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FOREWORD

The Building and Construction Authority's (BCA) Construction Quality Assessment System (CONQUAS) has been widely adopted as the de facto national yardstick for measuring the workmanship quality of building projects. To meet the rising expectations of homeowners, the Quality Mark (QM) Scheme was launched in 2002 to promote a higher consistency in workmanship standards for private residential developments. To help projects achieve the standards in CONQUAS and QM, BCA has developed a series of publications on Good Industry Practices for different trades.

This "Good Industry Practices – Engineered Wood Flooring" is part of the CONQUAS Enhancement Series to promote good practices. Engineered Wood Flooring is an emerging product that addresses a myriad of competing issues like environmental sustainability, use of productive technologies and need for high construction quality. The smart use of renewable resources in a factory environment leads to a high quality product that is as good as, if not better than, flooring comprised of solid timber. Engineered Wood Flooring is environmentally friendly, reduces labour intensive trades and attains consistent high quality that is cost effective.

This guide shares some of the good practices adopted by practitioners and contractors on how good workmanship quality Engineered Wood Flooring can be achieved on site. It provides simple and practical illustrations on the types of Engineered Wood Flooring, quality checks during manufacture and proper installation methods. Common issues associated with Engineered Wood Flooring, their causes and possible solutions to address them are highlighted.

This guide is not meant to be a definitive publication on or dictate how Engineered Wood Flooring must be designed and installed. It only serves to illustrate some of the good practices designers and contractors have adopted while designing and installing Engineered Wood Flooring. We gratefully acknowledge the contributions of practitioners in the production of this guide and trust that the industry will find this publication useful. We welcome any contributions from readers to further improve this and subsequent editions of this guide.

Lam Siew Wah
Deputy Chief Executive Officer
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Building and Construction Authority

ACKNOWLEDGEMENT

This "Good Industry Practices – Engineered Wood Flooring" was developed with inputs from Architects, Developers, Builders, Specialist Contractors and members from various industry associations and organizations.

A Technical Committee was formed to review the contents and good practices identified. We wish to thank the members of the Technical Committee for their valuable contributions.

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Agencies, Organizations and Firms
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Australian Timber Floor Association
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Goodrich Global Pte Ltd
Syarikat Malaysia Wood Industries Sdn. Bhd.

We would also like to thank Syarikat Malaysia Wood Industries Sdn. Bhd. for sharing Unilin's patented click system in this guide.

Ang Kian Seng
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CONTENTS

1. INTRODUCTION

High property prices, high end-user expectations for quality finishing, amidst a tight

option with a simplified installation process as compared to conventional timber flooring.

This guide provides simple and practical tips on how good quality engineered wood flooring can be installed on site. It highlights the salient quality issues involving design, installation

to high quality standards and improved productivity.

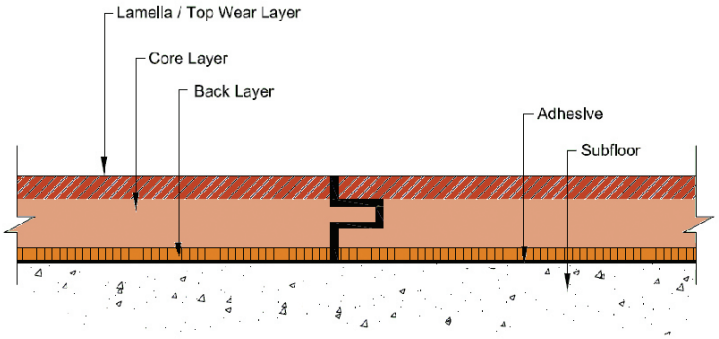
2. DESIGN

2.1 Common Types of Engineered Wood System

Engineered wood flooring can be laid directly onto the subfloor or an underlay based on the following systems:

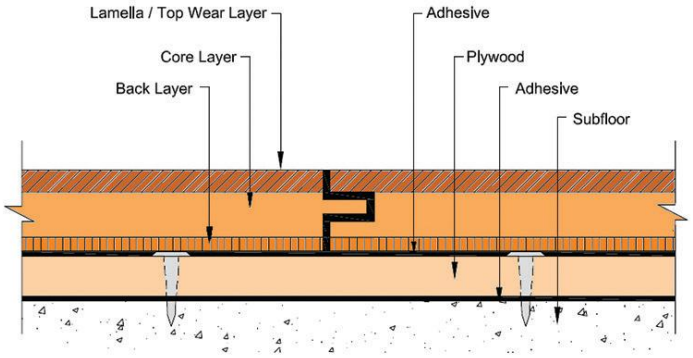
Direct Lay to Subfloor

For direct laying of engineered wood, the flooring strips are glued to the subfloor using compatible adhesive. This is effective for subfloor that meets evenness tolerance. This method of laying provides a solid feel for the user.



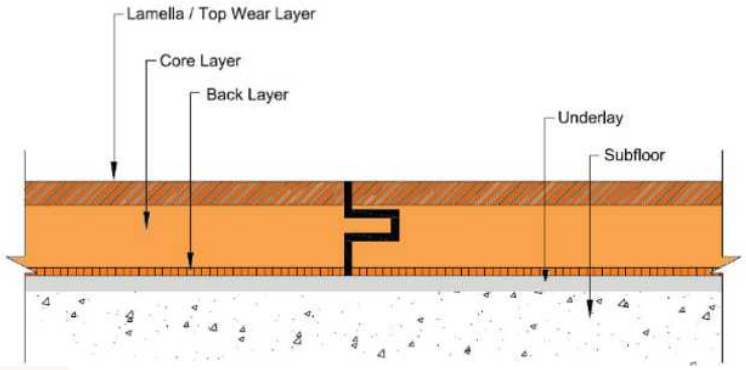
With Underlay and Fixed

The engineered wood flooring strips are glued to an underlay (plywood, rubber or felt) which is fixed to the subfloor using suitable adhesive and/or nailing. If plywood is used, it is recommended to use Water Boil Proof (WBP) plywood.



With Underlay and Floating

The underlay is not fixed to the subfloor and the engineered wood flooring strips are installed without fixing to the underlay. This method provides a floating feel.



The underlay can accommodate subfloor unevenness (within 3mm in 2 metres) and provide a smooth surface to receive the engineered wood. However, this should not be used as the solution to correct the levelness of the floor screed. Proper supervision and good workmanship are critical and should be employed to achieve the required levelness of the floor screed.

The underlay helps to cushion the flooring and makes it comfortable to walk on. Some underlays also act as a moisture barrier protecting the wood from any moisture ingress from the concrete floor and dampen the sound of steps making it a friendly environment for the user and also neighbours in the lower floor.

Each engineered wood floor manufacturer provides recommendations for installation of its product. These should be adhered to.

2.2 Subfloor

The condition of subfloor greatly affects the performance of the engineered wood flooring. The following are key factors that need to be taken into consideration.

Moisture

There are various methods, be it non-destructive or destructive, to test the moisture in the concrete / floor screed.

One of the methods is to check the Relative Humidity (RH) of concrete. This is done by drilling a small hole in the subfloor based on tester's specification 24hrs before the testing and sealing it up. A reading within the hole 24hrs later will indicate the RH of the concrete. The optimum is to have the RH below 80%.

The common method used in Singapore is measuring the moisture content of the subfloor. This is by placing the measuring device on the subfloor surface. The surface moisture content should be less than 6% or as specified by the flooring manufacturer.

If RH or moisture content exceeds the requirement, moisture barrier is to be applied on the subfloor surface.

Evenness

A relatively flat subfloor, with a tolerance of 3mm over 2m length, allows proper and even adhesion of the engineered wood flooring and result in even floor finish.

Excessive unevenness of the subfloor may lead to air pockets between the engineered wood flooring and the subfloor and thus cause noise and excessive deflection of the floor under foot traffic. Excessive unevenness would also result in over-usage or wastage of adhesive.

If the evenness of the floor screed is not within the required tolerance, proper rectification or self-levelling compound could be considered to be applied to the surface to achieve the required levelness.

Hardness

The subfloor surface should not be brittle or chip off or crack when tested for hardness. This is to ensure that the subfloor has the capacity to receive the nailing of underlay or the engineered wood flooring. The rigidity and hardness of the subfloor can be tested by tapping a hammer on the surface or using the grid-scratching method.

Cleanliness

The subfloor surface needs to be clean and free from debris, paint and dust before the underlay or wood flooring is installed as impurities will affect the bonding.

The subfloor surface can be grinded and vacuumed to prepare it for the next process.

2.3 Timber Planks

There are wide selections of timber species in engineered wood flooring. Timber being a natural product will have natural attributes e.g. knots, grains and various colours and tone. There can be big contrast of tone and colour even within a single species. In the production process, manufacturers would sort them in categories and collection. Some collections have minimum colour variation and a knot free look, while some would have contrasting tone with prominent knots. The photographs below show some of the collections available.

