TECHNICAL BULLETIN – TB131

COMMON PRACTISES THAT LEAD TO PROBLEMS WITH LEVELLING COMPOUNDS

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INTRODUCTION & SCOPE

There is an old saying, 'that a poor workman blames his tools' when something goes wrong. In the same way, problems in a flooring installation seem to be blamed on the products in the first instance, rather than looking at the installation practices.

In the 30+ years of ARDEX flooring products in Australia, experience and investigation of customer complaints have shown that the most common cause of problems results from poor installation procedures. This occurs either through unfamiliarity with the application and product properties or via ingrained procedures that go against the recommendations of ARDEX, flooring manufacturers, or the Australian Standard.

Installers must always remember that rectification costs roughly three times the initial job cost and that the profit from the next 30 or so jobs may be consumed in making good this one job. In this bulletin, we will look at some of the practices that are most likely to produce complaints.

WHAT ARE THESE PRACTICES?

Basically, there are four installation areas where issues can arise due to problems with poor working practices or omission of preparative steps -

- Moisture in the subfloor
- Preparation of the subfloor, including priming
- Mixing and application of the product
- Using the wrong product

MOISTURE IN THE SUBFLOOR

This is an area where there is a temptation to say, 'She'll be right,' and go ahead with the job, even though no measurements or checks have been done. The subfloor moisture can come from young, uncured, damp concrete or damp slab syndrome resulting from ground water or rising dampness. Moisture can be trapped under sheet vinyl and cause blistering or odours and smells in carpets.

Ignoring dampness can have genuinely catastrophic financial effects on installers. For example, a vinyl installation bubble, blister, or de-bond in a large supermarket or healthcare facility will result in lengthy disruption and large demurrage charges for lost income.

The corrective actions are straightforward –

- ✓ Is the slab young age, remembering that concrete dries around 25mm a month? If so, dampness is likely to be a problem. Let the slab dry naturally where possible.
- ✓ Has an exposed slab been rained on the last few days.
- ✓ Ask if the slab is below grade and look for signs of dampness during the inspection.

- ✓ Measure the subfloor moisture contents. The Australian Standard AS1884-2021 specifies 75% relative humidity at 40% depth.
- ✓ Install an appropriate moisture barrier and protective topping where moisture is problematic.
- ✓ Do not skimp on the membrane thickness; two coats of ARDEX WPM300 or ARDEX WPM368 MOISTURE BARRIER to a thickness of 0.3mm are required.
- ✗ Do not lay flooring directly onto the membrane.
- ✓ Refer to ARDEX Technical Bulletins TB006 or TB040 for specific information.

SUBSTRATE PREPARATION

Remember, when the installer starts the job, they have accepted the subfloor's condition and are responsible for everything after that with the flooring installation. This is written in the Australian Standard.

The leading causes of problems with flooring installations arise from poor substrate preparation. ARDEX recommends correctly preparing the substrate before any product (flooring, tiling, or waterproofing) is installed. Contaminants include old adhesives, paint, oil, grease, dust and dirt, cement laitance, rain-damaged surfaces, weak screeds, curing compounds, and sealers. Advice that products can be placed over contaminants is dubious, so 'when in doubt, don't' makes good sense. Steel-trowelled, highly dense, non-porous, and polished concrete also provides adhesion problems.

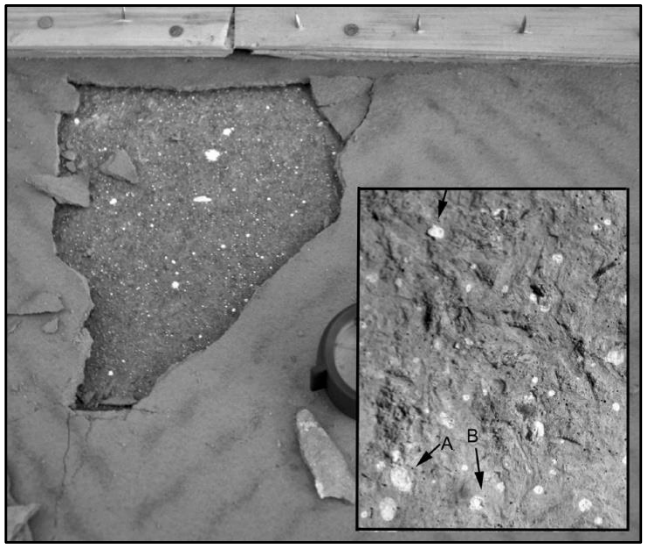
Failure to complete this elementary first step in a flooring job invites a problem. However, Technical Services are regularly told that preparation is too dirty and will make a mess, there is no time to do the preparation, or it is too expensive, and the customer won't pay for it. Another common request is, "Can we prime over the subfloor contaminants?" This is another poor practice that cannot be recommended since the bond for the primer/topping then relies on the contaminants sticking to the subfloor.

