FeRFA GUIDE TO FLOWABLE AND TROWEL APPLIED POLYMER SCREEDS AS UNDERLAYMENTS FOR RESIN FLOOR FINISHES

FeRFA Guidance Note No. 8

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1. INTRODUCTION

1.1 Scope

This guide aims to identify the criteria for flowable, polymer modified, cementitious screeds (known hereafter as "flowable screeds"), or trowel applied, polymer modified or plasticised, cementitious screeds (known hereafter as "trowel applied screeds"), when they are used as an underlayment for a resin floor finish.

When specifying the use of resin flooring systems, it is important to consider the substrate to which the system is being applied. Once applied, any thinner section resin flooring system will follow the profile of the underlying substrate. Therefore a major part of the preparation is to ensure the substrate is free of undulations, is sufficiently level to an agreed requirement (refer to Table 1 on page 4) and is sound enough to receive the chosen resin floor system.

Screed underlayments are frequently used for the cost-effective pre-levelling of existing substrates before applying resin flooring systems, although a resin scratch coat or bulked resin may be used instead to level over minor variations.

Flowable screeds can be applied by pump or conventional hand trowel method at typical depths of 5mm - 50mm.

Trowel applied screeds are applied at typical depths of 20mm upwards, although certain types may be able to be applied thinner. Refer to manufacturers' recommendations.

1.2 Description

Flowable and trowel applied screeds are cement based powder compounds containing redispersible powder polymers or plasticisers. They yield a compound used for smoothing and levelling concrete substrates. The compressive strength, hardness, wear resistance, flexural and bond strengths of the screed are influenced by its formulation and/or mix design. For use with resin flooring systems, such screeds should generally be bonded, although depending on the resin floor finish to be applied, they may also be laid in unbonded or floating construction. Always refer to manufacturers' recommendations.

These screeds fall into two categories:

Those in accordance with BS 8204 Part 3 (2004): Polymer modified cementitious levelling screeds and wearing surfaces: Code of Practice;

Those in accordance with BS 8204 Part 7 (2003): Pumpable self smoothing screeds: Code of Practice.

Both types are deemed suitable to receive resin floor finishes.

Screeds in accordance with BS 8204 Part 1 (2003): Concrete bases and cementitious levelling screeds to receive floorings – Code of Practice may also be suitable to receive resin floor finishes as long as certain strength criteria are met. Refer to manufacturers' recommendations.

2. SELECTION CRITERIA

Before specifying or installing a flowable or trowel applied screed, a number of key factors should be determined in order to establish the most suitable specification. Designers and manufacturers should be involved to ensure compatibility between the screed and the resin finish.

2.1. Existing substrate

What is the make up of the existing base? Is it concrete, sand-cement screed, calcium sulphate, etc? Note that mastic asphalt is often mistaken for dense floated concrete.

Thorough surface preparation is required before application of a flowable or trowel applied screed unless the screed is being laid unbonded or floating. Are there any specific site restrictions that may affect the preparation method, such as dust and noise restrictions which are often imposed in hospital and hygiene area refurbishment?

Are there any contaminants on the substrate which may hinder the bond of subsequent applications and therefore need to be removed?

Is the base sound, or is it weak and in need of consolidation? Are there any areas that need to be repaired before installation?

Are there expansion joints or structural joints in the base and how are these to be detailed within the screed?

2.2. DPM

The moisture tolerance of screeds may vary, so it is good practice to establish the moisture content of the substrate before laying the screed.

It should to be established if there is an effective DPM in the existing construction, and whether this has been broken or bridged. If it is established that the DPM is not effective, then application of a surface DPM should be considered before the screed is applied.

It is widely recognised that the surface hygrometer is the preferred and most accurate method for measuring moisture content (as specified in BS 8203 & BS 8204), but there are often practical difficulties with this method (e.g. leaving the hygrometers to equilibrate for several weeks on live building sites), so invasive methods using "in depth" hygrometers or a proprietary moisture meter are often more practical.

