

BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE INDIA



PAINTING OF CEMENT PLASTERED SURFACES

Cement plaster which is widely used in India is made with Portland cement, sand and water. Hydrated lime, wetting agents, plasticizers, etc., are sometimes added to improve the workability and other properties of the mortar.

Successful application of paint requires recognition of the physical and chemical characteristics of the substrate as well as service conditions. In the case of cement plaster two points have to be specially borne in mind. Firstly, it is alkaline in nature due to the presence of lime liberated during the hydration of cement and secondly, it always contains moisture, the proportion varying with the water cement ratio, atmospheric conditions, age of the plaster, etc. These and other factors which have to be considered while painting cement plastered surfaces are dealt with in this Digest.

Factors in the painting of cement plastered surfaces

1. *Moisture content.* A freshly plastered wall contains large quantities of water. Even in the absence of any impervious coating or dense cement rendering over the wall, it takes several months for the greater part of this water to escape.

The choice of a paint is governed by the moisture content of the plaster. For an impervious paint the moisture content should be low. Surface dry appearance should not be taken as an indication of its suitability for painting since the porous backing of brickwork or concrete may still hold large quantities of water. Freshly plastered surface should therefore be allowed to dry for 3 to 6 months although actual length of time is less important than the atmospheric conditions. Artificial heating can help provided it is used carefully in combination with ventilation.

The moisture content of the wall is not important in the case of paints which give porous films through which moisture can escape. The surface should not, however, be dripping wet.

2. *Alkalinity.* Oil based paints are susceptible to chemical attack by alkalis. Alkali present in plaster can cause the destruction of oil paint film especially in the presence of excess moisture. Alkali action is much reduced by complete air drying of plaster. However, alkali becomes active again if water gains access to the structure.

Besides attacking oil, alkali affects certain pigments also. Such pigments are bleached and the coating gets discoloured. Paints containing alkali fast pigments should therefore be preferred.

The use of various acids and acid salts to neutralize surface alkalinity of plaster has sometimes been advocated. But if these chemicals are used there is always the danger of subsequent efflorescence and failure of adhesion of paint film. Their use is, therefore, not recommended.

The best method of protecting oil based paints and distempers from alkali attack is the application of two coats of an alkali resistant primer paint. But this too is useful in the absence of excess moisture only. Alkali resistant primers are available in porous and impervious grades. The choice depends upon the moisture content of the plaster. Paints not containing any oil such as polyvinyl acetate and styrene resin emulsion paints; chlorinated rubber paints and cement paints can be applied directly over plaster surfaces without any primer.

3. *Defective plaster.* Plaster work in India invariably shows surface crazing. This is due to improper mixing of cement and sand prior to addition of water, use of partially hydrated lime, prevailing high temperature and lack of proper curing after application. Other defects generally encountered in plaster are dry out, loss of strength, sweating out, delayed expansion, pitting out, etc. Dry out and loss of strength are caused by rapid evaporation of water before full hydration of cement in the plaster takes place. In extreme cases the plaster surface will be powdery and too weak to hold the paint. Sometimes a sharp primer is applied to check the rapid evaporation of water, but the primer should neither entrap moisture nor contain any oil.

Sweating out is caused by too damp a backing for the skimming coat. If it is caused by locally present hygroscopic salts, plaster in the affected area should be removed and the portion replastered.

Another very common defect is variable suction due to varying porosity. Steel trowelling, which produces a finish denser than a wooden float finish, is largely responsible for this. The effect of variable suction becomes apparent after the application of paint by its non-uniform appearance. Smooth trowelled

plaster tends to suffer more from surface crazing. Where plaster is to be decorated subsequently, plastering should be done carefully using good quality materials and it should preferably be given a wooden float finish.

4. *Efflorescence.* Building materials such as brick, sand and cement contain small quantities of soluble salts. Water used in construction may be an additional source of salts. As a newly constructed wall dries out the soluble salts present are brought to the surface where they are deposited as a white crystalline growth, generally called efflorescence. It brings about the failure of adhesion of paint and in serious cases causes paint film to flake off.