Failing to perform adequate preparation results in de-bonding of the topping and covering from the subfloor. ARDEX can quickly identify this malpractice when conducting a forensic analysis since the contaminants are usually stuck to the back of the topping.

The corrective actions are based on sound techniques –

- ✓ Prepare concrete or timber by mechanical means to a sound surface with an adequate surface profile, removing all contaminants, old adhesives, and weak layers.
- ✓ Always vacuum the surface clean after mechanical preparation processes.
- ✓ ARDEX Technical Services has produced Technical Bulletins that give instructions on the types of preparation required and what happens when it is not done. Refer to TB037, TB039 and TB041.

The following case histories give examples of poor practices that have resulted in failures. In all these examples, a customer complaint was received, and ARDEX Technical Services investigated in conjunction with the sales representative. In each example, an examination of the site and samples traced the source of the problem back to an aspect of the subfloor preparation.



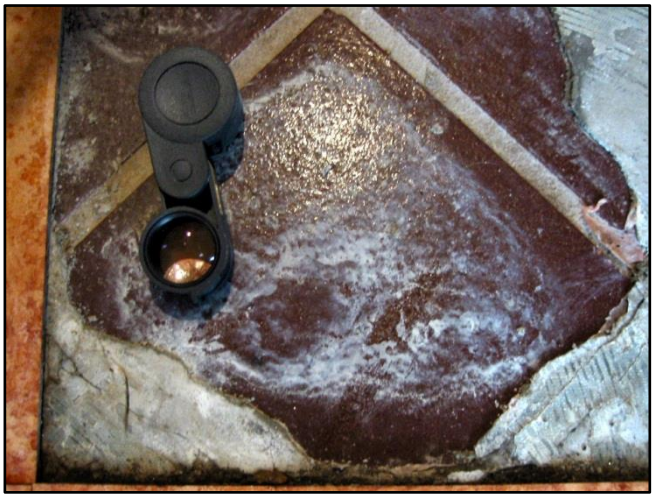
The floor on the left was particle board timber that had not been sanded to remove the waterproof coating and building contaminants, including plaster residues. It had also been rain-affected and had a weak surface layer.

The topping was ARDEX ARDITEX NA, which de-bonded the weak top layer.

An example of contaminants on the back face of de-bonded ARDEX 45.

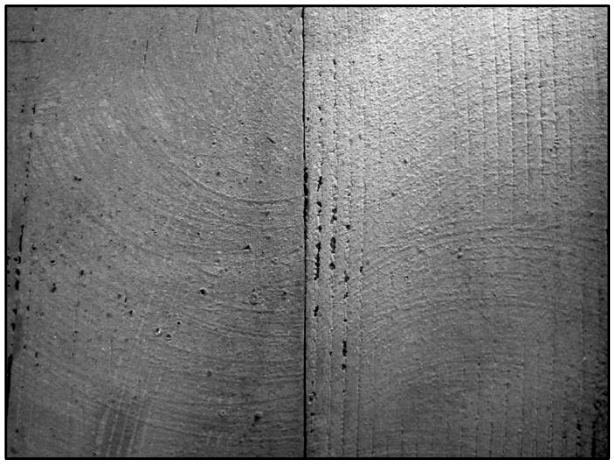
A – Weak concrete subfloor material such as laitance.

B – Clay dirt from foot traffic.



Ceramic tiles were covered with ARDEX K15. The glaze and other residues were not fully removed prior to the application of the levelling cement, which was partially responsible for the Neoprene primer de-bonding. Also, this location had rising damp (white efflorescence on the tile), which further degraded the ARDEX K15 and loosened the primer bond. Vinyl tiles de-bonded off the floor.

A concrete floor coated with a curing compound. The floor has been partially ground but not sufficiently to promote good adhesion.