Clear and well balanced

Rustic with natural attributes

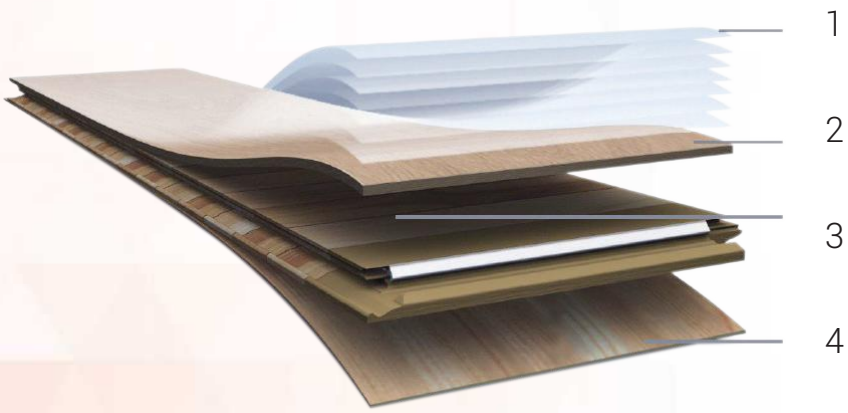
End users should be informed of the features and characteristic of the floor that they have selected. While attempts are made to sort to the control sample, it would be difficult to produce identical and consistent look as timber is a natural product.

Engineered wood flooring can be produced with a single plank lamella or 2-3 strips lamella. Single plank generally cost more and would have lesser colour variation and tonality within the board. Functionally, single plank and 2-3 strips plank are similar.

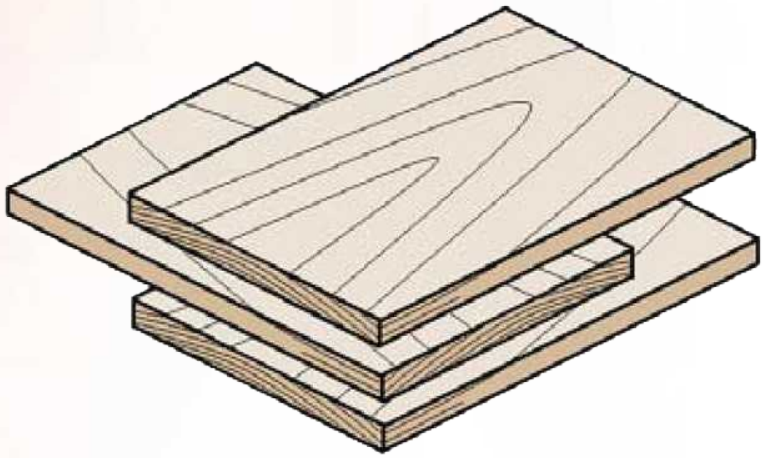
Full plank top

Multi strip top

2.3.1 Structure of Engineered Wood Plank

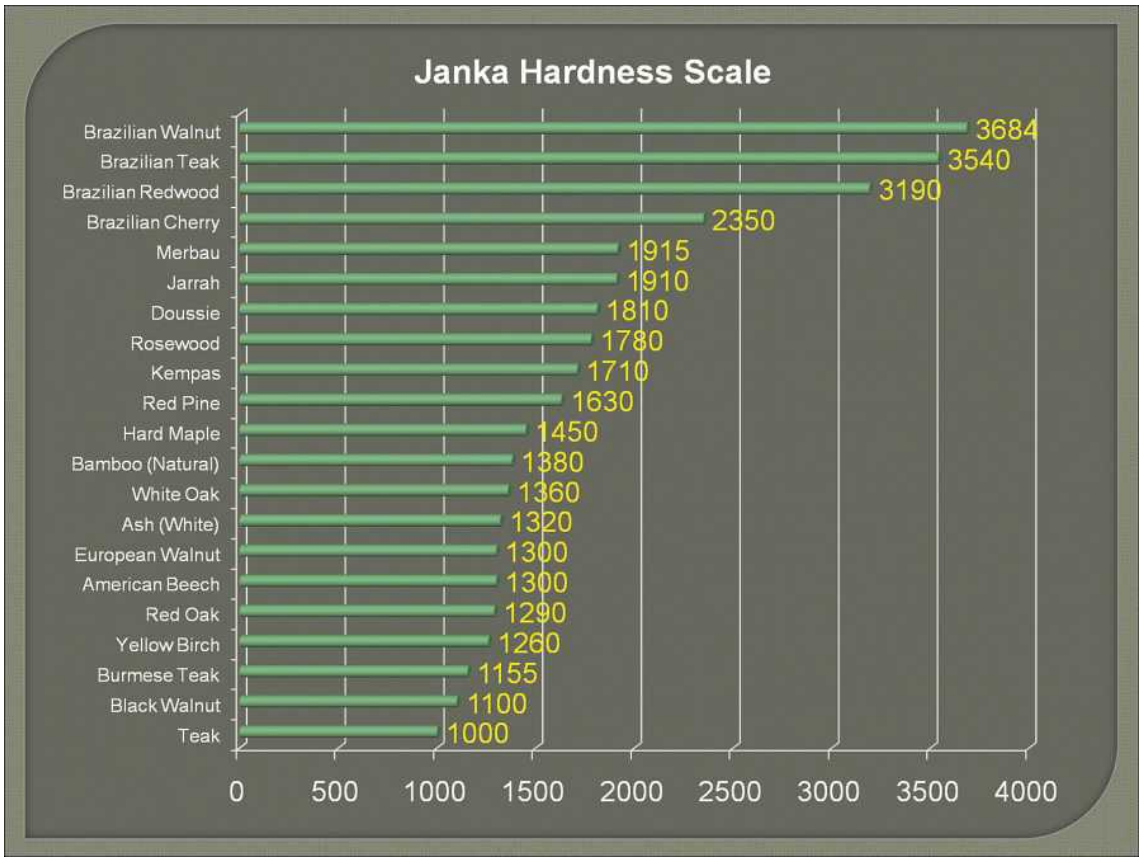


1. Finishing Layer	• UV-cured solvent free lacquer or oil, wax.
2. Hardwood Wear Layer (commonly known as Lamella)	• Solid wood layer, most commonly 2-4mm thick.
3. Core Layer	• Usually made of hardwood, spruce or compressed plywood with thickness based on manufacturer's specification. • Absorbs stress and strain and keeps the floor stable.
4. Back Layer	• Usually plywood or medium soft wood. • Combines with other layers to prevent the floor from cupping and warping.

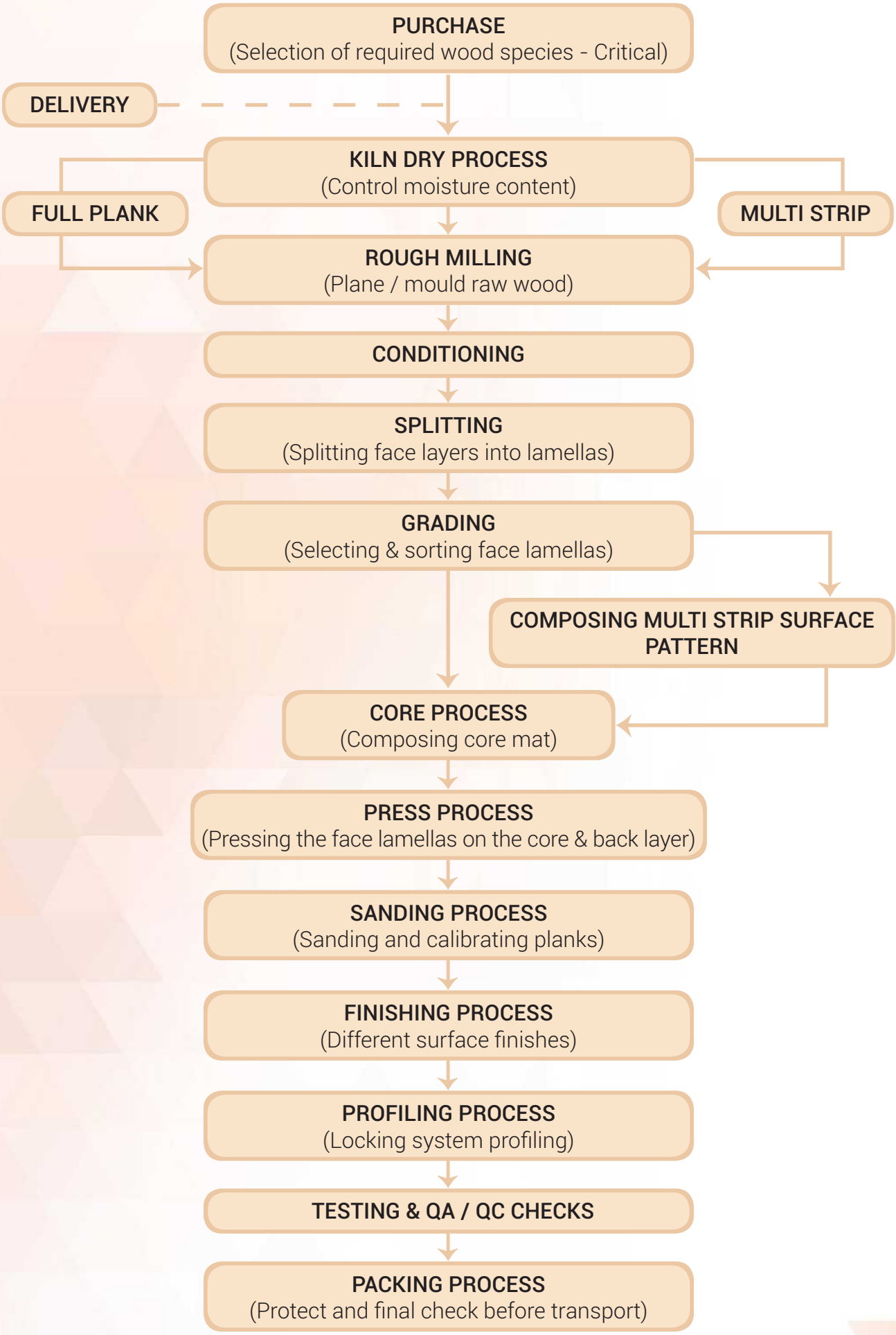


Engineered wood plank provides increased stability with each layer running at a 90 degree angle to the layer above. This restricts the widthwise movement of adjacent layers and helps to reduce warping within each strip.

