TECHNICAL BULLETIN – TB097

THE EFFECT OF AMBIENT CONDITIONS ON THE PERFORMANCE OF TILE ADHESIVES, GROUTS, FLOORING CEMENTS AND LIQUID APPLIED MEMBRANES

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INTRODUCTION

This Technical Bulletin outlines some weather-related product issues that have been the subject of inquiries to ARDEX's Technical Services, but also observations by ARDEX's Research & Development Department. These concerns will be looked at, and solutions provided to assist in obtaining optimal product performance.

The successful curing of freshly laid tile adhesives, membrane and floor levelling cements can be affected by the ambient temperatures and humidity, both at the high and low ends of the range. In order to achieve optimal results users of these products need to make some adjustments in normal procedures to allow for these material properties.

In the winter, the combination of cold temperatures and increased humidity produce one set of conditions which impedes curing, whilst at the other extreme hot and dry conditions in summer can result in too rapid curing.

See also ARDEX Technical Bulletin TB257 which deals specifically with membranes.

COLD WEATHER & WINTER EFFECTS

THE PROBLEMS

The cold temperatures and reduced evaporation rates can have the following effects on products:

Cementitious Products Slow Curing

1. Tiles adhesives, grouts and flooring cements based on Portland or Aluminate cements have slowed rates of reaction that reduce the initial hardness and subsequent final cure when the temperature drops below 10^0C. At temperatures below 5^0C the reactions can halt altogether. Below 0^0C the water in the material freezes which can produce damage in the materials if partially cured due to the formation of ice crystals.

Efflorescence in grout

2. Due to increased water residence times as a result of slowed evaporation, efflorescence can also be increased in cement-based materials such as grouts. Efflorescence is a deposit of water-soluble salts from the

cementitious components which are drawn out by the water and then deposit at the surface when the water evaporates. Premature sealing can exacerbate this effect.

Epoxy Slow Curing

3. Epoxy based grouts, adhesives, membranes and sealers cure by a chemical reaction between two components and this reaction is slowed or halted by cold conditions. The viscosity of the resins can also increase making effective mixing difficult. Water based epoxies can display increased drying times and apparent stickiness due to decreased rates of water evaporation.

Mastic Adhesive and Membrane Slow Curing

4. Water based membranes and mastic adhesives can show decreased rates of drying due to slow evaporation of the water carrier. They can also become thicker in cold conditions.

Freezing of Mastic Adhesives and Additives

5. Mastic tile adhesives and latex additives can freeze which both makes the products not able to be laid but may also cause the polymer/water suspensions to be damaged, rendering the product unusable.

THE SOLUTIONS

There are a number of simple procedures which can be observed to avoid the cold weather situations.

Do's

1. Materials should not be stored in the open or in buildings likely to drop below 0^0C.
2. Where the work area is indoors the surface or ambient temperature should be raised by portable heating or air conditioning to at least 10^0C. Even if the materials themselves are kept at the correct temperatures, they will come to the temperature of the substrate very quickly when applied to it.
3. Use rapid set adhesives to reduce cure times.
4. Where the product datasheet allows reduced water additions, use the lowest level consistent with the quoted minimum and workability.
5. During the installation, factor increased drying times between each step in the job.
6. Increase the amount of ventilation by the use of fans which will raise the rate of evaporation. This is useful for slow drying membranes and mastic materials. However, the air must not be supplied by a heater as this can cause cracking and should only be used on floor levellers after the material has hard cured.
7. If the daytime temperature is acceptable, but may drop significantly at night, only use products until around midday to allow the material to form an initial set prior to the onset of cold temperatures at night.

Don'ts

1. Work outside, or indoors when the temperature cannot be controlled, if the temperature is below 5^0C, and where possible minimise working below 10^0C.
2. Do not use water heated above about 30^0C for mixing.

   Note: The pot life and working times will be reduced for materials in artificially heated conditions, or when using heated water for mixing.

HOT WEATHER & SUMMER EFFECTS

THE PROBLEMS

At the opposite end of the temperature spectrum is the hot weather that occurs over the period late spring to mid-autumn. Depending on the area it could be either humid or very dry. The problems that can occur are basically the opposite of those in winter.

Cementitious Products Premature Curing

1. The maximum recommended temperature for the use of cementitious materials is 35^0C and summer temperatures can easily exceed this.
2. Cementitious based materials cure faster in hot weather due to the increased reaction rate of the components. This means that flow or working times of levellers will be reduced, and tile adhesives will have shorter open times before skinning.

Application to Hot Substrates

3. Dark coloured surfaces exposed to direct sun on a hot day can reach 50 to 80^0C. This can be a significant problem for dark coloured cement substrates and tiles. Concrete substrates can act as heat sinks and hold high temperatures after the air temperature has fallen.

