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WATER REPELLENTS FOR CONCRETE MASONRY WALLS

TEK 19-1
Water Penetration Resistance (2006)

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INTRODUCTION

Water repellents are used on exterior walls to provide resistance to wind-driven rain. In addition, water repellents can also reduce the potential for efflorescence and staining from environmental pollutants, and enhance the color or texture of a wall.

When applied in accordance with manufacturer's recommendations, water repellents effectively control water penetration. Water repellents are generally recommended for use on single wythe concrete masonry walls exposed to the weather. The choice of water repellent will depend on the surface to be protected, the exposure conditions, and on aesthetics. A wide variety of water repellents is available, offering many choices of color, surface texture, glossiness, and application procedures.

WATER RESISTANCE

Water penetration resistance of concrete masonry walls is dependent on wall design, design for differential movement, workmanship, wall maintenance, and the application of water repellents. This TEK focuses on water repellent products for above grade walls. The other factors are discussed in TEKs 10-2B, 19-4A and 19-5A (refs 3, 5, and 4).

The effectiveness of water repellents can be evaluated in several ways. In the laboratory, *Standard Test Method for Water Penetration and Leakage Through Masonry*, ASTM E 514 (ref. 9), is currently the only standard test method for water penetration. The test simulates 5½ in. (140 mm) of rain per hour with a 62.5 mph (101 km/h) wind for a duration of 4 hours. This test is often used to evaluate water penetration before and after application of a water repellent, or to judge the relative performance of several water repellent systems.

TYPES OF WATER REPELLENTS

There are two general types of water repellents: surface treatment repellents and integral water repellents. Surface treatment repellents are applied to the weather-exposed side of the wall after the wall is constructed. In addition to water repellency, surface treatment repellents also improve the stain resistance of the wall, by preventing dirt and soot from penetrating the surface, causing deep stains.

When used on new construction, choose water repellents that are able to resist the alkalinity of the fresh mortar. As an alternative, an alkali-resistant fill coat can be applied to the wall first, or the wall can be allowed to weather for about six months until the alkalinity is reduced.

In general, surface treatment repellents should allow for vapor transmission to ensure that interior humidity within the wall and structure can escape. Treatments which are impermeable to water vapor tend to fail by blistering and peeling when moisture builds up behind the exterior surface.

When choosing a surface treatment repellent, manufacturer's guidelines should be consulted regarding appropriate substrates and applications for a particular product.

Regardless of the type of surface treatment chosen, it should be applied to a sample panel or on an inconspicuous part of the building to determine the appearance, application method, application rate, and compatibility with the masonry surface. Surface treatment repellents will require reapplication after a period of years to ensure continuous water repellency.

Integral water repellents are added to the masonry materials before the wall is constructed. The water repellent admixture is incorporated into the concrete mix at the block plant. This way, each block has water repellent throughout the concrete in the unit. For mortar, the water repellent is added to the mix on the jobsite. It is critical when using integral water repellents that the repellent is incorporated into both the block and the mortar to ensure proper performance of the wall.

The following sections describe in more detail the characteristics of various generic surface treatment repellents and integral water repellents.

SURFACE TREATMENT REPELLENTS

Cementitious coatings: Coatings such as stucco or surface bonding mortar can be used to increase the water resistance of a wall, as well as to significantly change the texture of the finished wall surface. Consideration should be given to differential movement which may transmit stress into the coating. Further information on stucco is found in TEK 9-3A (ref. 8).

Paints: Paints are colored opaque coatings, used when color uniformity of the wall is important for aesthetic reasons. Paints are a mixture of pigment, which hides the surface, and resin, which binds the pigment together. The proportion of pigment to resin, and the type of resin will affect the fluidity, gloss, and durability of the paint.

The pigment volume concentration (PVC) compares the amount of pigment in a paint to the amount of binder. As the PVC increases, the paint has more pigment and less binder. High PVC coatings are used where limited penetration is desired, such as for fill coats on porous materials. High PVC paints generally brush on easier, have greater hiding power, and usually cost less than low PVC paints. Low PVC paints are generally more flexible, durable, washable, and are glossier.

Fill Coats: Fill coats, also called primer-sealers or fillers, are sometimes used to smooth out surface irregularities or fill small voids before application of a finish coat. Common fill coats include latex coatings and portland cement. In addition, acrylic latex or polyvinyl acetate is sometimes combined with portland cement for use as a fill coat. Fill coats should be scrubbed vigorously into the masonry surface using a relatively short stiff fiber brush.

Cement-Based Paints: Cement-based paints contain portland cement as the binder, which creates a strong bond to the masonry and is not subject to deterioration from alkalis. Cement-based paints effectively fill small voids so that large amounts of water are repelled. Durability is excellent.

Cement-based paints are sold either premixed, or in dry form and mixed with water just before use. They should be applied to a damp surface using a stiff brush, and kept damp for 48 to 72 hours, until the cement cures. If the cement-based paint is modified with latex, however, wet curing is not necessary. White and light colors tend to be the most satisfactory.

