

COATINGS FOR EXTERIOR WALLS

Technical Note



**Concrete
Manufacturers
Association**

COATINGS FOR EXTERIOR MASONRY WALLS

Introduction

This technical note discusses the purpose of applying coating systems to exterior masonry walls, identifies criteria that need to be considered when assessing the suitability for a particular product and provides information on products currently available for use in coating systems for reducing rain penetration through exterior masonry walls.

Purpose of coatings

The treatment of exterior masonry surfaces with coatings has the purpose of preserving, decorating and protecting, new and old, coated and uncoated masonry.

This technical note addresses the function of a coating or a coating system to prevent rain penetration through a masonry wall.

A coating material may be defined as a product in liquid, paste or powder form, that, when applied to a masonry surface or substrate, forms a film possessing protective, decorative and/or other specific properties.

A coating system is the sum total of the layers of coating materials which are applied to a substrate.

Evaluating various coating materials and systems





Coating materials and systems for exterior masonry surfaces are evaluated in terms of the substrate, the primary purpose in applying the coating and its ability to function satisfactorily over an economic period of time.

Adhesion of the coating to the substrate not only depends on coating composition, but on the quality of substrate - primarily strength and texture, and substrate preparation if any. The thickness, (of a film or layer), of the coating, its long term compatibility with the substrate and its durability are factors that affect its capability of preserving the main function of the wall.

The resistance of an exterior masonry wall to rain penetration is primarily related to the design of the wall structure and workmanship in building the wall. Suitable coating systems provide that confidence that the wall is going to perform its intended function of keeping out the rain.

Some walls such as cavity walls are inherently resistant to rain penetration. As such the coating system required is minimal. On the other hand, single leaf solid wall perform less efficiently thus the coating system is an essential barrier.

TABLE 1 - TYPES OF WALL STRUCTURE AND THE APPROPRIATE USE OF SURFACE TREATMENT

TYPE OF WALL	CAVITY WALL	SINGLE LEAF HOLLOW BLOCK	DOUBLE LEAF SOLID UNITS	SINGLE LEAF SOLID UNITS	
Sketch of wall					
Construction Cost	High	Average	Average	Low	
Unprotected resistance to rain penetration	Good	Average	Average	Poor	
PRODUCT TYPE	THEIR USES ON WALL TYPES				
Masonry primer	P	P	OP	OP	Essential primer for PVA & Acrylics
Acrylic & PVA	P&S	P&S	P&S	P&S	
Acrylates	S	P&S	S	S	For face work
Cementitious wash	P&S	P&S	P&S	P&S	
Resin plaster	S	S	S	S	Requires special primer
Plaster additives	OP	OP	P	P	Do not use with silicones
Silicones	OP	OP	P	P	Can be left unpainted
KEY P: Primary treatment or coatings S: Secondary coating OP: Optional primer					

The substrate

A sound masonry substrate is composed of concrete masonry units complying with the requirements of SABS 1215 laid in mortar of type class 11 or better, the mortar ingredients being of satisfactory standard, while the overall workmanship should ensure that the

masonry units are soundly bedded in the mortar, and the wall built to line, level and plumb. The substrate may be bare masonry and mortar joints or surfaces that are rendered or bagged.

Aspects of satisfactory masonry construction are covered in the CMA Masonry Manual.

Description of product types

Coating materials and coating systems may be classified in terms of:

Primary function:

- preservation, decoration, protection, waterproofing.

