Understanding the requirements when laying wood flooring over calcium sulphate based screeds

This document is designed to offer best practice general advice only, and it has been created as a result of collaboration between The Solid Wood Flooring Company, Sika Everbuild Limited and Gypsol Francis Flower.

The contents of this document are not exhaustive and it is intended to be offered and used as a guide only and to assist in avoiding problems when laying wood floors over calcium sulphate based screeds. Responsibility for any installation will still remain with the individual expert using the materials and for any additional information please contact the technical departments of:

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1. **General Comments - Screeds**

Gypsum, anhydrite or alpha-hemihydrate (calcium sulphate) screeds have become increasingly popular due to the versatility of the materials with regards to the speed and ease of installation, low shrinkage, flowability, low cost of placement and lower carbon footprint. They are often specified with water fed in floor heating systems because of their rapid strength gain, thinner sections, thermal characteristics and ability to flow around intricate pipework and manifold outlets. They are not generally suited as a wearing layer.

Anhydrite is available from a number of sources. These include synthetic forms as well and natural forms. The UK market uses mainly synthetic anhydrite sourced as a bi-product of the acid production industry. This material does not go through any separate calcination or autoclaving process. It is used in the UK generally in preference to alpha hemi hydrate

Alpha-hemihydrate is generally harvested as a bi-product of the coal fired power station flue gas desulphurization process. The raw material is either calcined or autoclaved depending on the specific manufacturer. This material is not currently manufactured widely in the UK and the major sources are from Europe.

When water is added to either product they crystallise to form gypsum. This is where the term gypsum screed comes from. It is occasionally suggested that these screeds are made of the same materials as wall plaster, or Plaster of Paris. However, whilst using the same basic mineral, gypsum, plasters are made using beta-hemi hydrate. These materials behave and perform significantly different to the materials used in screeding.

2. **General Comments on Wood Flooring**

Due to its sustainability, reduced impact on the environment, and stability in use, engineered wood flooring is now widely accepted as the preferred option for commercial and residential projects. The thickness of the engineered floor will depend on the individual requirements of the client and subfloor structure.

Engineered wood flooring works very well with under floor heating because wood is a natural insulator and will not only retain heat, but heat loss is minimal and 20mm thick boards with either 4mm or 6mm top layers of solid wood will only lose 0.10 m2 K/W and 15mm thick boards with either a 4mm or 6mm solid wood top layers will only lose 0.08 m2 K/W.

Fully bonding the wood flooring to the calcium sulphate substrate, using SW 890 adhesive made by Sika limited and designed for use with under floor heating, will increase the efficiency of the under floor heating system therefore making it more economical to run. The SW890 adhesive should be applied direct to the screed which should not be sealed and should have been prepared as described at Section 4 in this document.
3. **Mixing and Placing**

Whatever formulation of calcium sulphate screed you choose, they all require slightly more water than a traditional sand/cement screed. As well as using water, the flowing characteristic exhibited by the screeds is derived from plasticising additives and void filling technology. The binder reacts with the water in order to produce gypsum crystals. Around 80% of the anhydrite is converted to gypsum and this reaction uses a large proportion of the mixing water. The remaining is residual water and is surplus to chemical requirements. This must be removed from the screed, usually by evaporation prior to the application of any floor coverings including primers and smoothing compounds.

These screeds are fully self-compacting and are classed as self-curing. They therefore need no curing membrane to be applied post installation. In general calcium sulphate screeds can be installed over larger areas without joints than sand/cement screed and also be laid in lot thinner sections. The table below shows typical installation depths. It would be considered a reasonable expectation that installers attain a surface regularity of SR2 in accordance with BS8204. This states that “The surface regularity when checked with a 2m straight edge with 3 mm feet at each end placed anywhere on the surface will achieve a minimum of SR2 to BS8204 and have no gap greater than 6mm and the straight edge will not be obstructed by the substrate”

<table>
<thead>
<tr>
<th>Application</th>
<th>Minimum Depth</th>
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<tbody>
<tr>
<td>Bonded</td>
<td>25mm</td>
</tr>
<tr>
<td>Unbonded</td>
<td>30mm</td>
</tr>
<tr>
<td>Floating</td>
<td>Domestic</td>
</tr>
<tr>
<td></td>
<td>35mm</td>
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<tr>
<td></td>
<td>Commercial</td>
</tr>
<tr>
<td></td>
<td>40mm</td>
</tr>
<tr>
<td>Underfloor Heating</td>
<td>25mm cover to pipes</td>
</tr>
</tbody>
</table>

These screeds are usually finished using a “dappling bar” which is used in a similar way to a tamp. The dappling helps to remove any trapped air and to get the screed flat and level within defined tolerances.