Latex Paints: Latex paints are water-based, with any one of several binder types. They are inherently resistant to alkalis, have good hiding characteristics, and are durable and breathable, making them a good choice for concrete masonry walls. Butadiene-styrene paints and polyvinyl acetate emulsion paint are both categorized as latex paints. Latex paints can be applied to either damp or dry surfaces, and dry quickly, usually within 1 to 1½ hours. They are generally inexpensive and easy to apply by brush, roller, or spray.

Alkyd Paints: Alkyd paints are durable, flexible, have good gloss retention, are low in cost, but have low alkali resistance. They should be sprayed on, since they tend to be difficult to brush apply. They dry quickly once applied.

Clear Surface Treatment Repellents: Clear treatments are used to add water resistance to a wall without altering the appearance. These treatments are classified by the resin type, such as silicone or acrylic.

Clear treatments can be classified as either films or penetrant repellents. Penetrant repellents are absorbed into the face of the masonry, lining the pores. They adhere by forming a chemical bond with the masonry. Penetrant repellents do not bridge cracks or voids, so these should be repaired prior to applying the treatment. Silanes and siloxanes are penetrant repellents. Films, such as acrylics, form a continuous surface over the masonry, bridging very small cracks and voids. Because of this, films can also reduce the vapor transmission of a concrete masonry wall. Films tend to add a glossier finish to the wall surface, and may intensify the substrate color.

Silicones: Silicones can be further subdivided into silicone resins, silanes, and siloxanes. These treatments change the contact angle between the water and the pores in the face of the masonry, so that the masonry repels water rather than absorbing it. Silicones have been found to reduce the occurrence of efflorescence on concrete masonry walls.

Silicone resins: These are the most widely used silicone-based water repellents for masonry. They can penetrate the surface of masonry very easily, providing excellent water repellency. Silicone resins should be applied to air dry surfaces, and are usually fully dry after 4 to 5 hours.

Silanes: Like silicone resins, silanes have good penetration characteristics. Although volatility of silane has been a concern, the absorption of silane by masonry generally occurs at a much faster rate than evaporation of the silane. Silanes, unlike silicone resins, can be applied to slightly damp surfaces.

Siloxanes: Siloxanes have the benefits of silanes, i.e., good penetration and ability for application on damp surfaces. Siloxanes are effective on a wider variety of surfaces than silanes, and dry relatively quickly. Costs are comparable to silanes, and are slightly higher than silicone resins.

Acrylics: Acrylics form an elastic film over the surface of masonry to provide an effective barrier to water. Acrylics dry quickly and have excellent chalk resistance. Acrylics should be applied to air-dry masonry surfaces. Costs tend to comparable to silicone resins.

OTHER TREATMENTS

Epoxy, Rubber, and Oil-Based Paints: These paints form impervious moisture barriers on concrete masonry surfaces. This makes for an excellent water barrier, but does not allow the wall to breathe. As such, these paints are generally not considered water repellents. These treatments are better limited to interior walls, since they can blister and peel when used on exterior walls.

Oil-based paints adhere well to masonry, but are not particularly resistant to alkalis, abrasion, or chemicals. Rubber and epoxy paints offer high resistance to chemicals and corrosive gases, and are generally used in industrial applications.

APPLICATION OF SURFACE TREATMENT REPELLENTS

This section contains some general guidelines for application of surface treatments. In all cases, refer to manufacturers' literature for final recommendations and procedures. Surface treatments should typically be applied to clean, dry walls. Wall surfaces should be cleaned in accordance with manufacturer's instructions to ensure good adhesion and penetration. The wall should be allowed to dry for 3 to 5 days between cleaning or rain and application of the repellent. All cracks and large voids should be repaired prior to applying the repellent. If caulk is used in the repair, the caulk should be compatible with the surface treatment repellent and fully cured before treatment application.

Weather can have a significant effect on the application and curing of water repellents. It is usually recommended that the repellent be applied when temperatures are expected to remain above 40°F (4 °C) during the two to four days after application. There should be little or no wind during spray-on applications, to avoid an uneven coating and drift of the treatment onto other materials. Adjacent landscaping should be protected during application, and, depending on the surface treatment, it may also be necessary to protect other building materials, such as aluminum or glass.

Most manufacturers recommend applying clear surface treatments using a saturating flood coat, with a 6 to 8 in. (152 to 203 mm) rundown below the contact point of the spray. It is sometimes recommended that a second coat be applied when the first is still wet. Coverage rates vary from 75 to 200 ft^2/gallon (1841 to 4908 m^2/m^3) depending on the surface treatment repellent used and the type and condition of the masonry.

When applying a water repellent over a previously treated wall, ensure that the new treatment is compatible with the old. With some surface treatments, masonry should be uncoated for proper adhesion. In these cases, the old treatment can be allowed to weather off, or, if time does not permit this, a pressurized wash followed by high pressure water rinse can remove previous surface treatments from masonry.

The durability of a coating is a function of the type of coating, the application procedure, the rate of application, the surface preparation, and the exposure conditions. For this reason, it is difficult to predict how the various surface treatment repellents will perform under field conditions.