Vinyl tiles de-bonded with the skim coat of levelling cement. In this case, the swirl patterns shown are from the original concrete surface, which was rain-affected and had not been ground back. The combination of an overly thin layer of ARDEX K15, high floor loads, and a weak surface layer resulted in de-bonding.

PRIMING – FAILING TO DO IT

ARDEX flooring cements are part of a system, and each component has a role to play in that system. There seem to be erroneous perceptions that priming is optional, will cure many poor preparation sins, and that any old primer will do the job. Nothing could be further from the truth.

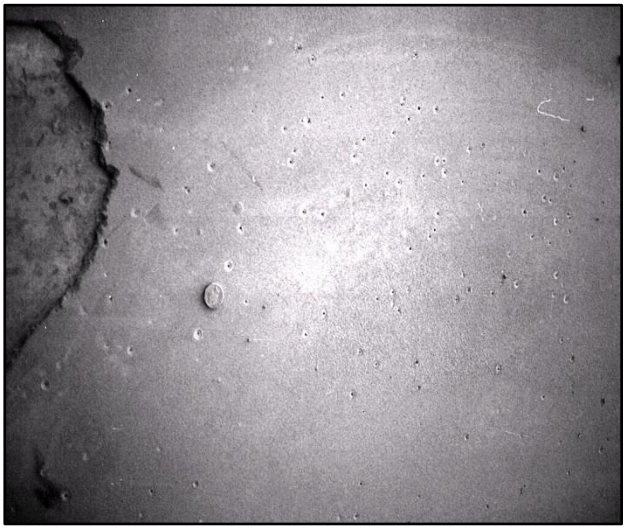
In the ARDEX systems, primers perform two major tasks.

- They penetrate the substrate and promote a chemical bonding key to the surface
- They assist in the correct curing of the cement base of the product by preventing premature water loss through absorption into the substrate.

The primers also close up the surface's pores (concrete) and prevent trapped air bubbles from migrating through the drying cement and producing antholing.

Primers are not intended to help bond the topping to contaminants. The primer typically bonds to contaminants such as old adhesives, weak layers, and dust, but the whole system comes off the floor when the contaminant de-bonds. Plastic films of ARDEX P51 primer have been observed to lift cleanly off a floor in a sheet because the primer has stuck to the cement dust and rubbish, not vacuumed off the floor in the first place, and not adhered to the concrete itself. Paint, for example, does exactly the same thing over dusty, dirty surfaces.

Another common question is, “Can we use XYZ bonding agent from the hardware?” The answer is simple—no. ARDEX primers are designed to work with ARDEX levellers; other manufacturers’ products are not. The results can be unpredictable, and no warranty will apply.



When priming is not done on porous surfaces, ant holing will occur. This is not satisfactory for vinyl flooring.

It is important to use the correct ARDEX primer for the attempted application. Don’t be tempted to cheat, go without, or use substitutes.

When using the primers, always –

- ✓ Mix the two parts of ARDEX P82 completely and do not apply too thickly over the surface.

- ✓ Use ARDEX P82 over ARDEX WPM300 Hydrepoxy or properly prepared nonporous surfaces such as tiles, timber, or metal decks.
- ✓ Use the appropriate dilution ratio for ARDEX P51 for the substrate.

  Diluted 1:2 with water for a porous surface

  Diluted 1:3 for highly porous surfaces and

  Diluted 1:1 for less porous surfaces or as a second coat over 1:3 dilutions.
- ✓ Apply thin coats and spread out evenly. Allow to dry for the recommended time. Typically, the floor is ready when the primer is tack-free.
- ✗ Do not lay leveller over pools of ARDEX P51 or ARDEX P82 on the subfloor. This can produce areas that are locally over-watered at the subfloor interface or can result in cracking of the topping.
- ✗ Do not allow more than 24 hours to elapse before placing smoothing cement over ARDEX P82 primer.
- ✗ Do not apply levellers over wet primer. Again, this can lead to problems with localized over-watering, primer rising through the topping and forming a skin, or even the formation of ant holes where the primer rises through the topping, and the water evaporates.
- ✗ Do not use primers from non-ARDEX sources, as unpredictable performance may occur.

- ✗ The floor at left has been primed with ARDEX P51 Primer. Some puddles must be dispersed and allowed to dry before the topping is poured.
- ✗ Below is a puddle of P82 about to be over-coated. This could cause cracking in the leveller.