Rapid Evaporation and Poor Bonding

4. Increased evaporation means the water can be removed from the laid materials before curing reactions have a chance to complete, resulting in weak bonds. Highly dried out substrates can draw water in as well. This can be a significant consideration in rendering concrete structures such as pools which can act as heat sinks. Liquid containing products can skin at the interface with the substrate preventing penetration into the substrate and reduced bonding strengths.

Epoxy Premature Curing & Slumping

5. Epoxy products can cure very rapidly at increased temperatures, especially where a large amount of material has been mixed and generates its own heat of reaction which significantly reduces pot life. These materials can also become less viscous and slump when applied on vertical surfaces.

Blistering of Membranes

6. Liquid membranes can skin rapidly and prevent the underlying moisture from escaping. If the substrate is impervious, blistering can occur or poor adhesion may result.

THE SOLUTIONS

Do's

1. Mixing of materials needs to be done quickly and power mixing is recommended.
2. Where the materials are being used indoors, it is recommended that if air conditioning is available that it is turned on. Externally, only work in the cooler morning or late afternoon hours and do not lay materials in areas exposed to direct sun after 11 a.m.
3. Store all materials out of the direct sun and in a cool place. Air-conditioned shipping containers can be used for large jobs in remote areas where bulk quantities of materials need to be stored and used. Even if the materials themselves are kept at the correct temperatures, they will come to the temperature of the substrate very quickly when applied to it.
4. Use the maximum amount of water permitted for mixing on the product datasheets.
5. Use cool water drawn from pipes or taps where the water lines are not exposed to the sun. Water chilled by ice can be used, but the ice must be melted, and the temperature should not be below 10^0C.
6. Mix small batches of material and only work on an area that can be covered before initial cure or skinning occurs.
7. Rendered surfaces can be lightly sprayed with water or covered with damp cloth.
8. Correctly prime the surface to minimise excessive absorption of moisture.
9. Grout lines can be kept damp to promote better curing, but this is restricted to light spraying or damp cloth and *does not* mean ponded water.

Don'ts

1. Hand mixing is completely unsuitable for bagged materials such as flooring cements and full bags of tile adhesives.
2. Overwatering of materials during mixing reduces the product strength and can lead to weak surface layers and other problems.
3. Water or extra liquid in two-part products, must not be added to mixed material. It is not acceptable practice to thin down mixed material that is curing.
4. Don't apply renders to bonding bridges that have already set.
5. Don't rework or attempt to lay tiles on adhesives that have skinned.

AMBIENT CONDITIONS – HIGH HUMIDITY

Moist Concrete Subfloors

- In cold and humid conditions, the evaporation of moisture from subfloors made of concrete slabs and screeds is retarded, potentially creating problems for some types of membranes, tile adhesives and vinyl and other impervious coverings. The solutions to this situation include where possible, running the air conditioning to dry out the air above the sub-floor

and draw the moisture out, use a moisture barrier membrane, or allow the subfloor to dry with time.

Timber Subfloors

- Timber subfloors can shrink in extended dry weather and expand in moist conditions. This can create appreciable stresses in covering systems applied onto the subfloor. Air conditioning can produce a differential in the humidity between the room and beneath the floor which can dry the top of the floor and produce cupping. Conversely, excessive moisture on the base of the timber can result in deformations as well. The ventilation of the sub-floor needs to be good to allow some equilibration. Where possible floor layers should avoid installations at times of continued low humidity or high humidity.

Air Conditioning

- Air conditioning in buildings, especially in the tropics can cause moisture in the sub-floors to rise and produce problems for impermeable floor coverings. Where possible, air conditioning should be operated during topping installations, and a moisture barrier system used to protect the coverings. A common source of problems is floors laid when there is no air conditioning working, and it is switched on after the floor is laid drawing the moisture up.

Rained on Membranes

- When rain is possible, external liquid applied membranes that are uncured, or curing should be protected from the rain to avoid being damaged.
- Moisture cure polyurethane membranes are very sensitive to atmospheric or subfloor moisture and should not be laid on damp substrates.

SUMMARY

- All water based products should not be used when the temperature is 5-10^{0}C.
- Cement based products should not be used at temperatures below 5^{0}C.
- The maximum recommended temperature for cement-based adhesives or levellers, liquid membranes and epoxy-based materials is 35^{0}C.

For further advice on particular conditions, sites or applications contact ARDEX Technical Services on 1800 224 070 (freecall), or the relevant ARDEX Sales Representative for the product in your state.

IMPORTANT

This Technical Bulletin provides guideline information only and is not intended to be interpreted as a general specification for the application/installation of the products described. Since each project potentially differs in exposure/condition specific recommendations may vary from the information contained herein. For recommendations for specific applications/installations contact your nearest Ardex Australia or Ardex New Zealand Office.

DISCLAIMER

The information presented in this Technical Bulletin is to the best of our knowledge true and accurate. No warranty is implied or given as to its completeness or accuracy in describing the performance or suitability of a product for a particular application. Users are asked to check that the literature in their possession is the latest issue.

REASON FOR REVISION – ISSUER

PERIODIC UPDATE

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