4. **Post Installation Requirements**

As with all screeds and concretes, calcium sulphate based screeds can form a laitance on the surface during settlement/compaction. During this compaction process, bleed water migrates to the screed surface. This brings with it finer, lighter particulates within the screed. Laitance is subsequently formed as a result of the evaporation of the bleed water, and once hardened can impede the drying process.

However, it’s removal is essential as it can interfere with the adhesion of any bonded floor coverings. There is no such thing as a “laitance free screed or concrete” the degree of laitance will however be affected by the degree and rate of bleed. In line with advice from the contract flooring association ALL screeds and concretes should be mechanically prepared to remove laitance and other construction debris.
5. **Drying**

Calcium sulphate screeds will begin drying immediately following installation but in order to prevent early age shrinkage cracking:

- **In the first 72 hours - over rapid drying should be avoided.**
- **After 72 hours assisted drying can commence by applying ventilation and dehumidification.**
- **After 7 days force drying can commence by commissioning the underfloor heating system or by the application of external heat.**

The conditions on site and screed depth play a large part in the drying times that will be required. The best drying conditions are achieved using elevated temperature and reduced atmospheric humidity. Calcium sulphate screeds dry at a similar rate to those made using sand/cement, which given the optimum conditions is 1mm per day up to 40mm thick and an additional 2 days per 1mm over this thickness. For example, with the correct ventilation and site conditions a 50mm thick screed will take approximately 60 days to reach a level of moisture content that is acceptable for the application of further finishes.

Drying times will be dependent upon the ambient conditions and therefore the moisture content should be verified using a suitable test method that conforms to BS8201:2011, and prior to the application of finished floor coverings, the target moisture content of the screed should be ideally 0.3% CM (Carbide Method) and no more than 0.5 % CM. Although there is no direct correlation between different measuring scales 0.5 % CM is approximately 65% Relative Humidity.

The use of dehumidifiers can accelerate the drying process for anhydrite screeds and can be accompanied by space heating if required. A strategy that employs warm, dry air being passed over the screed combined with good ventilation will vastly speed up drying compared to de-humidifiers alone but this is generally a specialist operation.

Laitance should be removed as soon as is reasonably practicable following installation of the screed but in all cases prior to the installation of any bonded floor covering, and this should be done by mechanically sanding the surface with a minimum 60 grit pad.

The responsibility for the preparation of the screed surface will lie with the main contractor (or Project manager or client whichever appropriate) and provision to remove the laitance must be allowed for in either the screed contractors contract or the wood floor installers contract, whichever is the most appropriate within the timescales allowed. It should be noted that the longer this operation is left the more difficult it is to remove.
6. Underfloor Heating Systems and Wood Flooring
Water fed under floor heating [UFH] systems offer a very efficient way of heating a property and are becoming ever more popular on large multi dwelling projects. Many of these systems are encapsulated within a calcium sulphate based screed. These screeds are laid in thinner sections than standard sand/cement screeds and therefore will dry after a relatively short period of time.

It is important that the UFH is fully commissioned with every component in place prior to the application of floor coverings.

Moisture tests should not be carried out until after the underfloor heating has been commissioned and run. BS1264 does not adequately describe the requirements for commissioning the under floor heating, therefore the under floor heating manufacturer should be consulted for guidance, and the heating engineer must complete commissioning to the manufacturers requirements.

7. Initial Start Up – Commissioning Before Installing Wood Flooring
The commissioning procedure can be carried out once the screed is at least 7 days old, and the procedure should be as follows:

- Initial heating should commence with the flow water temperature at no more than 25°C or the minimum available on the manifold, and this should be maintained for at least 3 days. It should be noted that some manifolds do not allow a flow temperature of less than 35°C.