FeRFA offers detailed guidance in areas relating to DPMs. Please refer to the FeRFA Guides: "Guide to Installing Resin Flooring Systems onto Substrates with a high moisture content" and the relevant section of "Guide to the Specification and Application of Synthetic Resin Flooring".

2.3. Surface regularity

Before applying a resin floor, the surface regularity of the finished floor should be agreed. Once this has been determined, the specification may include a flowable or trowel applied screed capable of achieving the level of smoothness required.

The straightedge method for testing surface regularity given in BS 8402-1 is generally satisfactory for the majority of floor users and the designer should specify one of the classes of Surface Regularity: SR1, SR2 or SR3 as shown in Table 1 below.

Table 1: Classification of surface regularity for wearing surfaces of normal and high standard flooring

Class	Maximum permissible departure from a 2m straightedge laid in contact with the floor (mm)	Application
SR1	3	High standard: special floors
SR2	5	Normal standard: normal use in commercial and industrial buildings
SR3	10	Utility standard: other floors, where surface regularity is less critical

For specific details please refer to the relevant section of the FeRFA Guide to the Specification and Application of Synthetic Resin Flooring.

2.4. Depth of screed

The chosen screed should be capable of achieving the required thickness.

With a pumped flowable screed it is normal to achieve such thicknesses in one application, while several layers may be needed when applying by hand, depending on the thickness required.

With a trowel applied screed it is normal to achieve thicknesses up to 50 mm in one application, although greater thicknesses may be possible with some screeds. Refer to manufacturers' recommendations.

Priming between layers may be required if multi-layer applications are undertaken and in such instances the screed manufacturer's recommendations should be followed.

2.5. Screed strength

Typically, the screed manufacturers' technical data gives the flexural, compressive and bond strength, and quotes the strength buildup increasing over a period of 28 days in accordance with BS EN 13892-2: Methods of test for screed materials. The screed must be strong enough to withstand any stresses and strains which occur during the curing and hardening of the resin system.

For specific details please refer to relevant section of the FeRFA Guide to the Specification and Application of Synthetic Resin Flooring.

2.6. Time before overlaying

Screeds can typically be overlaid with resin flooring systems when they have reached a compressive strength of 25N/mm^2 and a moisture content below 75% RH, although on trowel applied screed this moisture content can be exceeded by using a damp tolerant primer as long as the strength criterion is met. The time taken to reach these values is affected by the site conditions, but under the same conditions will be considerably shorter than with a conventional sand-cement screed.

3. APPLICATION OF FLOWABLE SCREED

3.1. Pumped

Flowable screeds are typically mixed on site in a continuous two stage mixer pump. Materials are added to the mixer using the water addition and mixing time specified by the manufacturer. The mixed material is pumped along a flexible hose to the working area where it is delivered on to the prepared substrate as a lump free homogenous fluid screed and allowed to build to the required thickness. The screed should be laid to retain a wet edge to maintain the level and uniformity of the finish. Immediately after laying, use a spike roller or dappler to aid air release.

3.2. Paddle mixed

For smaller areas that do not justify the use of a pump, the full contents of a bag of screed are mixed with a set quantity of water, pre-measured into a mixing bucket, using a slow speed mixer and paddle. After mixing for a set period in accordance with the manufacturer's instructions, the mixed material is applied to the prepared substrate using a flat edged trowel to help it to flow out.