Some of the popular solid wood species used in flooring and their respective hardness rating are shown below. This chart is not to be considered as an absolute indication of the hardness or performance of the flooring according to the type of wood used. For engineered wood flooring, other factors that affect the performance of the flooring include the type of core layer, thickness of lamella and finishing layer.



2.3.2 Engineered Wood Floor Manufacturing Process



2.3.3 QA/QC Checks and Good Practices in Manufacturing Process

High quality engineered wood planks can be achieved as the full manufacturing process and the finishing coats are done in factory. Automated process and well planned quality checks at necessary stages deliver consistent quality planks.

Process	Good Practices
Splitting of lamellas	
	• Thickness checks on the lamellas after the splitting process help to achieve consistency in size.
Grading of lamellas	
	• The lamellas are sorted according to shades and natural attributes. This allows better control of samples which can be more easily matched and used as per project requirements.

Finishing

Engineered wood planks go through a finishing process where multiple layers of protective coats are applied on the planks.

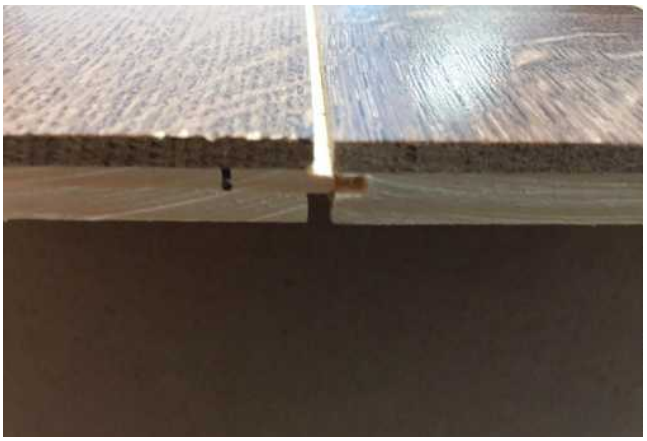
- Abrasion test checks the toughness of the coated surface.

- Random checks on the sheen/gloss level are done to ensure consistent coated surface.

- Random scratch tests are conducted to determine the resistance level of coating surface.

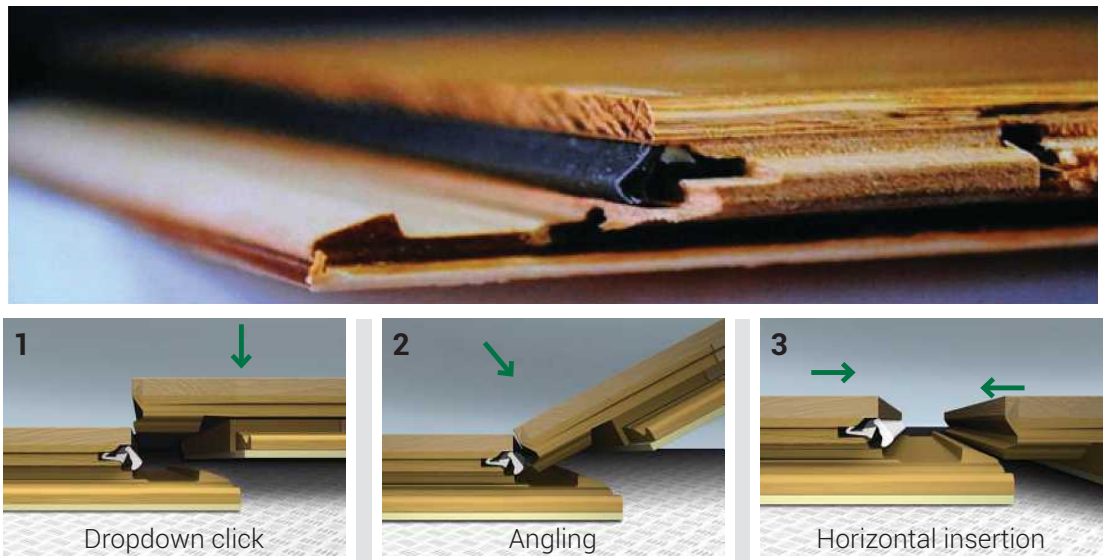
Profiling of the joint

Manufacturers adopt various methods of joining engineered wood planks to ensure edges of the planks are aligned during installation.



A) Conventional 'tongue and groove' method

B) Proprietary locking systems



C) Proprietary clicking system

**Courtesy of Unilin – patented Uniclic Multifit System*

Profiling of the joint

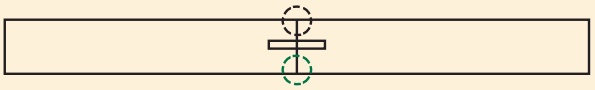
- A profile accuracy check ensures consistency in the joint profile dimensions and proper interlocking of engineered wood planks.

- A tensile stress test can also ensure the tightness of the engineered wood floor when the planks are installed on site.

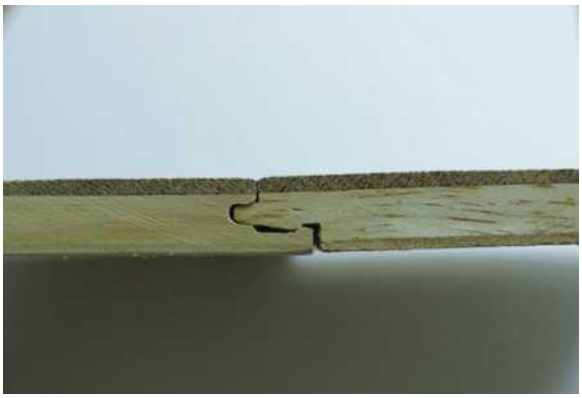
Types of Edge Finishes

There are various types of edge finishes, namely:

- Square/flat (Section View)



- Top & Bottom Bevel / Micro-bevel (Section View)



- Top Bevel / Microbevel & Square Underside (Section View)

Cupping and bowing check

- This ensures compatibility of the different layers of wood and absence of cupping or bowing due to adverse reaction of wood at the end of manufacturing process.

2.4 Selection of Adhesive

There are various adhesives for engineered wood flooring. It is critical to understand the behaviour and use of the respective adhesives. These include polyurethane and silane based adhesives. The surface where the adhesives are to be used on and the time available for curing also need to be considered. Table 2.4 below shows the conditions that need to be considered for the selection of adhesives.

Table 2.4 Selection of Adhesive Considerations

Type of subfloor & underlay	• The adhesive between the subfloor and underlay needs to be compatible with both surfaces. • Enough curing time should be considered.
Type of Engineered Wood	• Compatibility study needs to be carried out between the adhesive and wood. • To avoid water based adhesive on wood as wood would react with moisture.
Properties of Adhesives	• Shelf life: the length of time from the manufactured date that an un-opened container of adhesive can be stored without becoming unfit for use. Adhesive should be used within the shelf life to ensure that its properties are as specified. • Pot Life: this is usually for two components adhesive. It is the length of time the adhesive remains suitable for use after mixing the two components. • Open Time: the length of time the adhesive remains suitable for use after getting exposed to the atmosphere. Each application area and speed of flooring installer need to be considered to ensure optimum use of the adhesive. • Elasticity and adhesive strength of the adhesives should be considered to allow the flooring to resist moisture movement of timber and thermal expansion of substrates.

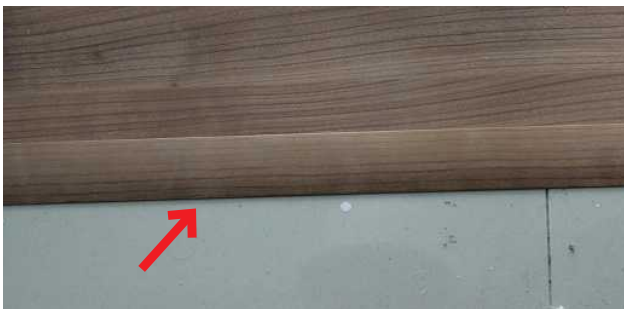
2.5 Provision for Movement

The lamination of wood layers laid 90 degrees to each other makes engineered wood planks more stable against width wise movement due to changes in relative humidity in comparison to solid wood timber. Nevertheless, it is important to introduce expansion gaps of 5 to 8mm or in accordance to manufacturer's recommendation for all the 4 sides of a location.