APPLICATION OF THE LEVELLING CEMENT

When it comes to laying the levelling cement, there are two stages where things can go wrong, and these are;

⇒ The mixing stage

⇒ The laying operation

MIXING STAGE

Gauge Water

ARDEX levelling cement is designed to work with specific amounts of added water or water/ARDEX E25 mixes. The relevant product datasheets, packaging, and Technical Bulletins for special applications clearly print these water ratios.

Underwatering generally has no real negative effects on product performance other than reducing flow properties. However, overwatering the product by as little as 10-15% produces a raft of problems that can lead to the need to re-do the floor.

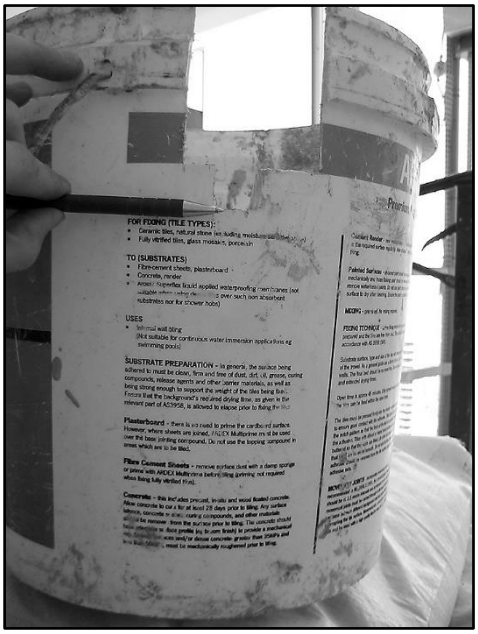
The problems that can be caused are.

- ✕ Segregation of the particles in the leveller.
- ✕ Slow drying.
- ✕ Excessive shrinkage with resultant cracking and de-bonding.
- ✕ Weak surface layers and reduction in overall underlayment strength.

The physical signs of over-watering are obvious. The surfaces are light in colour, often whitish, and variable. Water accumulates in low spots and produces distinctive tide marks as it evaporates. The excess water disrupts the viscosity properties of the leveller so that coarse grains settle to the bottom and the fines go to the top. This stratification changes the surface hardness and drying properties of the leveller. The fines at the surface are weak and soft, leading to indentations and possible de-bonding of the adhered floor covering. The different layers have varying degrees of shrinkage on drying, which can lead to cracking, concave cupping, and de-bonding of the topping.

Excessive water application leads to overall shrinkage problems, but also greatly retards drying of the levelling cement, which effectively negates the advantages of the ARDURAPID technology used in ARDEX levelling products.

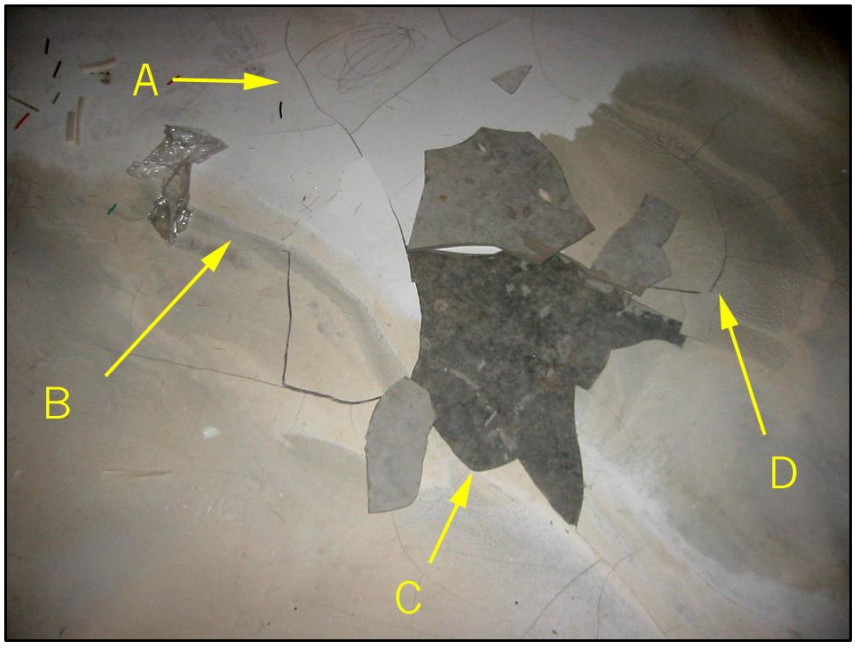
The following examples are case histories where over-watering has been responsible for creating problems on site. In each case, the complaint was investigated by ARDEX Technical Services, and the major contributing factor to the problem was identified. As noted above, the signs of over-watering are easily recognizable and can be seen in the illustrations.