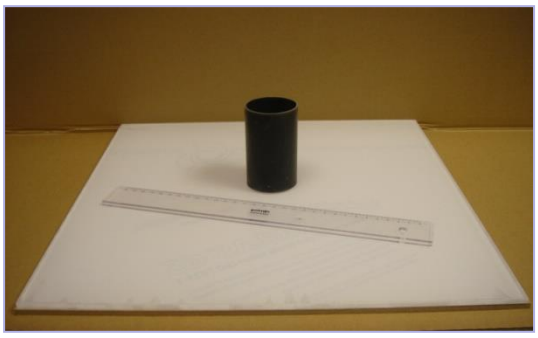
In both types of application, accurate thickness levels can be achieved by fixing setting pins into the substrate with heads set to the required screed depth. Alternatively dipsticks and pin-rakes can be used. Use a spike roller or dappler to aid air release immediately after laying.

3.3. Site quality control

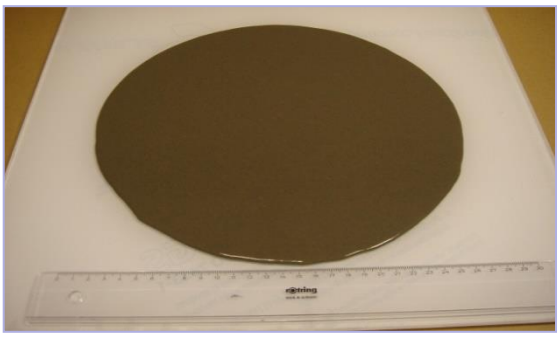
The consistency of the mixed material is monitored at regular intervals throughout the pumping application by a simple flow test. This involves placing a calibrated open ended cylinder vertically on to the centre of a smooth surface such as a glass plate. The cylinder is filled with material taken from the discharge end of the hose. The cylinder is lifted to free the material on to the glass plate where it creates a flow circle. Once flow ceases the circle diameter is measured in two directions and compared against the manufacturer's specification. The water addition to the pump can then be adjusted if necessary to give the correct flow.

The flow for paddle mixed material can be monitored in the same way.

Note: Flow requirements will vary between manufacturers.



Apparatus



Flow measurement

4. APPLICATION OF TROWEL APPLIED SCREED

4.1. Site mixed

Only forced action mixers should be used. Ensure that the mixer is in good condition, with no missing paddles or excessively worn blades. The mixing time must be sufficient to ensure thorough dispersion. Generally 3 minutes, from the time the last of the constituents is placed in the mixer, should prove adequate. Manufacturers' recommendations should be followed.

4.2. Ready mixed

These are mixed off-site by a batching plant with a forced action mixer. Truck mixing is not permitted. The retarder type and dose are determined by the screed supplier, and batched and mixed at the ready-mix plant. A plasticising retarder should not be used.

4.3. Application

Hand Laid Screed

The area to be screeded must be weather tight (i.e. all roofs, windows and doors must be covered). The mixed material should be placed and compacted within 20 minutes of mixing (unless using a ready-mixed screed with a

retarder). Compaction must be thorough. A weighted roller or heavy hand rammers are suitable. Treading in is acceptable if carried out evenly and thoroughly.

Thick screeds (over 75 mm) are to be laid in two layers of roughly equal thickness. By laying the second layer within 20 minutes of the first, a monolithic screed is achieved. Each layer is to be compacted separately, the surface of the first layer being roughened to ensure a monolithic total thickness.

For screeds laid over underfloor heating systems, apply the screed in two layers, the bottom layer being a little wetter than usual to ensure full compaction around the heating pipes.

Machine laid screed

For areas greater than 50m^2 the use of proprietary screeding machines may be found to be beneficial. Used on medium to large size jobs, outputs of 100 m^2 per hour are possible with reduced manual effort. Consistency of compaction and regularity are simpler to achieve. A final finish by power trowel should leave a uniform, smooth but not polished surface, free from trowel marks.

Finishing

Ruling off must be accurate to meet the required surface finish – see Section 2.3. SR2 will be the normal requirement but it is important to check what is required, including the tolerance from datum. To achieve the higher SR1 standard will require an increased intensity of supervision and attention to detail, which can be expected to increase the cost of application.