2.6 Joint Interface with Other Material

One of the design considerations is the interface joint of engineered wood floor with other materials such as ceramic tile, natural stone or aluminium door/window, etc. Planning for a smooth interface joint involves the understanding of sequence of works, matching the finished level of the adjoining flooring and selecting the appropriate interface material. Some designers may select wood filler to seal such joint whereas others may introduce metallic strip, capping or sealant, etc as an alternative to achieve a neat joint. Examples of metallic strip and capping are shown below.

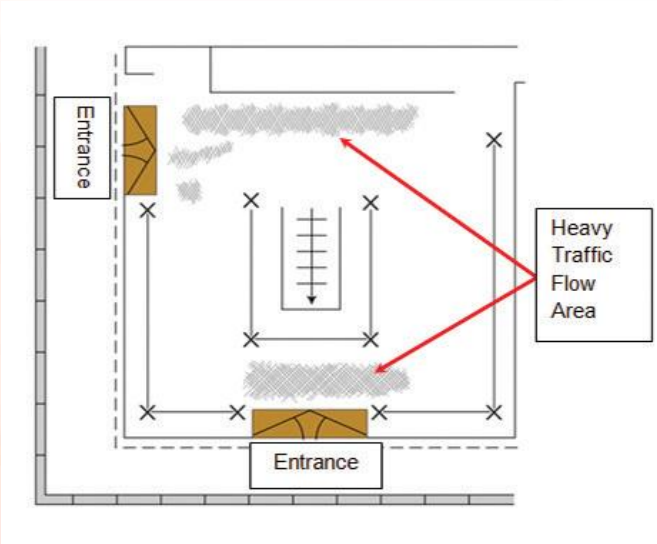
Metallic Strip Joint



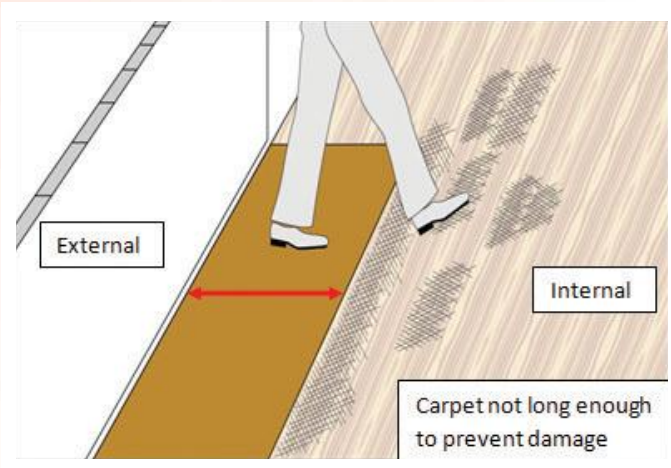
Joint with Capping

2.7 Other Considerations

It is important to identify the heavy traffic area where wear and tear is higher. The design should consider appropriate material for the flooring and if engineered wood is used, identify preventive measures to reduce wear and tear of the engineered wood surface.



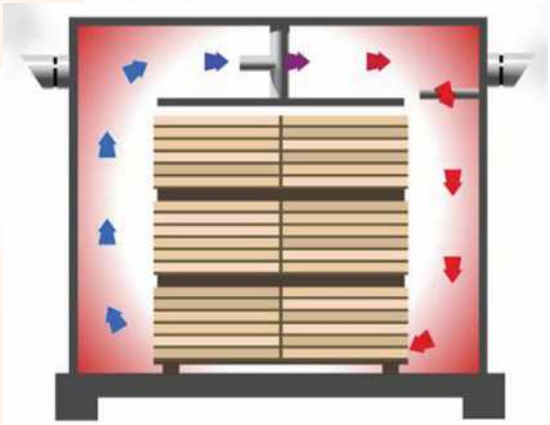
Besides identifying heavy traffic flow e.g. at the entrance, dust and sand particles may be brought into the interior by shoes. It is important to introduce mitigating measures such as dust trapping carpet at the entrance to reduce the amount of damage. However, the size of the carpet determines the effectiveness in trapping of dust.



3. DELIVERY, HANDLING AND STORAGE

3.1 Delivery (Factory to Site) for Engineered Wood

After being stored in the drying room, the engineered wood should be conditioned to site requirement before delivery to site. The moisture content is generally about 6-8% measured at factory. Engineered wood delivered from factory to site should be properly packed, wrapped with plastic and sorted in delivery packages.



At the site, all engineered wood planks should have a moisture content based on manufacturer's specification. This can be verified with a moisture meter before installation. Excessive moisture content in the planks after installation will create warpage to the engineered wood flooring.

3.1.1 Handling

Since the engineered wood flooring is prefinished, they should be loaded on a timber pallet to ensure that they are not in direct contact with the ground or in the open area and handled with care to prevent damage to the packages. Next is to ensure that the same type of timber flooring is not mixed with other batches.

3.1.2 Storage

At the site, the packages should be transferred immediately to the area for installation and safe from excessive dampness. Timber should be stacked on pallet to maintain its flatness.

3.2 Adhesive

3.2.1 Delivery

Adhesive should be delivered in original containers. Seals and labels should be kept intact until they are ready for use. Care should be taken during delivery to prevent damage or spillage due to improper stacking. Delivered batches are to be monitored and it is good to follow the 'first in first out' practice.

3.2.2 Handling

When transporting the containers to the place of installation, the adhesive should be handled with care and should not be stacked more than three tiers high or according to manufacturer's recommendation.

3.2.3 Storage

Adhesive should be used within the shelf life to ensure that its properties remain as specified. Expired adhesive should not be used. Delivery batches should be recorded.

The storage area should be clean, away from the weather or in the open area and within the temperature range recommended by the manufacturer.

4. PREPARATORY WORKS

The structure of engineered wood flooring makes it less vulnerable to environmental conditions. To enhance this characteristic of engineered wood flooring, proper preparatory works for laying of engineered wood flooring is important. Table 4.1 shows some of the points to take note for two types of subfloor preparation.

Table 4.1 Subfloor preparation

Preparatory works	Points to note
	• Ensure sufficient curing of concrete. This prevents excessive moisture content in the subfloor. • Concrete surface receiving the substrate must be clean, sound and stable. • Ensure that there are sufficient pegs to achieve the levelness and evenness of screed. • Ensure the screed is bonded to concrete • Ensure the correct finish texture of the substrate.
Screed Floor	
	• Self-levelling compound is usually a remedial effort used when evenness of the floor screed does not meet the required levelness and evenness in the specifications or drawings. • Clean concrete surface.
Use of self-levelling compound	

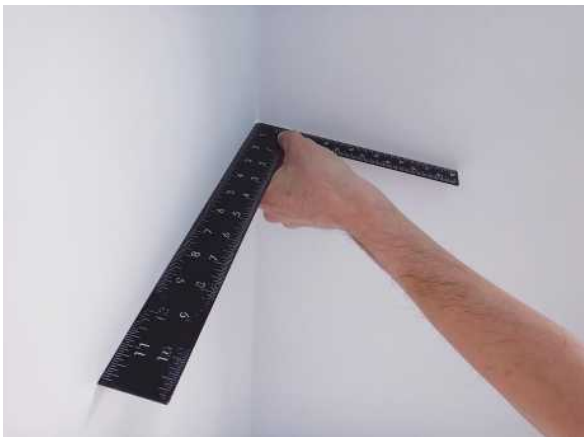
Wood, like many natural substances, is considered a hygroscopic material that naturally absorbs and releases moisture (as water vapour) from and into the air around it. Sufficient curing of the subfloor (approximately 3-4 weeks depending on site condition and other variable conditions) is always crucial towards reducing the moisture content in the subfloor. Table 4.2 looks into the types of moisture content measurement for the subfloor receiving the engineered wood flooring.

Table 4.2 Types of moisture content measurement

Preparatory works	Points to note
	• The moisture content can be measured using a moisture meter. This is a non-destructive method that measures the surface moisture content. • The moisture content should be less than 6% or within the tolerance specified by the manufacturer or in accordance to the specification.
Measure moisture content of screed surface	

Table 4.3 Other preparatory works before laying of engineered wood flooring

	• The levelness and evenness of the receiving floor should not be more than the tolerance specified in the technical specification or approved method statement or in accordance to CONQUAS standard, whichever is lesser.
Check levelness and evenness of receiving floor	



- The squareness of the room and alignment of the wall should be within the tolerance specified in the technical specification, approved method statement or in accordance to CONQUAS standard, whichever is more stringent.

Squareness of room and alignment of wall

- Rectification to cracks and hollowness must be done to ensure the soundness and quality of subfloor before the installation.

