

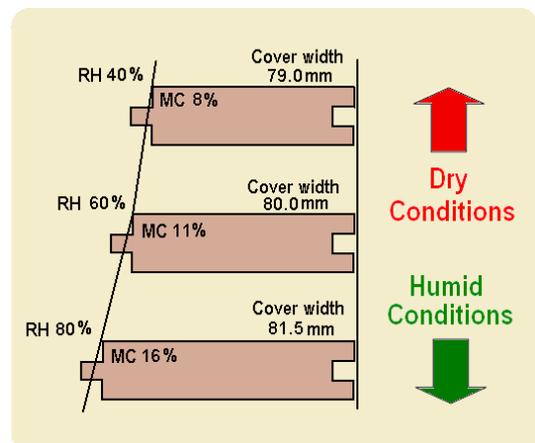
Introduction

With solid timber floors the topic of gapping at board edges and the possibility of filling those gaps is a subject often raised. There are many views on both the acceptability of gapping at floor board edges and also if gaps do exist, whether they can be successfully filled. This information sheet will discuss both these aspects.

Why do some floors show gaps?

It is apparent that some solid timber floors stay relatively tight with no observable gapping throughout their life whereas in other instances gaps may be present only during drier months or in some floors gaps may be present throughout the year. There are many factors that affect whether a floor will gap at board edges and these include the flooring moisture content range when installed, the locality environment, internal conditions at the time of installation and after occupancy, board width and the method of installation.

Before considering these, it is important to understand that timber is hygroscopic and that coatings are permeable. Essentially this means that irrespective of the coating applied, flooring boards absorb moisture if air humidity is high and release moisture to the air if humidity is low. When timber flooring changes moisture content there is a corresponding change in board width. For many hardwood species an unrestrained 80 mm wide floor board will shrink or swell by about 0.25mm for each 1% change in moisture content. The relationship between moisture content, relative humidity and board width is indicatively shown in the diagram.

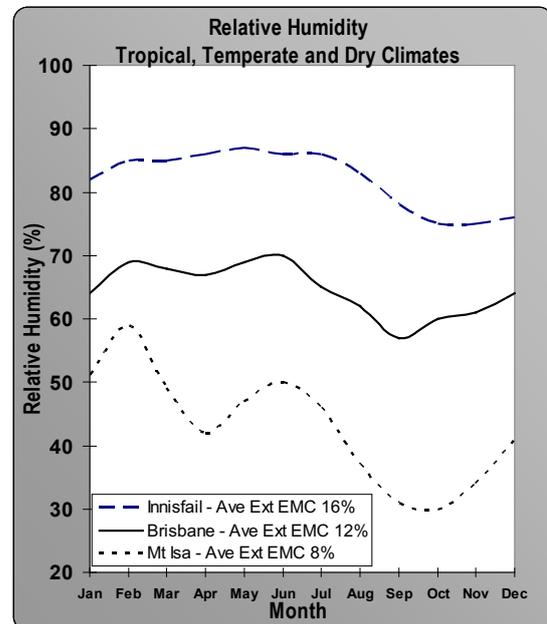


Now, if we consider the factors that influence whether a floor may gap or not we first need to consider the moisture content of the flooring. When flooring is dried not all boards are going to be the same moisture content. The Australian Standard AS 2796 Timber Hardwood – Sawn and milled products permits flooring to be manufactured in the range from 9 to 14% and although manufacturers may target 10 to 12% some board will be a little higher or lower. However, once in service the boards will further equalise and due to this, differences in cover width will result. Just as an 80mm wide board may change in width by 0.25mm for each 1% change in moisture content, with wider board flooring the movement (shrinkage or swelling) will be proportionally greater. That is a 130mm wide board about 0.45mm and for a 180mm wide board 0.55mm for each 1% change in moisture content.

Next, we need to consider the location and conditions at the time of installation. When a floor is being installed in a new dwelling it is not the 'lived in' conditions that will prevail after occupancy. The flooring, at the time of installation, more influenced by outside weather conditions prevailing at the time. These can

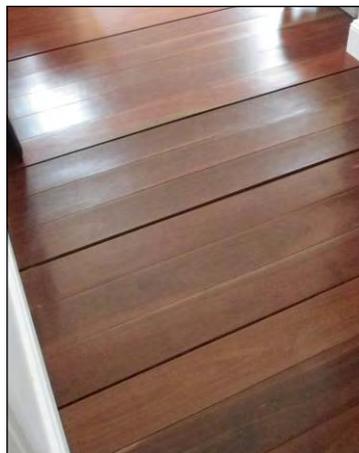
vary significant on both a daily and monthly basis and are not able to be controlled by either the flooring manufacturer or installer. The installer after checking the moisture content and board width of the flooring may decide to acclimatise the flooring but acclimatisation is very dependent on the conditions being right at the time. In some localities the relative humidity, and remember this largely dictates board shrinkage of swelling, will be quite variable throughout the year in some localities, while in other localities it may remain either high or low throughout much of the year.