- After 3 days the flow temperature can be increased by a maximum of 5°C per day (at the manifold) until the maximum design temperature or 55°C, whichever is the lower, is achieved. This should be maintained for a minimum of 3 days but if force drying longer, typically 7 days, may be required.

- The screed should then be allowed to cool by reversing the process and reducing the flow temperature by a maximum of 5°C per day down to the minimum,

- The heating system should then be switched off for 48 hours before moisture testing.

Before wood flooring is installed, the moisture content of the screed should be measured using a method recognized by BS8204:7:2003. These include the hair hygrometer, oven dried sample or carbide bomb methods. An electronic meter may be used to survey the floor and ascertain the wettest points where the approved testing should be carried out.

No coverings should be applied until the residual moisture level within the screed meets the floor covering manufacturers’ recommendation. Typically this would be 65% RH or 0.3 % CM to 0.5% CM moisture however different manufacturers may have different requirements.
Re-Introduction of Heat – after the wood flooring has been installed
Once moisture testing has been completed the under floor heating should be adjusted to suit the installation.
If it is a hot summers day then the heating should be left switched off until 72 hours after fitting has been completed – this will include finishing if unfinished boards have been used. If it is a cold winters day then it will be impractical to completely turn off the under floor heating so it should be turned down to it’s lowest idling temperature – if possible 10°C at the manifold. This can be maintained during fitting and will not compromise the performance of the SW890 adhesive.

If the heating has been switched off then it should be switched back on at it’s lowest temperature for 24 hours. The heat should then be gradually increased by a maximum of 5°C at the manifold every 24 hours and **THE TEMPERATURE SHOULD NEVER EXCEED 27°C AT THE FINISHED FLOOR LEVEL.** Wherever possible it is recommended that monitoring devices are designed into the floor to ensure that the temperature at finished floor level is fully controlled.

8. Membranes
In most cases, calcium sulphate screeds can have liquid DPM applied when they are below 1.5% CM moisture, are unheated and have achieved sufficient strength to perform the mechanical requirements of their application, and by implication this means that the screed therefore must be at least 28 days old. It is the recommendation of the screed industry and of the vast majority of DPM manufacturers that liquid DPMs should not be used over heated screeds of any type as a means to suppress residual moisture. Where no underfloor heating is present the use of liquid damp proof membranes may be considered, and the screed manufacturer will generally be able to offer guidelines as to a safe level of residual moisture for this to occur.

9. Smoothing Compounds
In some instances where the finished floor height has been incorrectly set or the screed has suffered mechanical damage it may be necessary to apply a smoothing compound. As a general rule you should never use a cement based smoothing compound over a calcium sulphate screed without first applying an acrylic or epoxy resin based primer.

When cement based materials come into contact with calcium sulphate screeds a reaction with the aluminate in the cement causes the formation of ettringite crystals which grow beneath the compound and eventually cause delamination of the smoothing compound. The use of an acrylic or epoxy primer should ensure that contact between the two materials is isolated. It is generally recommended that calcium sulphate based smoothing compounds are used in preference where possible as there is no risk of chemical incompatibility.

10. SikaBond Flooring Adhesives
All SikaBond flooring adhesives are elastic to accommodate differential expansion /contraction for wooden floors and are all compatible with Sika Levelling compounds and damp proof membranes.
11. Installing Engineered Wood Flooring over Calcium Sulphate Screeds

Before any wood flooring is received on site, the moisture content of the screed, the Relative Humidity and temperature readings should be taken using appropriate reliable equipment. Representative samples should be taken across a reliable area of the screed surface to ensure that an overall representative moisture level can be determined. It is good practice to ensure that this is recorded in a “Site Log” for future reference, and it is important that moisture readings are accurate and correspond to the full thickness of the screed.