Check the soundness of the receiving floor

- All wet trades should be completed.
- The area ready for installation should be weather tight. Closing completed external windows or doors act as a protection against wet weather.
- Limiting access act as a protection against pre-installation disturbance.

Protection from weather

The moisture content of wood is directly related to the humidity and temperature of the surrounding air. The equilibrium moisture content (EMC) occurs when the wood has reached equilibrium with its environment and is no longer gaining or losing moisture at that temperature and relative humidity. Hence, it is important to ventilate the room to achieve a stable ambient temperature and moisture content.

5. INSTALLATION

The elimination of conventional onsite multiple sanding, oiling and lacquering processes lead to higher productivity on site as compared to conventional solid timber flooring. Since engineered wood flooring is a pre-finished product, it is advisable to install it after all the wet trades are completed including painting and door frame installation. Table 5.1 demonstrates the engineered wood flooring installation process.

Table 5.1 Pre-installation Works

Installation works	Points to note
 Cleaning of surface	• The cleaning of receiving surface and type of cleaning method should be in accordance to the approved method statement. • Ensure the receiving surface is clean.
 Apply moisture barrier (dependent on subfloor moisture content and specification)	• If relative humidity or moisture content exceeds the requirement, moisture barrier is to be applied on the subfloor surface. • The type of moisture barrier and its application should be in accordance to approved submissions. • Use of moisture barrier will help to seal the residual moisture in the substrate. • Ensure the application of moisture barrier and the curing time must be in accordance to product specification and approved method statement.

Table 5.2 Laying - Direct Lay Method

Apply adhesive

- The method of adhesive application and type of adhesive used should be in accordance to the approved method statement and material submission.
- In order to achieve optimum use of adhesive, it is recommended to follow strictly to the manufacturer's recommendation on the pot life of the adhesive.
- If moisture barrier is used, it is recommended that non-water based adhesive be used for bonding engineered wood planks to subfloor.
  Water based adhesive can contribute excessive moisture to engineered wood flooring and cause excessive expansion.
- Ensure the use of proper tools and use the tools properly.

Table 5.3 Laying - Underlay Method

Underlay and Fixed

Installation of underlay material

- There are many different types of underlay material. The type of underlay material used and securing process must be in accordance to the approved method statement and material submission.
- Use of underlay material helps to eliminate any unevenness issue in the substrate.
  The proper selection and use of underlay material can act as a moisture barrier and sound insulant.
- In the floating system, the underlay and the engineered wood flooring strips are not fixed to the subfloor or underlay.

Underlay and Floating

Installation of underlay material

Engineered wood floor installation using direct lay method is shown below. The installation process on underlay is similar.

Table 5.4 Laying of Engineered Wood Floor

Laying of Engineered Wood Floor	Points to note
 Install 1st piece of engineered wood after applying adhesive  Leave expansion gap around perimeter of room	• The installation of the engineered wood floor should be in accordance to the approved method statement. The engineered wood material should be in accordance to the approved material and sample submission. • Install 1st piece starting from one corner of the room. • The groove side of engineered wood floor to face the wall. • It is important to leave sufficient expansion gap, 5-8mm, around the perimeter of the floor (4 sides) to cater for dimensional changes. • It is recommended to follow strictly to the manufacturer's recommendation on the open time of the adhesive. • It is recommended that non-water based adhesive be used. • Any excess adhesive shall be immediately wiped-off with a clean damp cloth. Use a dry cloth to wipe dry on pre-finished floor to avoid smearing. • Use a mallet and tapping block to press the first board into position and tap into the other board. • Use of correct tools and proper installation method will reduce any damage to the engineered wood floor.

Use mallet and tapping block to install boards

Measure & cut board according to space available for last row of boards

- For the last row of boards, measure the space available and take the expansion gap into account when installing the last row of boards. Cut the boards according to the measurement if necessary. Apply the adhesive in the groove and install the boards into place with the spacing bar or wedge to prevent movement.
- Provide adequate time for the adhesive to cure.
- Cover the engineered wood flooring with a protective sheet and prevent any human traffic during the curing period.

Table 5.5 Install Timber Skirting

Installation of Timber Skirting	Points to note
 Apply adhesive to the back of timber skirting	• The skirting installation method, type of skirting used and wood filler should be in accordance to the approved submission. • After completion of laying engineered wood floor, install timber skirting above the perimeter expansion joints. • Secure timber skirting in place using full or spot application of adhesive and brad head nails or as per manufacturer's recommendation. • Use matching wood filler to conceal nail holes.
 Secure timber skirting with nails	
 Use matching wood filler to conceal nail holes	
 Install timber skirting	

To ensure high workmanship quality, careful planning of work sequences and proper supervision of in-process work are always essential. Quality control management can prepare an Inspection Test Plan (ITP) that summarises the project inspection, acceptance criteria and frequency of inspection. It includes the preparation, installation, finished product and protection. A sample Engineered Wood Flooring ITP is attached in Appendix A of this guide.

An inspection checklist provides the site supervisor an inspection guide on step-by-step work execution. Inspection should be carried out at critical stages and rectification should be carried out before proceeding to the next stage of work. The finished works should be inspected to ensure they meet the client's requirements and standards.

Proper use of tools is also necessary for sound engineered wood flooring. Table 5.6 shows the tools needed for the flooring installation and their condition.

Table 5.6 Tools for Engineered Wood Flooring Installation

Types of Tools	Types of Checks
	• Use clean tools. • Notches with dried adhesive will prevent even spreading of adhesive. • Appropriate use of tools will also help towards achieving quality finish.
	
Use of tools	

6. PROTECTION

6.1 Factory & Delivery Protection

Protection of engineered wood floor starts from the manufacturing process till post-installation. In the factory where engineered wood is manufactured, samples for quality checks are to be taken to ensure consistency of quality. After production of engineered wood at factory, final packaging with proper shrink wrap is required to cushion the engineered wood planks from impact and prevent damage during transportation to project site.

Pre-finished engineered wood are packed after production

6.2 Site Storage Protection

When batches of engineered wood flooring are delivered to site, proper protection is required before installation at designated area. Site storage area need to be located away from adverse weather conditions. Moisture content of engineered wood must be monitored closely before installation.

Protection intact on site before installation

As the engineered wood planks are manufactured to the specified moisture content, the shrink wrap is kept in place till just before installation starts. This is to prevent changes in dimension to the engineered wood planks due to moisture ingress.

6.3 After Installation Protection

Upon completion of installation of engineered wood flooring, the floor should be covered with appropriate protection e.g. cardboard, corrugated paper, plywood, etc. The room conditions (as stipulated in Chapter 4) should be maintained after installation of engineered wood flooring.

As engineered wood floor is a finished product from factory, stringent control of access and minimum traffic should be permitted to minimize damaging the completed wood floor. Proper planning, implementation and site management to prohibit vibration and hammering of adjacent walls can minimise impact and also allow proper curing of the materials. Generally, the curing period is around 24-48 hours (depending on type of adhesive used and manufacturer's specification). After the curing period, protect the flooring by dry mopping away all dust and dirt.