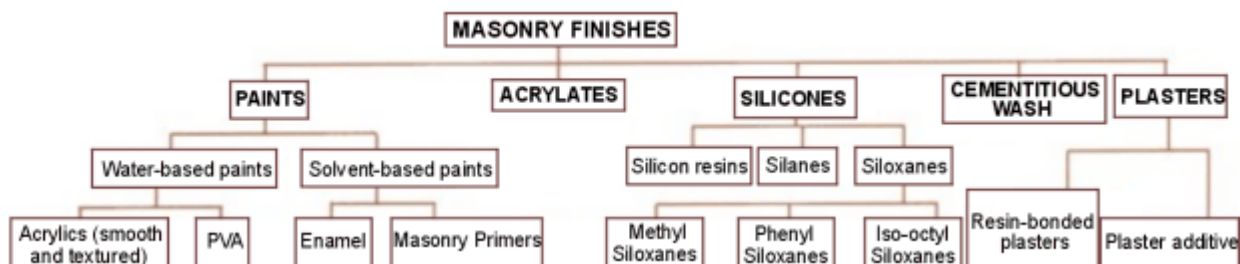
Chemical type of binder

- hydraulic lime, silicate, cement
- acrylic resin, vinyl resin, oil,
- alkyd resin, (silicone), epoxy
- resin, polyurethane and bitumen.

Dispersion of the binder in emulsion or solution

- Emulsion; water based
- Solutions; solvent based
- Solvent-free; e.g. epoxy

The description of product groups that follow are those readily available and used in the country. The large varieties of coating available and their specialised applications make it essential for the specifier and user to consult manufacturers and their technical trade literature.



Paints

Masonry Primer

A solvent-based coating for priming new cement surfaces to provide an alkali resistant barrier as part of a paint system. It also has waterproofing properties depending on the make and quality. Some manufacturers have clear as well as pigmented masonry primers.

Masonry primer should not be confused with so-called bonding liquids although many can fulfil a similar function. It is not designed as a finishing coat, but a cost-effective primer only

Emulsion Paints

Resins: PVA'S POLYMERS, ACRYLICS, FILLER COATS, ETC.

The name does not reflect the quality. Some cheap paints have as little as 10% resin in them and the resultant performance will be vastly inferior to a 100% resin-based product. The price is a good indication of the quality.

These products are generally smooth in texture and matt or sheen in nature. Matt products will mask surface imperfections better than sheen products. Sheen products, however, are currently very much in vogue because they tend to offer better protection and withstand dirt better. Quality varies dramatically with price. Top quality emulsion paints typically last 5 - 10 years (i.e. offer proper protection of the substrate) before repainting is required.

These coatings are available in a wide range of qualities, solids content, high or low resin content and application rates; all giving various degrees of protection to the surface. However, there are some coatings which are purpose-made waterproofers, made from specially modified acrylic emulsions for applying to problem walls that are already painted. Pure acrylics can be applied directly to a new plastered wall because they are resistant to alkali breakdown. Modified acrylics, PVAs, etc. require the surface to be primed with a good quality masonry primer. Filler coats are not recommended for external use because of their low resin content.

if cracks require filling, non-chalking filler which is resilient and flexible should be used. Fabric tissue membranes can also be used together with the coating to reinforce the paint over cracks.

Cheaper products will usually wet back (i.e. after a rainstorm the pattern of the underlying bricks can clearly be seen through the paint), allow penetration (resulting in interior rooms being damp and even mouldy) and fail within months (the paint can even be washed or lightly rubbed off the wall in extreme cases).

Textured coatings

The texture will vary from quite light to very rough depending on the products. The texture in the product hides minor surface imperfections and ensures the paint goes on thick. This is particularly important to prevent water ingress into the substrate. In general these should be used to repair hairline cracks in walls as the coarse ingredients that give the product its texture will ensure the cracks are bridged. Generally the quality products also have additives that ensure flexibility in the coating. Thus the hairline cracks remain bridged. As with emulsion paints the price paid reflects quality. It is suggested that when painting outside, the highest possible quality is used to ensure protection against water penetration. It is possible to economise on the inside. Textured coatings have a tendency to retain surface dirt.

As with exterior paints the price of the product indicates its performance and quality. Top quality emulsion paints will stand up to many years of repeated cleaning. Inferior products absorb stains and the paint will wash off the wall when these stains are cleaned.