On occasion, a good standard of wood float finish is adequate, but generally a tightly closed and flat, steel trowelled finish is specified. Power trowelling to a pan finish by skilled operatives is acceptable providing the required surface regularity is maintained.

Curing

Most screeds require curing, although some very rapid drying screeds may not. Cure the screed under polythene for the period recommended by the manufacturer. The polythene sheet must be well lapped and completely cover all exposed edges. Failure to prevent moisture loss from edges can greatly increase the risk of edge hollowness or curling. Premature drying generally can increase the risk of cracking and reduce the screed's wear resistance. On completion of the curing period, the polythene may be left in place but will normally be removed to enable the screed to dry out.

Drying

Good drying conditions are a warm, well ventilated environment with low ambient humidity (20°C and 50% RH). Forced drying (dehumidifiers) may be used 28 days after laying of the screed but will inevitably increase the risk of shrinkage cracks and hollowness. A screed that is wetted (by rain or leaks) will have a considerably extended drying time.

4.4. Site Quality Control

During application

The minimum amount of water should be added to the screed mix to give the correct consistency for it to be laid and compacted. The consistency can be checked with the "snowball test", as described in BS 9009-9 Section 4.3.3.2 and CIRIA Report 184 Section 5.

Inspection and testing after laying

Check the completed screed with a straightedge to confirm that it has been laid to the specified level tolerance. Check bonded and unbonded screeds for compaction using the BRE Screed Tester ("Drop Hammer"). The Drop Hammer test may also be used on some floating screeds and heated screeds, but there are likely to be limitations to prevent impact damage to the screed. Refer to the manufacturer's recommendations.

Installation of floor finish

The screed should have reached sufficient strength to take the resin finish – refer to the manufacturer's recommendations. Before installation of the finish, the screed's moisture content should be tested with a hygrometer as described in BS8203-1 Annex A. Note that with a suitable moisture tolerant primer, resin finishes may be installed on a screed with moisture content up to 100% RH as long as it is visibly surface dry.

5. JOINTS

Construction joints in the base concrete should always be mirrored through the flowable screed. Joints can be pre-formed to provide a neat vertical edge; alternatively they can be formed by saw cuts in the hardened screed. Saw cutting should be carried out within a few days of application to prevent random cracking.

Day joints are formed in the screed to divide up areas of work but are not intended to accommodate movement. These joints are formed to leave neat vertical edges on the screed. When screeding continues these edges are primed to achieve a good bond. It is good practice to coincide daywork joints in the screed with construction joints in the substrate wherever possible.

Expansion joint width should be the same width as in the base concrete. Proprietary sealants or jointing strips should be used to fill these joints. Guidance should always be sought from the screed and joint manufacturers.

6. PREPARATION OF SCREED TO RECEIVE A RESIN FLOORING SYSTEM

6.1 Surface preparation

When the screed is dry and strong enough, prepare the surface and remove all residues to leave a dry and dust free open textured surface. Refer to the FeRFA Guide to Preparing Substrates to receive Resin Flooring and Finishing of Resin Terrazzo Systems.

6.2 Priming

Refer to the resin manufacturer's recommendations for selection of a suitable primer. The surface of a flowable screed is generally denser than a concrete floor slab, so a lower viscosity primer than usual may be needed, otherwise loss of bond may occur.

7. FERFA CLASSIFICATION OF RESIN FLOORING SYSTEMS

Type	Name	Description	Duty	Typical thickness
1	Floor seal	Applied in two or more coats. Generally solvent or water borne	LD	Up to 150 µm
2	Floor coating	Applied in two or more coats. Generally solvent free.	LD/MD	150 um to 300 µm
3	High build Floor coating	Applied in two or more coats. Generally solvent free.	MD	300 um to 1000 µm
4	Multi-layer Flooring	Aggregate dressed systems based on multiple layers of floor coatings or flow-applied floorings, often described as 'sandwich' systems.	MD/HD	> 2 mm
5	Flow applied Flooring	Often referred to as 'self-smoothing' or 'self-levelling' flooring and having a smooth surface.	MD/HD	2 mm to 3 mm
6	Resin screed flooring	Trowel-finished, heavily filled systems, generally incorporating a surface seal coat to minimize porosity.	MD/HD	> 4 mm
7	Heavy Duty Flowable flooring	Having a smooth surface.	HD/VHD	4 mm to 6 mm
8	Heavy Duty resin flooring	Trowel-finished, aggregate filled systems effectively impervious throughout their thickness.	VHD	> 6 mm