This homemade gauging bucket can result in variable or inaccurate water dosages unless carefully cut and used.

✓ Above is the standard ARDEX gauging bucket.

✕



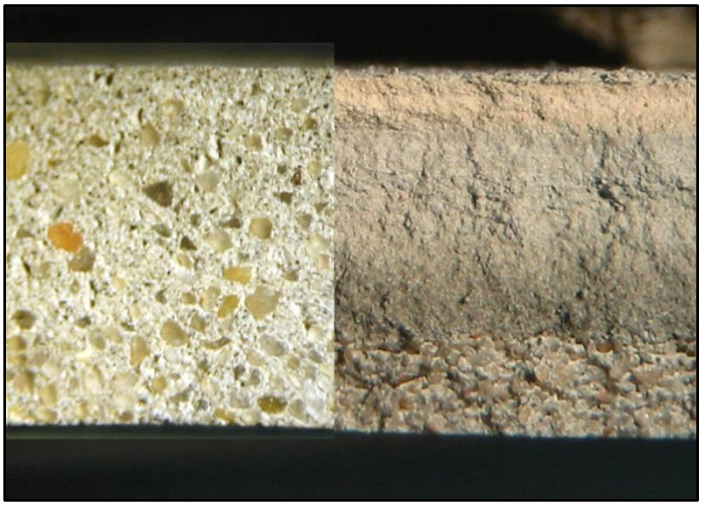
Classical signs of over-watering product.

A- Light discolouration, which is made up of fines on the surface.

B- Watermarking

C- Sheet de-bonding off floors

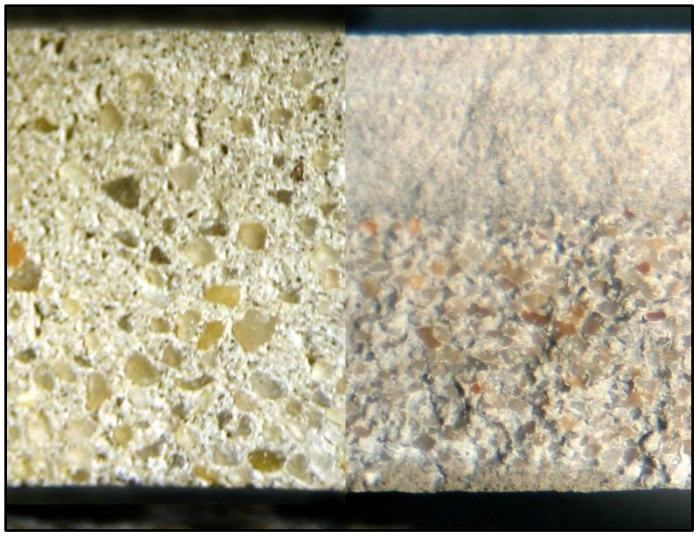
D- Polygonal shrinkage cracking



Samples of products returned from job sites.

The sample on the left is ARDEX levelling cement with the correct amount of water

The sample on the right has been over-watered by approximately 100%



The right-hand sample was over-watered by approximately 50%.

The obvious feature of both of these returned samples is the degree of particle segregation. The pale colour at the top is weak and soft.

Why do floor layers over-water?

- ✕ Wrong water gauging buckets used (not calibrated).
- ✕ Don't know the correct water amount (haven't read the bag instructions).
- ✕ To try and 'improve' the product flow.
- ✕ To try and re-invigorate the mixed leveller that has started to cure.
- ✕ Assumption that levelling compounds are like concrete and can have extra water added for workability.
- ✕ Bad mixing techniques or mixers.
- ✕ There is too much haste when adding the mixing water.

When mixing, always use clean water. Do not use water that contains mud or dirt or has been used for cleanup. In rural areas, avoid using bore water, which contains mineral salts and may be alkaline, acidic, or heated.

