mm thick prior to laying

Thinner overlay flooring is prone to respond to humidity changes more quickly than 19 mm thick flooring and can distort with the traditional acclimatisation practices as outlined above. For this reason manufacturers generally state that overlay should not be acclimatised but that a period of adjustment is required after laying and prior to sanding and finishing.

Thinner overlay is always laid over a structural sub-floor and therefore moisture uptake and loss from the air is always through the exposed surface assuming that the sub-floor is of correct moisture content to accept the floor. The adhesives used beneath the boards will also act in restraining the movement of the lower board surface. Therefore, due to these factors small changes can occur after installation that may result in minor cupping and gapping if board moisture contents reduce or peaking with board joints tight and raised, if pressure from expansion is experienced. Peaking also gives a cupped appearance to a floor.

A period of two weeks between installation and sanding and finishing is generally sufficient to accommodate these changes provided conditions are close to the expected in-service conditions. Additional care should however be exercised during very hot and dry periods or very wet periods as such conditions can have a more extreme and detrimental effect on the floor. If such conditions occur after laying, the floor may need some protection during this time, such as a temporary sealer.