This graph helps to illustrate this where the average 9am monthly humidity is shown for Innisfail, Brisbane and Mt Isa. In Innisfail humidity remains quite high throughout the year. In Brisbane it is moderate and in Mt Isa both low and quite variable. Note that external humidity ranges in Brisbane, Sydney, Melbourne and Perth are similar and as these are major markets, timber flooring is generally manufactured to about 11%. However, what is also important to understand is that flooring manufactured at 11% moisture content will increase to about 15% moisture content in Innisfail with boards manufactured 80mm wide often increasing in width to perhaps 81.5mm and in Mt Isa 80mm wide boards would be at say 8% moisture content and 79mm wide (refer to the first diagram). As such you can think that boards will be less prone to gapping in Innisfail as floors expand in this climate, but in Mt Isa boards are more prone to shrinkage gaps due to both the low humidity and the variation in humidity throughout the year. A floor laid in Mt Isa in February will experience very different conditions to a floor in October.



The photos show the dry conditions that generally occur in Mt Isa and the associated wide gapping resulting from an installer not understanding the effects that low humidity in this locality can have on a timber floor.

Now you may be thinking that you don't live in Mt Isa but that you live in say Melbourne. Therefore, we next need to consider the influences on the in-service environment and particularly in parts of the country that experience cold winters where heating the dwelling over winter is the norm. The way the 'physics' works is that when there is rise in temperature there is a lowering of the relative humidity. So that means that when houses are heated in these climates, although humidity may be high outside, a lived-in dwelling through heating will be creating lower humidity and much drier conditions inside. It is in part for this reason that average in-service conditions in say Canberra and Melbourne are a little drier than Sydney or Brisbane and gapping can be more prevalent in floors in these cities. But is not only internal heating that needs to be considered as the likes of large windows and the direction they face also affects the heat gain and humidity in the dwelling. You may have noted that Adelaide has not been mentioned so far. The climate in Adelaide can range from conditions of being similar to other major centres but Adelaide can also have significant periods of being extremely dry and again under such conditions shrinkage gaps often develop.



The final aspect to be discussed relates to the installation method. Solid timber flooring is very versatile in that it can be laid over many different subfloors and by a variety of methods. When floors are laid direct to joists the underside of the floor experiences external conditions and these can differ significantly from

internal conditions. Boards on joists or battens are also not held as firmly as say a floor that is full trowel bed adhesive fixed to a particleboard or plywood subfloor and therefore will be subject to greater movement. Although, full adhesive beds reduce board movement this also places greater stresses in the boards and on the subfloor and this too can influence the fixing method.

So, what if my solid timber floor has gaps?

At this point, you should be considering that some gapping at board edges in solid timber floors is quite normal and that for a variety of reasons including manufacture, locality, conditions at installation, board width, fixing method, house design particularly with floor exposure to direct sunlight and heating or cooling systems that some gapping will occur in many floors. Ever since there have been solid timber floors there has been gapping present at board edges. Whether gaps will occur or not, does not depend on whether it is a 'new' floor or 'old' floor, but to all the above factors, many of which cannot be controlled at manufacture or installation.

This however is not to say that gapping can at times be excessive and when this is the result of either manufacture or installation then remedial work is often necessary.

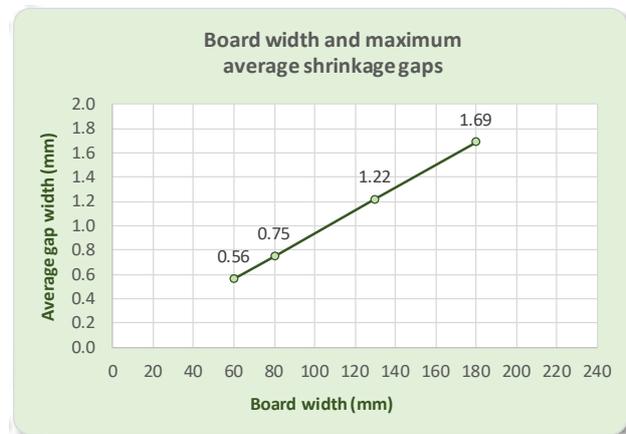
Concerning acceptable gapping, ATFA uses the following assessment in its publications.