Floor finishes covered with cardboard after installation

Floor finishes covered with plywood (thickness - 3mm) after installation

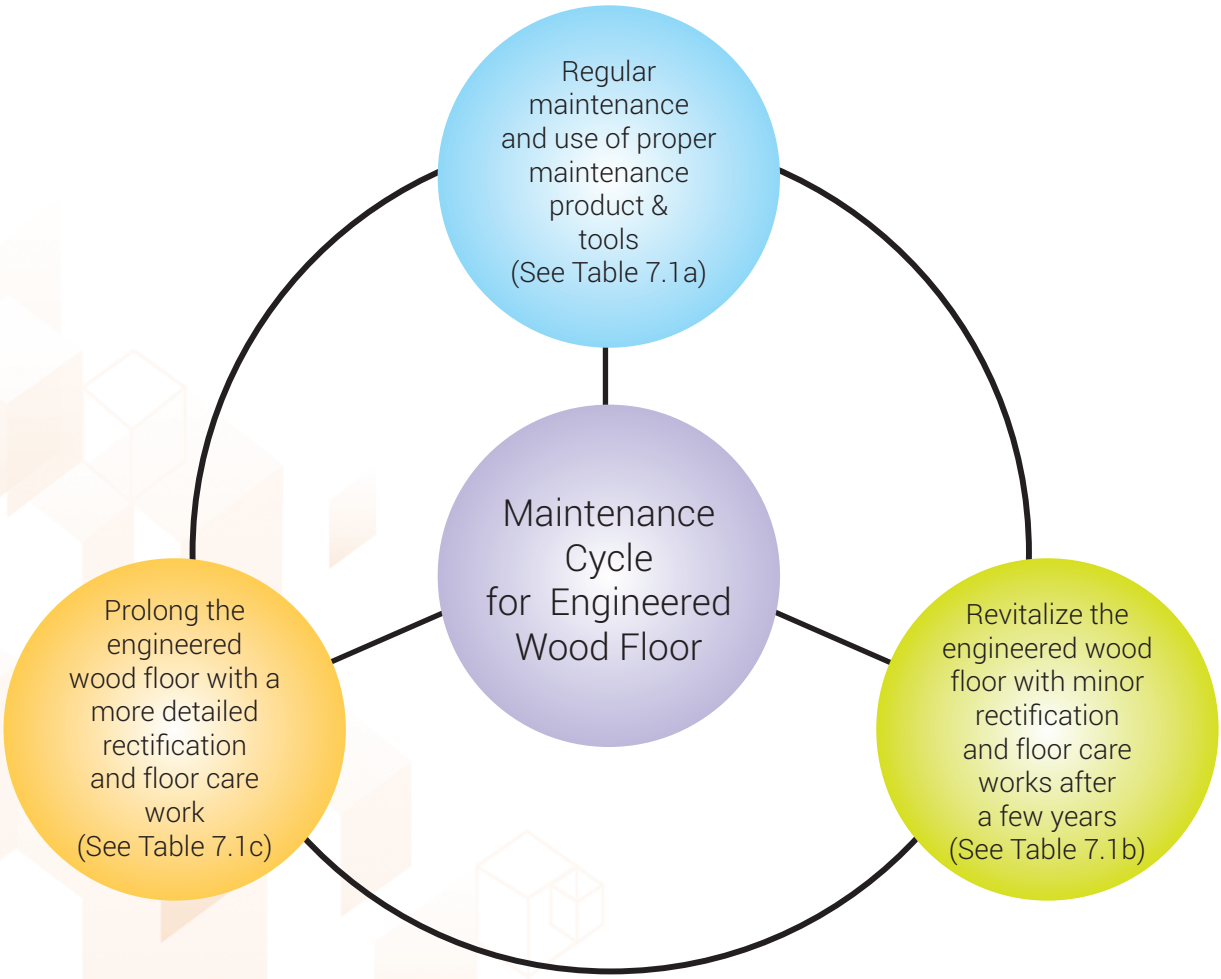
Proper co-ordination among various construction trades is important in preventing damages to the engineered wood floor. Sequence of works and exact time frame for the various trade contractors to carry out their works in the rooms completed with engineered wood flooring should be scheduled so that access to the room is restricted and work conflicts are prevented. By doing so, it is easier to identify the party that is responsible for any damage of the completed engineered wood flooring and rectification works can be closely monitored.

7. MAINTENANCE

7.1 Maintenance Cycle

The durability of timber wood floor has always been at the top of users' concerns. There should be more emphasis in engineered wood floor maintenance than conventional solid wood floor due to the lamella thickness, which limits the number of major sanding. Proper maintenance is necessary to retain the beauty of wooden floors for years. The maintenance product used should be easy to understand and use.

The life span of engineered wood floor can be prolonged with the 3 steps procedure shown in the figure below:



Some of the common maintenance methods for timber floor as follows are also applicable for engineered wood flooring:

- Prevent rain from splashing onto the floor.
- Avoid leaving stagnant water on the floor.
- Sweep or vacuum any dirt or grit.
- Avoid footwear that can damage the flooring.
- Lift and carry furniture instead of sliding across the floor.
- Clean all spillage and stain immediately.
- Allow natural ventilation to units if units are to be left vacant for long period of time.

The 3 easy steps for engineered wood floor care are:

- Vacuum or sweep.
- Spray with correct cleaner.
- Clean using a microfiber cloth mop.

Table 7.1a shows some of the regular maintenance to be done throughout the engineered wood floor life span.

Table 7.1a

Maintenance works	Points to note
 Finished floor cleaning detergent	• Appropriate cleaning product can help to remove contaminants and restore slip resistance. • Use near neutral PH value cleaning detergent. • Some of such products can help to remove scuff marks. • Follow manufacturer's recommendation when using such maintenance products. If in doubt, carry out a trial on a small area before applying to the whole room.
  Use correct type of cleaning apparatus	• Use appropriate mop pad so as to eliminate damage to engineered wood flooring. • Use easy to manoeuvre mop that can reach difficult areas. • Mop must not be dripping wet.

Table 7.1b shows minor rectification and floor care after a few years to revitalize the engineered wood floor.

Table 7.1b

Maintenance works	Points to note
 Light buffing	• Follow manufacturer's recommendation on the periodic maintenance. • Use appropriate equipment for some light buffing.
 Finishing coat	• Follow manufacturer's recommendation on the periodic maintenance. • Use of appropriate finishing coat and tools can help revitalise the engineered wood floor.

Table 7.1c shows re-sanding of surface depending on human traffic conditions which can improve the durability of the engineered wood floor.

Table 7.1c

Maintenance works	Points to note
 Re-sanding	• Follow manufacturer's recommendation on re-sanding existing surface to expose the bare wood. • It is important to consider the thickness of the lamella when it comes to re-sanding.
 Wood filler	• Follow manufacturer's recommendation on the appropriate wood filler to help enhance the engineered wood floor.
 Buffing	• Follow manufacturer's recommendation on the buffing and type of screen to remove excess wood filler.

- Apply protective coating in accordance to manufacturer's recommendation.

Apply protective coating

8. COMMON DEFECTS AND RECTIFICATION

8.1 Pre-installation Rectification

Pre-installation inspection and rectification works for subfloor should be conducted before the installation process. Defects, e.g. hollowness, unevenness and cracks on the subfloor should be rectified before installation to achieve good performance of the engineered wood flooring.

8.2 Good Practices and Common Defects

To achieve high quality engineered wood flooring and workmanship standard, contractors should understand the common complaints and how to avoid them. It is important that quality control should be committed and driven by management. It is a good practice for contractors to prepare an Inspection and Test Plan (ITP, see Appendix) which summaries and keeps track of the project's inspection, acceptance criteria and frequency of inspection. It should ensure that the finished work is inspected based on client's requirements and standards.

Users should be mindful that the lamella on engineering wood floor is a natural product and is subject to the natural colour variations within the species. Although colour or tone variations are less apparent in some species, no two batches of flooring will be identical. This is the beauty and uniqueness in choosing a natural product. Users need to be fully aware and accept that colour variation may still occur although the manufacturer has adopted a very high standard when selecting the lamella during production.

The other aspect of this natural product is the presence of grains and knots on the lamella. These are part of the natural patterns of the wood from which the flooring is manufactured and are not considered as defects. However, the manufacturer needs to ensure that the plank surface with grains and knots is adequately treated and that the area with the grains and knots on the finished product should be smooth with all the coatings in place.

The contractor can make use of inspection checklist to set benchmark for the site team when conducting the inspection. The inspection criteria in the checklist can be in accordance with the CONQUAS® quality assessment standards. The following are some good practices and common defects.

Table 8.2a shows finishing check and defect in CONQUAS® Assessment

Consistent colour tone

Consistent tonality – pattern and shades are well distributed aross the room

Inconsistent tonality – mismatch of some planks

Possible Causes
- Mixing of planks from different batches.
- Poor quality control from manufacturer.

Recommendations
- Ensure that the planks are from the same batch. It is recommended to open 2-3 bundles during installation so that it is possible to blend the planks more consistently.

Table 8.2b shows the alignment & evenness check and defect in CONQUAS® Assessment

Surface is even (not more than 3mm over 1.2m)

Evenness ≤ 3mm per 1.2m

Evenness ≥ 3mm per 1.2m

Possible Causes
- Uneven sub floor.

Recommendations
- Ensure sub floor is even. Do necessary rectification if uneven.
- Apply self-levelling compound for direct installation or plywood in accordance to manufacturer's recommendation or thicker for plywood base installation.

Table 8.2c shows crack & damages check and defect in CONQUAS® Assessment

No crack and other visible damage

No damages

Dents and damages

Possible Causes
- Poor human traffic control within the unit.
- Insufficient protection on the completed flooring.

Recommendations
- Control access to restrict workers entering unit.
- Plan sequence of work in order to minimise damage on flooring.
- Provide cardboard corrugated sheets or suitable protection to protect flooring after engineering wood flooring is installed.

Table 8.2d shows delamination check and defect in CONQUAS® Assessment

i) No squeaking sounds when walking on engineered wood flooring

No squeaking sound or vertical movement

Insufficient adhesive – produces 'cracking' or squeaking sound

Possible Causes
- Insufficient bonding for the planks with sub-floor / plywood.
- Floors bonded but dip in slab with thinner adhesive.
- Uneven sub-floor level and movement of boards.
- Types of sub-floor system installed, e.g. joists or battens system

Recommendations

- Apply sufficient adhesive for engineered wood planks.
- Ensure evenness of sub-floor.
- Ensure correct expansion allowance to prevent the floor from buckling and causing failure in adhesive bond.

* Hollowness check will not be performed on timber flooring and engineered wood flooring. Timber flooring and engineered wood flooring will have a 'drummy' sound based on the evenness of subfloor and depth of adhesive. This is not a concern unless there is squeaking sound and vertical movement of the planks (delamination) when walking over the flooring.

ii) No Cupping of Engineered Wood Flooring

Cupping of engineered wood flooring

Possible Causes

- Water has penetrated the engineering timber flooring either through the flooring or through the windows.
- Loss of adhesion of engineered timber boards at the edges due to water seepage.
- Excessive exposure to sunlight may also cause slight cupping.