Light duty	(LD)	light foot traffic, occasional rubber tyred vehicles
Medium duty	(MD)	regular foot traffic, frequent fork lift truck traffic, occasional hard plastic-wheeled trolleys
Heavy duty	(HD)	constant fork lift truck traffic, hard plastic wheeled trolleys, some impact
Very heavy duty	(VHD)	severe heavily loaded traffic and impact

8. GLOSSARY OF TERMS

DPM	(Damp Proof Membrane) - an impervious material used within the construction of ground bearing floors to stop moisture or prevent damp
Flooring	uppermost fixed level of a floor that is designed to provide a wearing surface
Flowable screeds	cement based powder compounds containing polymers which are mixed with water to produce a flowable compound
Trowellable screeds	semi-dry compounds containing cement, sand, aggregates if required, water and polymers or plasticisers
Joint	formed discontinuity in either the whole or part of the thickness of a screed or slab.
Levelling screed	screed finished to obtain a defined level and to receive final flooring
Screed	layer of material laid in situ, directly onto a base, to obtain one or more of the following purposes: - to obtain a defined level - to carry the final flooring - to provide a wearing surface
Substrate	building element that provides support for a screed or flooring
Surface regularity	deviation in height of the surface of a flooring layer over short distances in a local area

9. STANDARDS AND PUBLICATIONS

BS 8203: Code of practice for installation of resilient floor coverings
BS 8204 Parts 1, 3, 6 and 7
BS EN 13892-2: Methods of test for screed materials

FeRFA PUBLICATIONS

All the FeRFA publications listed below are freely downloadable from FeRFA's web site at www.ferfa.org.uk.

- Guide to the Specification and Application of Synthetic Resin Flooring (RIBA CPD Approved)
- Guide to the Selection of Synthetic Resin Flooring
- Assessing the Slip Resistance of Resin Floors (TGN 01)
- Osmosis in Resin Flooring (TGN 02)
- Chemical Resistance of Resin flooring (TGN 03)
- Static Controlled Flooring (TGN 04)
- Guide to Installing Resin Flooring Systems onto Substrates with a high moisture content (TGN 05)
- Guide to Cleaning Resin Floors (TGN 06)
- Guide to Seamless Resin Terrazzo (TGN 07)
- Guide to Flowable and Trowel Applied Polymer Screeds as underlayments for resin floor finishes (TGN08)
- Guide to the selection of deck waterproofing and wearing surfaces for car parks (TGN09)
- FeRFA Environmental Guide (TGN10)
- Guide to preparing substrates to receive resin flooring and finishing of resin terrazzo systems (TGN11)
- 'Comfort' resin flooring systems (TGN12)
- Guide to Personal Protective Equipment for use with In Situ Resin Floors and Surface Preparation – also available in printed form as a pocket guide

FeRFA

FeRFA, the Resin Flooring Association, represents the major product manufacturers, specialist contractors and surface preparation companies, raw material suppliers and specialist service providers within the UK Resin Flooring Industry. Established in 1969, FeRFA now represents over 90 UK based companies. The Association has established Codes of Practice for full members. It takes an active role in promoting resin flooring and in developing both national and international standards.

All FeRFA publications are freely downloadable from the website at www.ferfa.org.uk for further information, contact FeRFA at: PO Box 3716, Stone, Staffordshire, ST15 9EU
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