With solid timber strip flooring shrinkage gaps over ten boards can average 0.75 mm for an 80 mm wide board floor under drier internal conditions. For wider boards, proportionally wider average gapping can be expected. The appearance should indicate gapping between most boards and be free from irregularly spaced wide gaps associated with edge-bonding. The provision of expansion gaps as part of the installation process and evident throughout the life of the floor is acceptable.

Provided below are two photos. The first, which is considered acceptable, has gapping at the upper limit where the average gap size was 0.75mm and the second photo has gapping that is not considered acceptable where the average gap size was 1.8mm. Note that it is the average gap size over ten boards so some gaps are greater than the average and other less than the average.



The first graph below shows the board and gap widths for the floor in the first of the above photos. This more clearly shows how both the board and gap widths vary across this section of floor and reflect the natural movement experienced with timber. Regarding the average gap size that could be expected based on board widths other than 80mm, it can be determined from the second graph or by simply dividing your board width by 80 and then multiplying by 0.75. As an example, for 108mm wide flooring it would be: - $108/80 \times 0.75 = 1.0\text{mm}$.



It also needs to be considered that 'Guides to Standards and Tolerances' as provided in some states by the QBBC, VBC and Fair Trading NSW regard any gap wider than 2mm, of at least 1m in length and in non-heat affected areas of a floor, as requiring attention. These publications do not consider the effect of board width although in NSW and Victoria if wider gapping is expected from the system, the wider gaps are not seen as needing attention provided that the owner has been informed in writing and their written acknowledgement obtained.

If I have gaps at board edges, can I have them filled?

This question is often asked and for many years advice has been not to fill them. It should be apparent from the information above that there can be significant seasonal movement in a floor. Many floors will gap at board edges during drier conditions and this may be due to a change in weather or from heating during winter months, yet when more humid conditions are present those gaps will close. Hence the problem with filling gaps is that the filler can dislodge with natural seasonal movement in the floor. If the floor has filler applied during drier conditions it can extrude out under humid conditions and if applied under humid conditions it can crack and fall out under dry conditions, as shown in the photo. Due to this it is general practice for flooring contractors not to fill gaps at board edges.



However, it is also evident that at times gaps at board edges have been filled successfully, but we need to consider why. In the past many floors were fixed direct to joists over open subfloor spaces and thereby subject to greater seasonal movement. Floors laid direct to joists is no longer the most common installation method with most floors now being laid over particleboard or plywood subfloors or particularly in Western Australia direct to concrete. In many instances a full adhesive bed has been used and as indicated above this restricts seasonal board movement. When a floor has stabilised over time, meaning that manufacturing moisture content variations have reduced with time and the floor has also settled into the seasonal

variations of its installation environment, then ongoing seasonal changes to board width and gap size can be quite small. This stabilisation period can be in the order of two years from installation. In these instances, some flooring contractors have been prepared to fill gaps at board edges and have achieved reasonable success. But also realise some risk is still present and results may not always be fully successful. In other instances, floors that have been down for some years may have a few wider gaps at board edges and again reasonable stability in the floor has been evident. That is the gap size does not vary much throughout the year. In such instances a flexible filler such as 'Sikaflex' has been used in these wider gaps with success.

So, to summarise this, it should not be an expectation that a flooring contractor will fill the gaps at board edges in a floor. However, with certain types of floors, age of floor, board width and installation method some contractors may agree to fill such gaps. Solid timber floors do not generally expand or shrink appreciably in length and therefore there is no issue with filler that may be used at board ends and similarly filler used in nail holes. With new floors that have gapped due to problems with the flooring at the time of laying, due for example to the flooring becoming wet prior to or at installation, or where edge bonding is involved, then filling cannot be expected to work as these floors are not stable. Edge bonding refers to the condition where the coating has acted as an adhesive in board joints. This causes irregular spaced gapping subject to greater seasonal variation in the size of gaps. The photo shows a floor that became wet on installation that also edge bonded after coating and is exhibiting irregular wide gapping 4 and 6 boards apart.



Finally, it is important to realise that small gaps at board edges are not a problem and considered a natural part of the seasonal movement that occurs in many timber floors. If attention is paid to ensuring the flooring remains dry prior to installation, that the flooring moisture content is appropriate to lay, that the dwelling conditions are suitably complete for installation and that moderate internal conditions are provided then issues with wider gaps, where the temptation may be to fill them, will seldom occur.