The points below are for guidance only and designed to help understand how natural materials should be installed. Detailed installation advice and full NBS specifications can be supplied on request but will be based on the information supplied. However, any wood flooring manufacturer supplies materials only, and rarely has the benefit of inspecting an installation or even seeing the boards to be used. Therefore when others take the materials provided and re-manufactured them into a finished floor, responsibility for ensuring that conditions are correct for installing wood, acclimatizing the materials, inspecting each board and selecting the ones for use - will always remain with the person who has manufactured the floor.

Fitting

Wherever possible all wood flooring should be laid fully bonded and must be fitted in accordance with BS 8201:2011 which is The Code of Practice for Flooring of Timber, Timber Products and wood based panel products.

Aesthetics

Wood is a natural product and will contain inherent characteristics such as shade variation, colour, different graining, sap wood and knotting. It is the art of the fitter to ensure that fitting is conducted to achieve an acceptable blend of all of the inherent characteristics contained within any natural wood product.

Moisture

The moisture content of wood flooring will vary depending on the conditions that they are exposed to. BS 8201 provides general guidance on the moisture content that timber flooring will generally settle to in different environments, as follows:

<table>
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<tr>
<th>Condition</th>
<th>Moisture Content</th>
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<tbody>
<tr>
<td>Unheated conditions</td>
<td>15% to 19%</td>
</tr>
<tr>
<td>Intermittent heating</td>
<td>10% to 14%</td>
</tr>
<tr>
<td>Continuous heating</td>
<td>9% to 11%</td>
</tr>
<tr>
<td>Under floor heating</td>
<td>6% to 8%</td>
</tr>
</tbody>
</table>

However, the moisture content that timber flooring will settle to in service conditions can vary from the values given in BS 8201. In particular, when specifying a moisture content for timber flooring, special consideration needs to be given to the heating/air conditioning regime of the building, and to the location in the building where the flooring is to be installed. For example, a conservatory in a house or a glazed atrium in a commercial building may be subject to significant solar gain throughout the year.
Bonding
Engineered boards are to be laid fully bonded using SW890 adhesive, applied with a 6mm notched trowel to provide a solid bed of adhesive between the base of each board and the substrate.

Expansion
In line with BS8201:2011 room for expansion should be designed into the floor. A minimum of a 10mm clean joint should be left around the perimeter of each floor, and where the wood butts up to differing materials. Where the distance exceeds 8 Linear metres in any one direction, extra room for expansion should be designed into the floor. Day work joints and construction joints in Calcium Sulphate screeds cannot be bridged and expansion joints in the finished floor must be sited directly over these joints.

Protection
The Solid Wood Flooring recommends that all wood flooring should not be covered, as this can compromise the performance of the structure of the boards and the finish. However, it is accepted that there are times when protection has to be provided, and in that instance only protective coverings that will not damage the floor should be used, and any responsibility for providing that protection will remain with whoever has decided to cover the floor, and any subsequent damage will not be the responsibility of the materials supplier.

A covering such as 2mm to 3mm foam then a layer of 6mm hardboard taped at the joints should be considered to protect the floor. It is important that - whilst covered no under floor heating is working and the heating should not be switched on until all protection has been removed. If the finished floor has to be covered to protect it from other trades who are completing works after the floor has been installed, then any responsibility for the finish of the boards will remain with those who have chosen to protect the floor.

Fitters/ Builders Clean
On completion of fitting, the surface of the boards should be vacuumed to remove any particles of wood or sawdust, and the fitter should ensure that no residues from any of the fitting remains attached to the surface of the boards. The fitter should clean the boards with the recommended cleaner and ensure that the contractor and client (if appropriate) understand how the wood flooring should be cleaned and maintained.

The Contractor/Client
On completion of the project, an Operations and Maintenance manual should be requested to ensure that the finished floor is cleaned and maintained correctly.
General Observations

The information, and, in particular, the recommendations relating to the application and end-use of Engineered wood flooring and Sika products, are given in good faith based on The Solid Wood Flooring Company, Sika Limited and Gypsol Francis Flower’s current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with The Solid Wood Flooring Company, Sika Limited and Gypsol Francis Flower’s recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product’s suitability for the intended application and purpose. The Solid Wood Flooring Company, Sika Limited and Gypsol Francis Flower reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

Notes