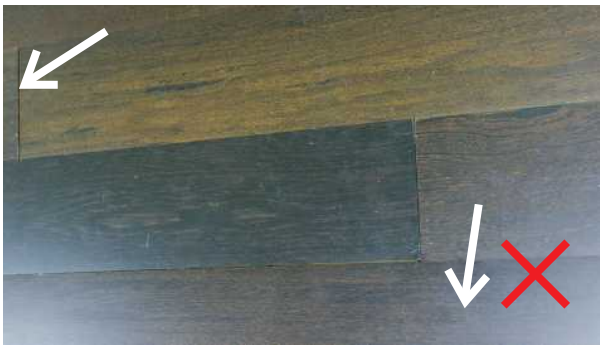
Recommendations

- Ensure that the flooring is protected from the weather and the flooring is not flooded after the timber planks are installed.
- Use proper waterproofing or stop the source of water seepage.
- Protect floor that is exposed to excessive sunlight.

Table 8.2e shows jointing check and defect in CONQUAS® Assessment

i) No visible gaps between engineered wood strips

Good jointing



Obvious gaps between engineered wood strips

Possible Causes

- Engineered wood planks moisture content higher than 14 %. Poor ventilation within the room resulting in excessive temperature difference causing movement of flooring.
- Poor workmanship.

Recommendations

- Ensure that the moisture content is within the manufacturer's recommendation.
- After installing the engineered wood floor, ensure the room has air circulation.
- Ensure installer is trained adequately to meet the workmanship quality.

ii) No visible gaps between engineered wood floor and skirting

No visible gap between skirting and engineered wood flooring

Uneven gap between skirting and engineered wood flooring

Possible Causes

- The floor is uneven.
- The skirting is not properly installed.
- The glue or nail holding the skirting is not firm.
- Too many joints on the skirting.

Recommendations

- Ensure that the flooring is as flat and even as possible, e.g. using self-levelling compound.
- Make sure that the holding system adopted to fasten the skirting to the wall is effective.
- Reduce the number of joints by providing a full length or longer piece.

Over time, engineered wood flooring will respond to its environmental condition and usage. Thus, end users need to be aware that these conditions may cause tone variations across the flooring and appearance of gaps between some planks.

8.3 Rectification

8.3.1 Repair Kits for Minor Defects

For minor defects such as scratches and dents, users can use repair kits or paste to rectify and touch-up defects by themselves without replacing the engineered wood flooring. The ready-to-use material is easy to use and the flooring repaired by matching the tonality of the wood.

Recommended repair kits and paste by suppliers / vendors

8.3.2 Re-coating of Pre-finished Floors

Subject to the floor condition, it is recommended to re-coat existing flooring to extend the life span of engineered wood flooring. This process involves light buffing using correct buffing machine followed by an application of protective coating. It is recommended to test and check for compatibility of coating with the manufacturer or contractor.

8.3.3 Re-sanding and Re-application of Protective Coating

Depending on extent of wear and tear by human traffic and usage, users can consider carrying-out re-sanding and re-application of protective coating on existing flooring. This process involves sanding of existing floor surface to expose bare wood followed by buffing with fine screen to remove excess filler and preparing surface for coating.

Sample of Inspection and Test Plan (ITP)

Project:

Appendix A

Scope of Work: Engineered Wood Flooring

S/No	Activity	People –In– Charge	Inspection Method	Requirement Reference	Frequency	Acceptance Criteria	Stages	Records
1	Submission (Shop Drawing / Method Statement)							
1.1	Shop Drawings	BR / ADOS	Review	-	Each unit type	As per Specification & Approved Drawings	Prior to Start Work	Approved Submission
1.2	Method Statement	BR / ADOS	Review	-	Each unit type	As per Specification	Prior to Start Work	Approved Submission
1.3	Method Statement • Engineered Wood • Underlay • Skirting • Wood Filler • Moisture Barrier • Adhesive • Accessories • Protection	BR / ADOS	Review	Section 2	Each unit type	As per Specification	Prior to Start Work	Approved Submission
Prepared By:			Verified By:			Approved By		
Date:			Date:			Date:		
Legend	BR – Builder Rep.			ADOS – Architect /Designer / Owner / Supervisory Personnel				

This form serves as a guide only.

Sample of Inspection and Test Plan (ITP)

Project:

Appendix A

Scope of Work: Engineered Wood Flooring

S/No	Activity	People –In– Charge	Inspection Method	Requirement Reference	Frequency	Acceptance Criteria	Stages	Records
1.4	Sample Submission • Engineered Wood • Underlay • Skirting • Wood Filler • Moisture Barrier • Adhesive • Accessories • Protection	BR / ADOS	Review	Section 2	Each unit type	As per Specification	Prior to Start Work	Approved Submission
2	Incoming Material Inspection							
2.1	Types of Material Delivered • Engineered Wood • Skirting • Underlay • Moisture Barrier • Wood Filler • Adhesive • Accessories • Protection	BR / ADOS	Visual / Specifications	Section 3	Each Delivery	As per Specification	Prior to Start Work	Delivery Document
Prepared By:			Verified By:			Approved By		
Date:			Date:			Date:		
Legend	BR – Builder Rep.			ADOS – Architect /Designer / Owner / Supervisory Personnel				

This form serves as a guide only.

Sample of Inspection and Test Plan (ITP)

Project:
Scope of Work: Engineered Wood Flooring

Appendix A

S/No	Activity	People –In– Charge	Inspection Method	Requirement Reference	Frequency	Acceptance Criteria	Stages	Records
2.2	Storage and Handling of Material • Engineered Wood • Skirting • Underlay • Moisture Barrier • Wood Filler • Adhesive • Accessories • Protection	BR / ADOS	Visual / Specifications	Section 3	Each Delivery	As per Specification	Prior to Start Work	Delivery Document
2.3	Selection of Material for Testing • Engineered Timber • Skirting • Moisture Barrier • Adhesive	BR / ADOS	Visual / Testing	Section 3	Random Selection	As per Specification	Prior to Start Work	Delivery Document
3	Preparation							
3.1	Method of Installation	BR / ADOS	Visual / Specifications	Section 4	Each Location	As per approved submission	Prior to Start Work	Approved Submission
3.2	Mock Up Unit	BR / ADOS	Visual / Measurement	Section 4	Each Location	As per approved submission	Prior to Start Work	Approved Submission
Prepared By:			Verified By:			Approved By		
Date:			Date:			Date:		
Legend	BR – Builder Rep.		ADOS – Architect /Designer / Owner / Supervisory Personnel					

This form serves as a guide only.

Sample of Inspection and Test Plan (ITP)

Project:

Appendix A

Scope of Work: Engineered Wood Flooring

S/No	Activity	People –In– Charge	Inspection Method	Requirement Reference	Frequency	Acceptance Criteria	Stages	Records
3.3	Surface Preparation Check • Moisture content • Surface evenness • Hollowness • Squareness at corners • Interfacing joint	BR / ADOS	Visual / Specifications	Section 3	Each Delivery	As per Specification	Before Installation	Checklist
3.4	Setting Out Check	BR / ADOS	Visual / Measurement	Section 4	Each Location	As per approved submission	Before Installation	Checklist
3.5	Cleanliness of Floor	BR / ADOS	Visual / Measurement	Section 4	Each Location	As per approved submission	Before Installation	Checklist
4	Installation							
4.1	Apply Moisture Barrier (Optional) (Allow to cure)	BR / ADOS	Visual / Specifications	Section 5	Each Location	As per approved submission	Before Installation	Checklist
4.2	Apply Adhesive with Notched Trowel	BR / ADOS	Visual / Measurement	Section 5	Each Location	As per approved submission	Before Installation	Checklist
Prepared By:			Verified By:			Approved By		
Date:			Date:			Date:		
Legend	BR – Builder Rep.			ADOS – Architect /Designer / Owner / Supervisory Personnel				

This form serves as a guide only.

Sample of Inspection and Test Plan (ITP)

Project:
Scope of Work: Engineered Wood Flooring

Appendix A

S/No	Activity	People –In– Charge	Inspection Method	Requirement Reference	Frequency	Acceptance Criteria	Stages	Records
4.3	Install Underlay (if applicable)	BR / ADOS	Visual / Measurement	Section 5	Each Location	As per approved submission	Installation	Checklist
4.4	Install Engineered Wood	BR / ADOS	Visual / Measurement	Section 5	Each Location	As per approved submission	Installation	Checklist
4.5	Protection	BR / ADOS	Visual / Measurement	Section 6	Each Location	As per approved submission	Installation	Checklist
4.6	Install Skirting	BR / ADOS	Visual / Measurement	Section 5	Each Location	As per approved submission	Installation	Checklist
4.7	Quality Checks	BR / ADOS	Visual / Measurement	Section 8	Each Unit	As per Specification	Quality Check	Checklist
Prepared By:			Verified By:			Approved By		
Date:			Date:			Date:		
Legend	BR – Builder Rep.			ADOS – Architect /Designer / Owner / Supervisory Personnel				

This form serves as a guide only.