INTEGRAL WATER REPELLENTS

Integral water repellents are usually polymeric products incorporated into the masonry products prior to construction. Because integral water repellents are evenly distributed throughout the wall, they do not change the finished appearance. In addition, integral water repellents are effective at reducing efflorescence, since water migration throughout the block is reduced.

As stated earlier, it is essential that an integral water repellent admixture be incorporated into the mortar at the jobsite, as well as into the block and any other masonry wall components, such as precast lintels. The same brand of water repellent admixture should be used in the mortar as was used in the block, to ensure compatibility and bond.

Questions often arise regarding the effect of integral water repellents on mortar bond strength, due to the decreased water absorption. Research has shown that bond strength is primarily influenced by the mechanical interlock of mortar to the small voids in the block.

When walls containing integral water repellents are grouted, the grout produces a hydrostatic pressure which forces water into the surrounding masonry unit, allowing proper curing of the grout.

Generally, the use of other admixtures in conjunction with integral water repellents is not recommended. Some other admixtures, especially accelerators, have been shown to reduce the effectiveness of integral water repellents.

Some integral water repellents are soluble when immersed in water for long periods of time. Conditions which allow standing water on any part of the wall should be avoided. For this reason, mortar joints should be tooled, rather than raked. In addition, walls incorporating integral water repellents should not be cleaned with a high-pressure water wash.

REFERENCES

1. Clark, E. J., Campbell, P. G., and Frohnsdorff, G., *Waterproofing Materials for Masonry*. National Bureau of Standards Technical Note 883. U. S. Department of Commerce, 1975.
2. *Clear Water Repellents for Above Grade Masonry*, Sealant, Waterproofing, and Restoration Institute, 1990.
3 *Control Joints for Concrete Masonry Walls - Empirical Method*, TEK 10-2B. National Concrete Masonry Association, 2005.
4. *Flashing Strategies for Concrete Masonry Walls*, TEK 19-4A. National Concrete Masonry Association, 2004.
5. *Flashing Details for Concrete Masonry Walls*, TEK 19-5A. National Concrete Masonry Association, 2004.
6. Fornoville, L., *Water Repellent Treatment of Masonry*, Proceedings of the Fourth Canadian Masonry Symposium, University of New Brunswick, Canada, 1986.
7. McGettigan, E., *Application Mechanisms of Silane Waterproofers*, Concrete International, October 1990.
8. *Plaster and Stucco For Concrete Masonry*, TEK 9-3A. National Concrete Masonry Association, 2002.
9. *Standard Test Method for Water Penetration and Leakage Through Masonry*, ASTM E 514-05a. ASTM International, 2005.

DEFINITIONS

Acrylic—A thermoplastic synthetic organic polymer made by the polymerization of acrylic derivatives such as acrylic acid, methacrylic acid, ethyl acrylate, and methyl acrylate; used for adhesives, protective coatings, and finishes.

Alkyd resin—A class of adhesive resins made from unsaturated acids and glycerol.

Film repellent—A protective treatment that fills masonry pores, forming a continuous film on the surface.

Integral water repellent—An admixture incorporated during the manufacture of concrete masonry units and added to the mortar mix to improve the water repellency characteristics.

Latex—Milky colloid in which natural or synthetic rubber or plastic is suspended in water. An elastomer product made from latex.

Latex paint—A paint consisting of a water suspension or emulsion of latex combined with pigments and additives such as binders and suspending agents.

Penetrant repellent—A protective treatment that lines masonry pores; no film is formed on the surface.

Polyvinyl acetate—A thermoplastic polymer; insoluble in water, gasoline, oils, and fats; soluble in ketones, alcohols, benzene, esters, and chlorinated hydrocarbons; used in adhesives, films, lacquers, inks, latex paints, and paper sizes.

Silane—Generally refers to alkyltrialkoxysilanes. A monomeric organosilicon compound with one unhydrolyzable siliconcarbon bond, which forms a chemical bond with siliceous minerals providing water repellent protection. Silanes are usually dissolved in organic solvents, but some are dispersed in water.

Silicone—A fluid, resin, or elastomer; can be grease, a rubber, or a foamable powder; the group name for heat stable, water repellent, semiorganic polymers of organic radicals attached to silicones, for example, dimethyl silicone; used in adhesives, cosmetics, and elastomers.

Siloxane—Generally refers to alkylalkoxysiloxanes that are oligomerous (i.e., siloxane of low molecular weight with the polymer consisting of two, three, or four monomers). As with other silicones, application is accompanied by chemical bonding to the substrate if silicate materials are present.

Styrene-butadiene—The most common type of synthetic rubber, made by the copolymerization of styrene and butadiene monomers; used in tires, footwear, adhesives, and sealants. Also known as SBR.

Surface treatment repellent—Any water repellent material applied to the surface of any substrate.

Water repellent—Property of a surface that resists wetting (by matter in either liquid or vapor state) but permits passage of water when hydrostatic pressure occurs.

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