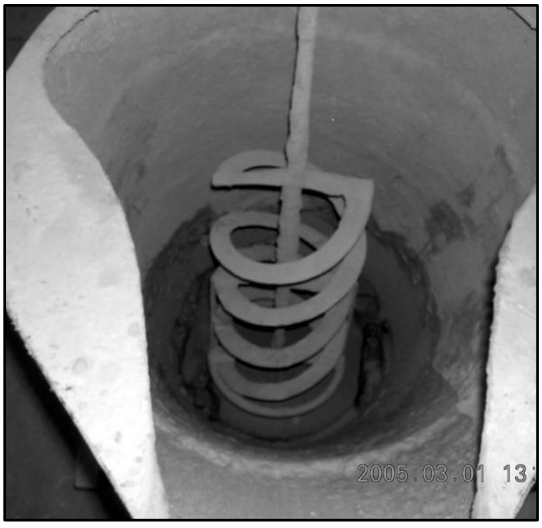
Mixing technique and equipment

The ARDEX recommended mixer is a paddle type that breaks up lumps and creates a good vortex in the mix. Many layers use a spiral type of mixer designed for surface coatings. In ARDEX's experience, this type of mixer does not adequately break up lumps or create a sufficient vortex to turn over the viscous cement. When using bulk fills, the spiral mixers do a poor job and tend to overwork the mixer's electric motor.

Where the mixer is fixed to the side of the mixing container, cement builds up on the sides in unmixed and hard lumps, which can then drop into the mixed material and end up on the floor. A hand-held heavy-duty drill/mixer will allow the user to scour the sides of the bucket and the base to ensure thorough mixing.

Poor mixing and not mixing for the recommended minimum of 2 minutes has several side effects.

- ✗ It can lead to localized over-watering.
- ✗ The formation of un-mixed lumps and segregation.
- ✗ Does not allow special additives in the leveller to disperse and react properly, altering flow and viscosity.
- ✗ *Do not use concrete mixers with levelling cement.*
- ✗ *Do not over-mix.*



✗ The above picture is a spiral-type mixer, which is not preferred by ARDEX for its products.

✓ The ARDEX mixing paddle and mixing of material with the paddle and a heavy-duty drill.

LAYING STAGE

Weather Conditions

The first thing to consider is the weather conditions. If it is below 10^0C, there will be delayed curing, and at 50C and less, the reactions stop. Above 30-350C, the levellers react very quickly, which significantly limits working time and can result in premature hardening of the floor and poor workability.

The poor practices that occur in this situation tend to be at the high-temperature end, where extra water is added to help workability—leading to over-watering. At the low end, heaters may be used, which leads to rapid drying with possible surface cracking.

Refer to ARDEX Technical Bulletin TB097 for advice.

Laid Thickness of material

The levelling products are designed to be laid at certain thicknesses, and it must be remembered that these are toppings, not slabs. ARDEX K15 and ARDEX K80 are not thickness restricted, whilst ARDEX K900BF is limited to 90mm maximum. The other levelling cements are designed to be laid less than 35mm and a number less than about 8-10mm. Adding aggregate varies the thicknesses allowed for certain products listed in the product datasheets and ARDEX Technical Bulletin TB102.

When products are laid in excess of their recommended thickness, there can be problems such as.

- ✗ Slow drying
- ✗ Shrinkage cracks leading to de-bonding
- ✗ In some cases, high temperatures generated during curing can affect adhesion.

These problems can be avoided by -

- ✓ Selection of the correct product for the job, and not just whatever happened to be cheap or available at the time.
- ✓ Use a bulk fill product for high thicknesses to reduce cost and technical reasons.
- ✓ Use the higher performance products for deeper fills, such as ARDEX K15, ARDEX K80, or ARDEX K900BF.
- ✓ Follow recommended maximums for ARDEX K12, ARDEX ARDITEX NA and ARDEX LQ92.
- ✗ Do not lay excessive thicknesses of ARDEX K125, K275, ARDEX ARDITEX NA, or ARDEX FEATHER FINISH.

Here is an example of material used above the recommended thickness. In this case, the product is ARDEX A45, used above the recommended maximum thickness of 20mm without a filler aggregate.

During curing, the cement can become hot and produce tensile strains, which can result in cracking or possible de-bonding from lower-strength substrates.

Conversely, laying a leveller over an impervious surface in too thin an application can also cause problems. The final surface is then not porous enough for certain types of water-based adhesives.