Sample of Inspection Form

Appendix B

Project Title: **ABC** Work Trade: **Engineered Wood Flooring**		Main Contractor: **AAA Contractor Pte Ltd** Engineered Wood Supplier: **XL Timber Flooring Pte Ltd**
Location of Inspection: Block: **B** Unit No: **50-50**		Inspection Request No:: **JKCCK/EW/5779/01**
Signature, Date & Time of Inspection form submitted: …… *By Builder Rep.*	Signature, Date & Time of Inspection form received: …… *By RA/RE/RTO*	ITP Reference No: **3 (Preparation) & 4 (Installation)** Drawing No: **Arch/EW/Inspect/14**

☐ 1st Inspection ☐ 2nd Inspection ☐ 3rd Inspection

Description of Activities		By Builder Rep.		Comment by RA/RE/RTO	By RA/RE/RTO	
		Signature	Date		Signature	Date
Proper storage & handling of material				☐		
Preparation	Surface Preparation			☐		
	Moisture content					
	Hollowness					
	Squareness at corners					
	Interfacing joint					
	Setting Out Check					
	Cleanliness of Floor					
Installation	Apply Moisture Barrier			☐		
	Protection during curing period					
	Application of Adhesive					
	Install underlay					
	Install Engineered Timber					
	Install Skirting					
Quality Checks	Finishing			☐		
	Alignment & Evenness					
	Material & Damages					
	Delamination					
	Jointing					
	Rectification of Defects					
Protection	Protection to flooring surface			☐		
	Control of Access					

☐ You may proceed with the next stage of work ☐ You are not to proceed with next stage of work ☐ Others (Please Specified): _____	**Endorsement by RA/RE/RTO:** *Date & Time of Endorsement* *Inspector Signature*	**Acknowledgement By Builder Rep.:** *Date & Time of Acknowledgement* Builder Rep Signature

This form serves as a guide only.

REFERENCES

1. SS CP 1
   Code of practice for the use of timber in buildings

2. BS 8201 : 2011
   Code of practice for flooring of wood and wood based panels

3. Australian Timber Flooring Association
   Technical Publication on Engineered Wood Flooring

4. Good Industry Practices Guide
   Timber Flooring

5. Good Industry Practices Guide
   Design and Material Selection for Quality – Volume 2

6. Quality homes: A Homeowner's Guide

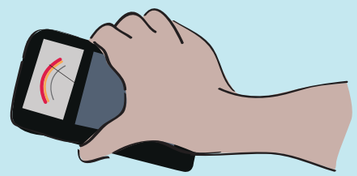
QUICK GUIDE FOR ENGINEERED WOOD FLOORING INSTALLATION

1 Laying of Screed

Screed Floor

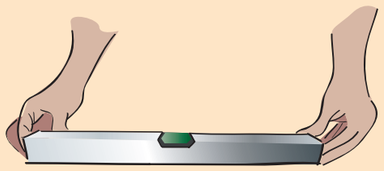
Use self-levelling compound (For remedial effort)

Ensure sufficient concrete curing

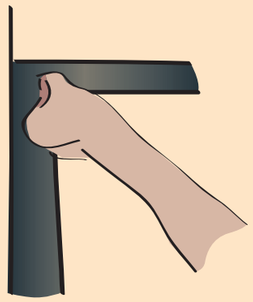


Measure moisture content of screed surface

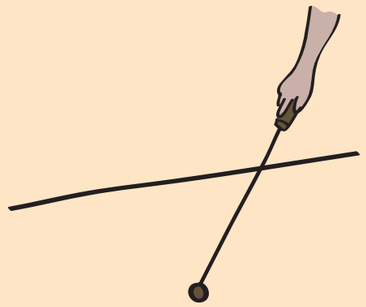
2 Preparation



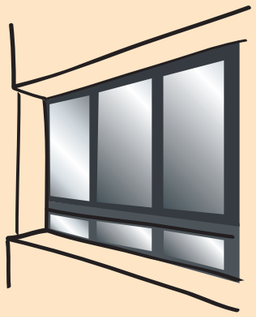
Check levelness and evenness of receiving floor



Check squareness of room and alignment of wall

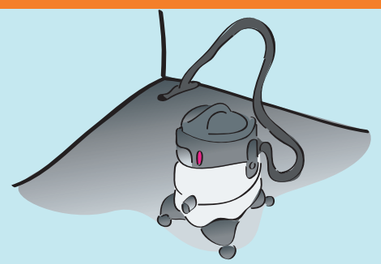


Check soundness of receiving floor

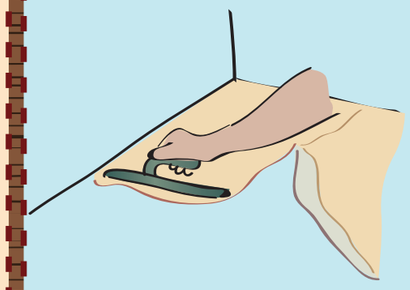


Protect from weather

3 Installation of Engineered Wood Flooring

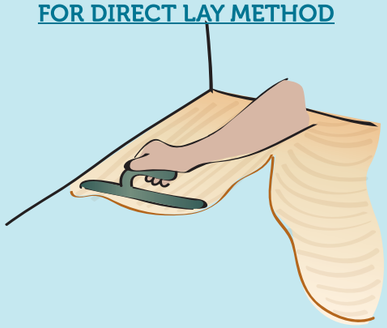


Clean surface



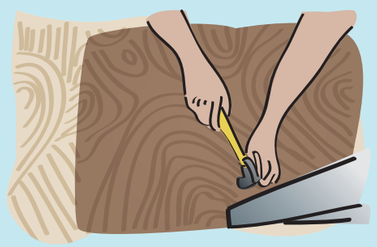
Apply moisture barrier (Optional)

FOR DIRECT LAY METHOD



Apply adhesive

FOR UNDERLAY & FIXED



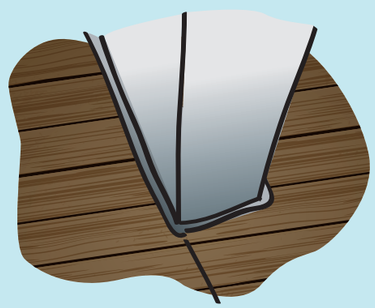
Install underlay material (Fix underlay to substrate)

FOR UNDERLAY & FLOATING

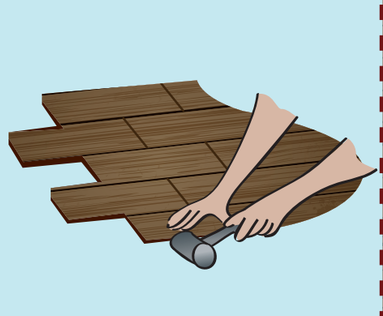
Install underlay material

FOR UNDERLAY & ONWARDS INSTALLATION

Install engineered wood planks

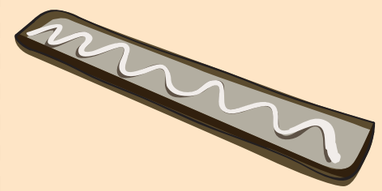


Leave expansion gap around perimeter of room

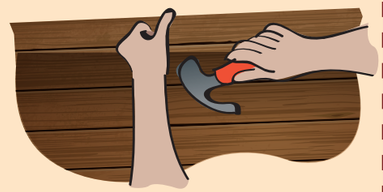


Use mallet and tapping block to install boards

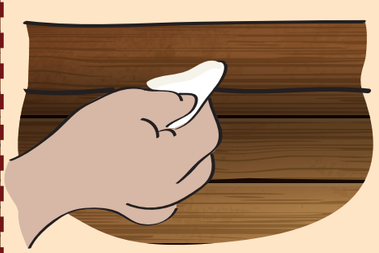
4 Installing Timber Skirting



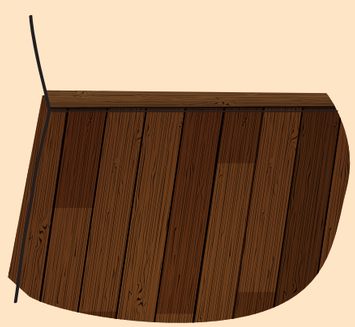
Apply adhesive to back of timber skirting



Secure timber skirting with nails

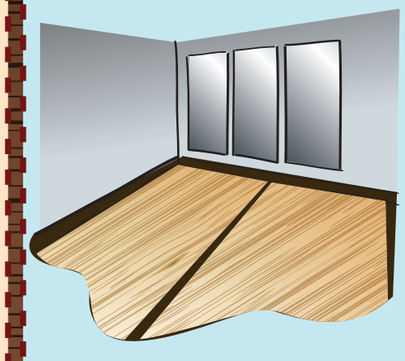


Use matching wood filler to conceal nail holes



Complete Flooring

5 Protection



Lay protection sheets

Restrict access to completed works

For details on the steps, please refer to the Guide Book.

Building and Construction Authority

We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.