It is often the case that enamel paints (Gloss or Eggshell) are used on interior surfaces because they are tough, long-lasting and wash/clean well e.g. bathroom and kitchen.

Repainting over enamel paints is more time-consuming as preparation is more extensive. The whole surface must be sanded and then over-coated with undercoat. Painting with emulsion paints is more straightforward and for this reason is often preferred.

Acrylates

These are solvent (or water) based clear coatings developed to fulfil a number of specific functions. They perform on their own and are not usually used together with other systems. Pigmented varieties are available for use in bathrooms, kitchens, etc.

The clear products are used as decorative and waterproofing coatings for facework, etc. Its use as a carbonation barrier for off-shutter concrete results in the formation of a vapour barrier effectively trapping moisture in the substrate. (This is not recommended for masonry used for habitation.) Its excellent UV resistance make it suitable for preventing dirt ingress and fungus growth in paving. The user should be selective in his choice of these coatings because some types turn a milky colour in the presence of water.

Liquid silicone

Silicone is the name of a family of products: Siloconates, Silicone Resins, Silanes and Siloxanes. The use of each are fairly specific. They all, however, have a number of characteristics in common in respect of how they function on a masonry surface:

- They are thin liquids which penetrate into the substrate thereby lining the capillaries and stopping capillary absorption of water. It is therefore not a surface coating but a substrate treatment. A simple flooding run-down application achieves the desired penetration.
- Their ability to repel water ingress is excellent in walls in which all holes and cracks are repaired. Where crack widths exceed 0,3mm, the effectiveness of the Silicone against water penetration is greatly reduced.
- They are UV-resistant
- The treated raw masonry surface is paintable as paints contain wetting agents.
- These should only be applied to unpainted masonry (concentrated silicone on painted surface will repel further coats of paint).
- They effectively prevent all water-caused damage to masonry such as, efflorescence, washing out of lime, moss and fungi growth, peeling of interior paint, corrosion of structural steel, damp patches after rains, etc.
- Some silicone products are available in ready-to-use form whilst others are concentrates requiring dilution with the correct solvents.



The effect of sealant on wetted concrete masonry

Types of Silicone-based water repellants

Siliconates

A water-based product used for in-plant pre-treatment of concrete masonry units and tiles. Treatment is applied only to the exposed face of the masonry unit.

Silicone Resins

An older-technology solvent-based silicone for treating masonry. The masonry has to be absolutely dry for effective product performance.

Silanes

Silanes are solvent-free moisture-curing products that are specifically made for treating concrete structures. It's small molecular composition and the absence of solvent gives it unique ability to penetrate deep into dense high-grade structural concrete used in high-tech buildings and bridges. At the same time, the product is distributed with uniform high concentration practically throughout the entire penetrated area. Both, deep and effective penetration, are prerequisites for long-term durability and effective protection against chloride corrosion of the steel reinforcements. Although the product is purchased as a high solids compound, it is seldom used at this concentration. Adjustment of the solids content is common in most applications. Porous building materials, containing lime and cement bonded materials such as concrete, mortar or plaster, have to be treated with a product containing an appropriate solvent. Also, it is essential that the substrate be alkaline and slightly damp for proper performance of the silane.

Siloxanes

These products represent the latest state-of-the-art in general-purpose silicones for already-erected masonry structures. They combine the advantages of both silicone resins and silanes in that they have the cost advantage of the silicone resins and, being moisture-curing, the moisture-tolerance to the substrate of the silanes. Most siloxanes, unlike silanes, contain a curing catalyst which becomes active upon exposure to moisture.

There are, however, three types of siloxanes which the user should take care in identifying:-

The methyl and phenyl types or combinations methyl-phenyl siloxanes are self-curing with only the presence of some substrate and atmospheric moisture needed for curing. These products are correctly used in old low-alkaline (below 9,5 pH) substrates and for pressure injection of silicone damp-proofing into bases of wall to cure rising damp.