The solution to the problem of efflorescence should be sought in prevention rather than cure. Careful selection of building materials and proper constructional methods should go towards this end. Before proceeding to decorate, the surface should be carefully examined for signs of salts, and if these have begun to appear it should be cleaned with a dry brush and kept under observation for a few days longer. If further efflorescence appears, it will be better to postpone painting until the growth ceases. It is useless to rely on the application of anything in the nature of a "sealing liquid" in the hope of holding back the salts. It is far safer to allow the growth to expend itself by normal drying, the deposit being brushed off as it appears. Washing the surface with water should never be tried since the salts will in part be carried back into the plaster to reappear later.

5. *Organic growth.* Much of the discolouration on painted plaster surface are due to organisms such as algae, mould and lichen. They may be black, purple, green or red in colour. Suitable conditions for their growth are high humidity and dampness. They grow freely on organic materials and even on almost wholly inorganic materials. Soft porous paint films are particularly susceptible to attack.

To prevent discolouration of decorative coatings suitable precautions should be taken from the beginning. The substrate should be free from any organic growth. If it is already infected it should be cleaned and sterilized with an antiseptic wash. Two percent sodium pentachlorophenate, and 0.2 per cent mercuric chloride are suitable antiseptic washes. Any attempt to hide the blemish due to organic growth is bound to fail because the organism will grow through the new coating.

In general, paints which dry quickly to give a hard glossy film are less susceptible to mould growth than those which give softer and more porous films.

Selection of the treatment

Suitable paints for plaster work include both porous and impermeable types. Paints of the porous type are cement paint, limewash, distemper, silicate paint, flat oil paint, and emulsion paints of the styrene, polyvinyl acetate and alkyd resin types, while paints of the

impermeable types are certain grades of emulsion paints, oil gloss and hard gloss paints and chlorinated rubber paints.

Selection of a paint will depend on the location and the condition of the plaster at the time of painting. The paint has to be chosen with due regard to the ultimate scheme of decoration of the surface. For example, if the surface is to be finished with a glossy oil paint the early decoration should be done with a paint which can be easily and completely removed or with one which is suitable for receiving oil paint later on.

The properties of paints generally recommended for cement plaster surface are given below:

1. *Limewash.* Limewash or colourwash is based on lime, inorganic alkali fast pigments and a few other additives. Whitewash is a limewash containing no pigment. The ingredients of limewash are suspended in water prior to application. Glue, casein, common salt, alum, drying oil and tallow are often used to increase the service life of limewash. Addition of drying oil and tallow is of special interest to tropical regions. They impart to the film resistance to water which in turn makes the film less susceptible to organic growth. Drying shrinkage is also reduced. Eight per cent by weight of tallow on lime increases the service life of limewash 3 to 4 times.

Fresh plaster is sometimes painted with colourwash. The pigment used gets cemented in the plaster.

2. *Distemper.* Distempers are superior to limewashes and are available in a wider range of colour. They are marketed as dry powder as well as in the form of paste. Depending on the binding material employed, they may be washable or non-washable. Non-washable distempers are usually based on whiting and size or glue. In washable distempers the binder usually is a mixture of casein and borax or an emulsion of a processed drying oil or oil varnish in water. Recently polyvinyl acetate resin emulsion has also been used as a binder.

Distempers are widely used for interior decoration and a few special formulations are applied on external walls too. The chief attraction of distempers is that they provide a cheap decoration for walls and ceilings even in new buildings which have not properly dried out. Their main limitation is poor washability. They may be applied by brush as well as by spray gun. To satisfy the high suction of the surface and to avoid building up a thick film of distemper, glue size solution (clearcole) is applied prior to the application of distemper. Sometimes distempers are thinned down with excess water to avoid such trouble.

Non-washable distemper should always be removed before redecorating. Washable distemper in sound condition can be redecorated with a similar distemper after dusting down.

