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## TTA ADVICE NOTE 4

### Tiles and Service Conditions – EN 12004 Classification

The publication of BS EN 12004, “Adhesives for tiles – Definitions and specifications” has seen the introduction of a new classification system for ceramic tile adhesives, based on a series of standard tests to measure performance of key properties.

Adhesives are put into three categories by chemical type, dispersion (ready mixed), cementitious (including modified cementitious) and reaction resin (generally epoxy resin based). These categories are designated a pre-fix letter, D for dispersion, C for cementitious and R for reaction resin.

Certain performance characteristics are deemed to be fundamental for each type and hence these are made mandatory. Other characteristics are optional, some being performance enhancement over standard, in which case they are said to be “Additional Characteristics”, whilst others are for different properties which are classed as “Special Characteristics”.

This classification system replaces the Types 1 -5 classes in BS 5980 and does away with the Classes AA, A and B for water resistance.

The new system enables adhesive performance to be broken down into much more detail, enabling the specifier to be more specific in his specifications.

How can the specifier, distributor, contractor and client understand the link between adhesive classification and suitability for end use?

With reference to tile type it can be said that all types of adhesives will be suitable for use with BIII porous body tiles. For porcelain tiles (BIa) and vitrified tiles (BI) enhanced adhesion and the drying/setting characteristics will need to be taken into consideration, additionally so for large format tiles (greater than 300mm x 300mm). For these tiles dispersion adhesives will be very slow to dry, even on a porous background, and cementitious adhesives will require a C2 classified product to achieve the necessary levels of adhesion.

We can take a look in more detail at the links between tile type and service conditions and the classification of adhesives in each of the three classes.

### Dispersion Adhesives

In simple terms we can say that D1 adhesives in the new Standard are essentially those which would be Class B adhesives in BS 5980, ie they would not claim to be water resistant. Thus, D1 adhesives may be specified for dry internal wall tiling

where standard size porous body tiles are being fixed. On the other hand, D2 adhesives are those which would be classed as Class AA products in BS 5980. They would generally be suitable for use in wet areas, eg showers, but not for total immersion conditions. Again, the tiles should have a reasonable degree of porosity (BII or BIII) and should be standard size.

The classification allows for products with an open time greater than 30 minutes, such products receiving an "E" classification to signify this. Slip (initial grab) is an optional characteristic designated by the letter "T".

Taking a D2TE classification as an example, this signifies a water resistant dispersion adhesive having good non-slip properties and an extended open time.

### Cementitious Adhesives

Again, in simple terms, a C1 cementitious adhesive is equivalent to a standard, traditional cementitious adhesive whereas to achieve C2 the product would need to be a highly polymer modified adhesive.

The latter are often branded as "flexible" adhesives. All tile types may be fixed with cementitious adhesives but for porcelain and fully vitrified tiles a C2 adhesives should be specified to ensure that the necessary level of adhesion is attained. Similarly, large format tiles should be fixed with cementitious adhesives (C1 or C2) but if they are also of low porosity a C2 product should be used.

The fundamental characteristics of cementitious adhesives include tensile adhesion in the dry, total immersion in water, heat ageing and freeze-thaw cycling as well as a minimum 20 minutes open time (10 mins for rapid setting adhesives). Slip is an optional special characteristic as the pourable cementitious adhesives used on floors have no requirement for high grab properties on a vertical surface.

The C2 classification calls for twice the level of minimum tensile strength ( $1\text{N/mm}^2$ ) compared to C1 and has the option of an extended open time (> 30 mins).

The increased use of porcelain tiles has seen the demand for C2 adhesives rise dramatically whilst the popularity of natural stone tiles has also seen a need to use white cementitious adhesives rather than grey, to avoid the possibility of staining.

In general, we can say that the more arduous the service conditions, whether they be under water, external, at elevated or sub-zero temperatures, the greater the need to specify C2 adhesives.

An additional optional classification has been brought into the cementitious adhesives ratings. This relates to performance in the "Transverse Deformation Test", which is a measure of the adhesive's ability to deform under stress, ie to accommodate limited movement. The classification is S1 and S2. Adhesives which deform between 2.5mm and 5mm in the test are classed as S1, those that achieve greater than 5mm are S2; any adhesive below 2.5mm is not classified.

In practice, highly polymer modified, single component cementitious adhesives may just reach the 2.5mm threshold and adhesives modified with a liquid polymer additive should achieve an S1 rating. To attain an S2 rating it is normally necessary to have a rubber modified cementitious adhesive, with a liquid polymer component.

If the ability to accommodate some early movement stresses is deemed important then an S1 adhesive could be specified. It should be noted that ultimately these adhesives achieve high levels of tensile and compressive strengths. For movement stresses which are likely to be continuous eg vibration or deflection of a timber floor, an S2 adhesive should be considered as it is likely that adhesives in this category will have the ability to deform or flex slightly on a permanent basis.

#### Reaction Resin Adhesives

This classification is equivalent to Type 5 in BS 5980 and usually consists of epoxide resin based products, although polyurethanes may also fall into this category. These products are not widely used but if there is a requirement for a bedding and grouting system needing a high level of chemical resistance, or if the tile and/or substrate are difficult bonding surfaces, then this type of adhesive may be specified. There are R1 and R2 classes, the latter possessing a high level of adhesion after thermal shock.

All of these classification symbols described above are now beginning to appear on manufacturer's packaging and in their literature so that the distributor and contractor can clearly see exactly what rating of adhesive he is purchasing. For further guidance on the suitability of products for specific applications it is recommended that the manufacturer's advice is sought.