Some less advanced siloxanes require the catalyst to be added to the product immediately prior to application. The effective life of methyl siloxanes in substrates with a higher pH level has proven to be not much more than five years.

The third siloxane is the iso-octyl which has a chemical affinity to alkali (like silanes) and thus becomes more effective with the presence of alkali in the substrate. These products have proven to be effective for at least 20 years (and effectively the life of the wall) because of their total resistance to alkali breakdown in new concrete masonry.

In summary, the methyl siloxanes are more effective than the iso-octyl on non-alkali masonry and equally effective on alkaline substrate but only in the short-term. This is why the user should



Applying sealers to masonry wall

be discerning in his choice because some manufacturers claim that their methyl types can be used on concrete but re-treatment would be necessary every three to five years. This is undesirable in the context of, for instance, new affordable housing, which, firstly would be impractical to re-treat on a mass basis, and secondly would probably be painted and thus untreatable. It is therefore safer to use products which simply are identified as oligomeric iso-octyl alkoxysiloxanes.

Cementitious wash

These products are available in powder form. They are basically comprised of white or grey cement to which synthetic resin binders and pigments are added. These binders improve water resistance, adhesion and serve as a carrier for the pigments. Cementitious washes contain chemical complexes which combine with free lime in the concrete masonry substrate and therefore improve adhesion of the product.

However, surface preparation is critical and care has to be taken in the application for successful results. The manufacturer instructions should be followed on the application of the product. Cementitious washes have the ability to cover imperfections on the masonry.

The powder is mixed with water to a slurry and applied by block brush in two or three coats. Available in the variety of colours, although some are grey cement-coloured.

Plasters

Plaster additives

These are liquid additives which replace some of the water in the mortar mix. Their action is to retard the penetration of water to a greater or lesser degree depending on the quality of the product and chemical action. The higher-priced products are more effective.

Resin-Based Plaster coatings

These resin bound plaster coatings are trowel-applied to a primed raw plastered surface to obtain special decorative effects on upmarket properties. Their waterproofing properties

are varied, but mostly they rely on the substrate for waterproofing in the form of cavity walls, plaster additives or long-term water-repellant treatments. Recently, some products claim the incorporation of waterproofing protection as well.

Maintenance of unpainted masonry walls

During construction, particular care needs to be taken to prevent mortar smears on the face of the masonry unit. Mortar droppings which adhere to the exposed face of a unit can be removed with a chisel after being allowed to dry and harden. The remaining mortar can then be removed with a stiff fibre brush.

Cleaning of unpainted walls can usually be done by scrubbing with water and a small amount of detergent. Clay or dirt should first be removed with a dry brush. Most efflorescence can be removed when it first appears by simple hosing with water but some efflorescence requires brushing with acid. One part hydrochloric acid and nineteen parts water is a good concentration - adequate for the job and not too disagreeable to work with. The wall should be wetted before the diluted acid is applied. Care must be taken to prevent splashing on floors and other surroundings. The wall must be rinsed thoroughly afterwards with a hose if outdoors, or several times with buckets of clean water and sponges if indoors. Rubber gloves and goggles should be worn. Since the acid wash will probably create a subtle change in the appearance of the surface with which it comes in contact, care must be taken to wash the entire wall to avoid undesirable variations in appearance.

Maintenance of the well-designed and constructed masonry wall is minimal. On unpainted masonry wall is minimal. On unpainted masonry surfaces, however, inadvertent staining from oil, grease or other foreign substances can destroy the appearance of an otherwise attractive structure. Stains resulting from metal or other attachments to the wall can also create appearance problems.

Tables 2a and 2b provide information covering removal of many common staining materials. Table 2a describes the chemicals, detergent, or poultice materials recommended for particular stains and contains letter keys pertaining to the sequence of steps which should be followed in removing the stain. Table 2b (Procedures for stain removal) includes the identification letters and the particular procedure associated with the letter for cross-reference with table 2a.