When a surface is repeatedly decorated with distemper the film tends to flake off. Complete removal of the film is desirable after four to six redecorations. Steaming followed by stripping with a conventional knife gives the best results. When flaking is not serious a petrifying liquid or sharp primer is applied to provide a strong base for the new coat of distemper. Highly chalked surface may require binding down with a specially formulated oil primer. Oil bound distemper generally works out more expensive than non-washable distemper but gives films which are washable and re-coatable. When applied on a good well prepared surface distemper provides a perfect matt finish of clear luminous tint.

3. *Cement paint.* Cement paint consists of white cement, alkali fast pigment, accelerator, and certain other additives. It is the most commonly employed external finish and is supplied in the form of a dry powder. It is mixed with water immediately before application. Cement paint possesses good decorating qualities and is available in several shades. It provides a cheap water-resistant, durable coating which is particularly suitable for application on walls which are damp at the time of painting or may become damp after painting. Cement paint should not in general be used on non-porous surfaces, gypsum plaster or lime-wash. Its adhesion is poor on smoothly finished cast concrete, and its service life is longer on rough surfaces. It can be redecorated with cement paint or other types of paint, preferably non-oil based paints. If oil paints are to be used, one or two coats of alkali resistant primer should always be applied.

4. *Silicate paint.* Silicate paints consist of a thin pasty suspension of alkali resistant inorganic pigments and extenders in a water glass solution. Mostly they are applied on interior surfaces, but a few special proprietary formulations are suitable for exterior surfaces also. Silicate paints are not damaged by alkali in cement and are porous enough to allow moisture to escape through their films. They may be applied directly on brick, plaster and concrete after wetting the surface. No priming coat is necessary. Two to three coats are applied. The tool employed for applying the paint should be cleaned with water immediately after use. Painting should not be carried out in hot weather. Before redecoration, all paint existing on the surface must be removed.

5. *Emulsion paints.* Emulsion paints are now used in large quantities as decorative finishes for buildings. There are three major types for masonry surfaces, namely, polyvinyl acetate, styrene and acrylic resin emulsion paints. Only the first two types are avail-

able in India at present. The distinguishing feature of emulsion paints is that they are thinned with water. Other advantages are ease of application, rapid drying in 1.5-2 hours, absence of odour and excellent alkali resistance. The paint films are tough, washable and of matt to semigloss finish.

Emulsion paints may be applied by brush or spray gun. Sound surface preparation is important as the paint will not penetrate a loose chalky surface. Size solution should not be applied to plaster before decorating with emulsion paint as it will be dissolved and taken up within the structure of the paint film resulting in loss of strength and adhesion. Emulsion paints should also not be applied over soft distemper or colourwashes. They may, however, be applied over oil bound distemper or flat oil paint provided these are in sound condition.

Two coats of emulsion paint are recommended for long service life. The second coat may be applied the same day as the first. To avoid excessive consumption of emulsion paint on the rather rough surface of cement plaster, a thin coat of cement paint may be applied first.

6. *Chlorinated rubber paint.* This is a valuable paint for cement plaster. It can be applied without a primer and gives a durable water-, mould- and algae-resistant paint. It is also highly resistant to the action of acids, alkalis and fire. Other features of chlorinated rubber paint are non-toxicity, ease of application and rapid drying.

7. *Oil paints.* A large variety of special grade oil paints for alkaline surfaces are available. They provide a coating which is almost impervious to water. Oil paints, whether containing synthetic resin or not, should always be protected by one or preferably two coats of an alkali resistant primer. Flat oil paints, which provide a film relatively permeable to moisture, are highly pigmented systems and are often applied directly to plaster without a primer. However, it has a shorter service life.

Oil paint should not be applied during damp and humid weather. It may again be emphasized that dampness in the wall will impair the life of the coating.

Redecoration of surfaces finished with oil paint should be carried out before the paint film starts flaking and cracking and becomes unsuitable as a foundation for fresh paint. Redecoration should preferably be done with oil paint itself.

There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need this institute is bringing out a series of Building Digests from time to time and the present one is the 38th in the series. Readers are requested to send to the Institute their experience of adopting the suggestions given in this Digest.

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