Over-working the leveller on the floor

In terms of the finished floor, overworking can have effects that can be visually indistinguishable from overwatering, which has many of the same problems.

Flowable grade floor levellers are designed to be poured out, raked once or twice with the thickness rake to adjust depth, and then given one or two passes with the spreading trowel to smooth out edges and ripples.

However, layers may decide the material needs to be 'worked' and will drag the trowel back and forth and do multiple passes over the leveller. At the same time, they might walk back several metres into the laid area and 'adjust' a small irregularity. The first practice results in the fines being brought to the surface, segregation, and a weak top layer. The second can produce marks in levellers that are on the way to the initial set, which then has to be 'worked' again.

- ✗ Don't overwork the material.
- ✓ One or two passes of the trowel only (or spiked roller for ARDEX ARDITEX NA).
- ✗ Don't walk into a laid leveller more than 5 minutes old.
- ✓ Do wear studded football boots.

Laying Toppings over Joints

Movement and construction joints are designed to allow building elements to move around independently. Some clients request that joints be covered by the floor covering, be it vinyl, carpet, or tiles.

This practice must be condemned as any movement in the subfloor will crack through the leveller, and result in cracking or de-bonding of tiles, lumps in carpets, and depressions or tears in the vinyl.

Movement joints must be correctly detailed with the leveller diamond cut-through and flexible sealants or proprietary joint strips or systems used for the carpet/vinyl.

Premature laying of coverings

The last thing to do is lay the floor covering. If the leveller has not fully cured, this can lead to moisture problems, mainly with vinyl flooring, though carpet glues are affected as well. The rapid set technology levellers are ready to lay vinyl on after periods of time that vary between 30 minutes and 24 hours, depending on the product. Hydration products require between 2 and 3 days to cure and will remain damp during this time period.

USING THE WRONG PRODUCTS FOR AN APPLICATION

There is a temptation to use what is available in the back of the truck or the cheapest product, which can lead to problems. Some products are more flexible in their application than others, for example, ARDEX ARDITEX NA can be used in many environments, but some levellers are more specialized and should be used in their correct usage.

Another temptation is to be creative with products and use them in ways other than intended, which may or may not work.

Each product in the ARDEX flooring range has particular attributes, though there is a degree of overlap between them in applications. The product bags and the datasheets describe the use for each leveller, but the following rules apply.

Remember, the majority of ARDEX products are for internal applications only.

- The only products rated for external usage as underlayments in *protected* conditions are ARDEX LQ92, ARDEX ARDITEX NA, and ARDEX K900BF.
- The only externally rated products that can be exposed to the weather are ARDEX K301 or ARDEX A46.
- The only product that can be considered a dry area wear surface is ARDEX K80.
- ✕ ARDEX neither warrants nor recommends using ARDEX K15 as a wear surface ‘feature floor’.
- ARDEX LQ92 and ARDEX K900BF can be used to level and create falls in wet areas.
- ARDEX K15, ARDEX K12, and ARDEX A45 can be used in internal wet areas under suitable membranes with sheet vinyl floor coverings.
- ARDEX K15 mixed with ARDEX E25 is recommended for heavy-duty vinyl installations in supermarkets, commercial premises, or institutions.
- ARDEX K15 mixed with ARDEX E25 or ARDEX ARDITEX NA are rated for flexible surfaces such as Compressed fibre-cement sheets or timber.
- The only products that can be laid over suitable ARDEX flexible membranes are ARDEX ARDITEX NA or ARDEX FEATHER FINISH.

An example of a poor product choice is ARDEX K12, which was laid on a floor subject to continuous disinfectant washing under a water-resistant carpet.

The ARDEX K12 had no membrane or protective coating and degraded over time. Eventually, the topping de-bonded in patches from the subfloor.

CONCLUSIONS

When used within ARDEX recommendations and correct industry practices, ARDEX flooring products perform at the top end of the market and provide a strong and durable surface for flooring, which have been proven in service since 1949.

When poor practices are used, some of these products will tolerate a degree of abuse, but others will not and bite the installer hard. As we have already mentioned, the financial cost of being bitten is high, and the best way to avoid this is to follow good practice, read the product literature, and insist that specifications are followed when doing an installation.

It is in the installer's best interests to encourage builders and specifiers who may have contracted them to take on a job so that the full set of correct procedures can be followed.

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