Graffiti removal

A good cleaning material should be quick-acting and easily remove the marking material without damaging the substrate. Powerful paint removers and alkali and acid cleaners may remove most of the markings. Strong chemical cleaners, however, may easily etch the masonry. In many cases, traces of the markings are invariably left behind as shadows, because pigments and binder have penetrated into the pores of the masonry. It is difficult to dislodge these residual traces.

For fresh paint markings or stains on concrete masonry surfaces, a commercial paint remover or a solution of trisodium phosphate in water (0.2kg/l of water) can be used. The paint remover or solution can be applied to the surface with a brush and then allowed to remain to soften the paint. The paint can then be removed with a scraper or wire rush and the wall surface washed with water. Commercial paint removers should be applied over a small test area on a trial basis.

Other methods commonly used for cleaning masonry walls can

TABLE 2a - MATERIALS FOR STAIN REMOVAL AND PROCEDURAL SEQUENCES

STAIN	APPEARANCE	CHEMICALS & DETERGENTS	POULTICE MATERIAL	PROCEDURAL SEQUENCE
Aluminium	White deposit	Hydrochloric acid (10%)	-	A - B
Asphalt	Black	1. 'Ice 2. 'Scouring powder	-	N - C N - A
Emulsified Asphalt	Black	Water	-	A
Cutback Asphalt	Black	1. Commercial Paint remover 2. Scouring Powder	Talc or Whiting	D A
Iron	Brown or yellow	Sodium or ammonium citrate (1) water (6) Glycerine (lime-free)(7)	Whiting or Diatomaceous earth	B & D
Oil/grease	Dark	1. Trisodium phosphate 1 kg/l water 2. *Benzene	Talc, Lime or Whiting	D - B M - G - A
Mortar smears	Grey	-	-	N
Paint, at least 3 days old freshly split	Varies	Commercial paint remover Commercial paint remover	-	H - P S-R-H-P
Perspiration stains and hair oil stains	Brown or yellow	Trichloroethylene	Talc	T D
Plant growth Mould and moss	Green, brown or black	Ammonium sulfamate (from garden supply stores)	-	V, and B if needed
Smoke and fire	Brown to black	Trichloroethylene	Talc	T - D
Soot and coal smoke	Black	Soap, Water Pumice	-	A
Wood tar and smoke	Dense Black	1. 'Scouring powder, water 2. 'Sodium hypochlorite	- -	A F

Note: Numbers indicate that materials are to be used in sequence

TABLE 2b - PROCEDURE FOR STAIN REMOVAL

A	Scrub with brush and chemical or detergents or water
B	Wash thoroughly with clear water
C	Cool until brittle. Chip away with chisel
D	Stir solids and liquid to thick paste. Apply paste to stain to thickness of 5mm. Let dry as needed for periods up to 24 hours. Scrape off
F	Apply with soft cloth
G	Dissolve solid chemicals in water
H	Apply liquid to surface by brush
L	Put paste on trowel. Sprinkle crystals on top of paste. Apply to surface so crystals are in contact with block and paste is on outside
N	Scrape any solidified matter off surface
P	Let stand. Remove with scraper and wire brush
R	Allow to age three days
S	Absorb with soft cloth or paper towels, then scrub vigorously with paper towels
T	Provide thorough ventilation
V	Follow manufacturer's directions

also be used to remove graffiti. High pressure water-blasting or steam-cleaning using strong detergents may prove effective with some markings. These methods are expensive, may not be completely effective, may damage the surface of masonry and may damage other areas. Dry and wet sandblasting methods are also very effective, but may do even more damage.

Graffiti resistant coatings

Untreated masonry is generally absorptive and susceptible to graffiti and staining. If vandalism is a possibility then a graffiti resistant coating should be considered.

Coating materials would resist the absorption of marking into these surfaces and can easily be cleaned. Coating of this kind would not only simplify removal but substantially reduce the cost of building maintenance.

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