



TECHNICAL GUIDELINES
FOR NATIONAL MONUMENTS

PAINTING NATIONAL MONUMENTS

Preservation of Sites and Monuments
a division of the National Heritage Board



**National
Heritage
Board**

BY PRESERVATION OF SITES AND MONUMENTS, NATIONAL HERITAGE BOARD



Painting National Monuments

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INTRODUCTION

This guide is a revised edition of *Painting Historic Buildings* produced in June 2009 by the Preservation of Monuments Board.¹

It provides information for monument owners, stakeholders and conservators who have the intention to carry out painting works on National Monuments.

It should be noted that the information provided here is not meant to be exhaustive. For more information, please refer to the Preservation Guidelines (PGL) and/or consult the Preservation of Sites and Monuments (PSM), a division of National Heritage Board.

All drawings and photographs are prepared by PSM except where specifically noted.

PERMISSION FOR PAINTING WORKS

All painting works to be carried out on a National Monument require PSM's approval before they can commence.

Our National Monuments are living representations of our historical past. The layers of paint and/or unique finishes on our monuments provide insights into each monument's history.

It is therefore crucial to preserve the original finishes as far as possible. By requiring permission for painting works, PSM ensures that all such works are carried out in the best interests of our monuments.

To seek PSM's approval on painting work, please submit the following:

- Proposed colour scheme;
- Paint specifications;
- Method statements on removing existing paint and applying new coat of paint; and
- Proposed timeline for painting works.

¹The Preservation of Monuments Board has been changed to the Preservation of Sites and Monuments Division since November 2013.

“By requiring permission for painting works, PSM ensures that all such works are carried out in the best interests of our monuments.”

THE GUIDING PRINCIPLES



Original finishes that must be retained: (from left) Shanghai plaster finish; facing brick finish; and natural stone finish.

Surfaces with Special Finishes

Not all building surfaces can be painted and painting is not allowed on surfaces with special finishes. These special finishes typically refer to building materials that were used in the past and are hard to reproduce or can no longer be reproduced today. They include original exposed facing bricks, Shanghai plaster and other granolithic finishes, Peranakan tiles, natural stone, and other decorative embellishments.

As a result, surfaces with special finishes must be preserved in their original states, and it is recommended that an appropriate conservation coating (consolidant) be applied to these surfaces to help strengthen and protect them from weather conditions.



Colour Scheme

Requests for colour change are assessed on a case-by-case basis. However, unless there is strong historical evidence or justification, colour change is usually not approved. If a historical paint palette is no longer in production, the closest colour palette can be considered.

That said, evidence supporting colour change can come from a historic paint layer analysis and all such tests must be carried out by a paint specialist. Colour change can also be justified by using historical photo documentation.

If the existing walls or structures have inappropriate paint works (please refer to *Surfaces with Special Finishes* on page 3), incompatible paint type and/or inaccurate paint colour, then rectification must be carried out during the next phase of painting works.

From left: Before colour change at Former Telok Ayer Market; and after colour change based on archival evidence.

Paint Type

The approval of painting works is also dependent on the proposed paint type. It is important to choose an appropriate paint type that allows walls to “breathe” (see next page). It is not advisable to apply **film-forming paint which locks moisture within walls, and may cause paint or plaster to blister and salt efflorescence to appear on wall surfaces.**

The methods of removing old paint and applying new paint, must also be clearly expressed in the method statement for PSM’s consideration.



From top: Severe paint blistering on a wall due to the use of incompatible paint (film-forming paint); and plaster spalling, excessive salt accumulation and paint blistering due to moisture trapped beneath the film-forming paint of this column pilaster.



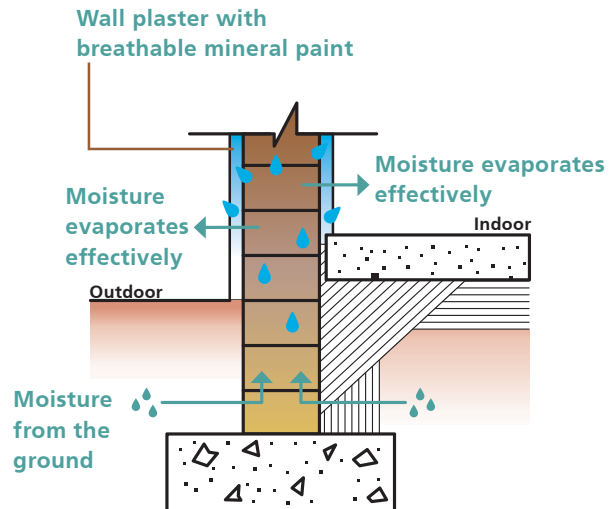
HOW DO DIFFERENT TYPES OF PAINT AFFECT THE MONUMENTS' BUILDING FABRIC?

Walls Breathe Too!

The breathability of a wall after paint application should be the primary consideration when selecting paint type. "Breathability" refers to the ability of a material (such as paint) to allow moisture to move freely through its structure and, more importantly, to allow moisture within its structure to evaporate.

Water or moisture penetration is a common problem for many buildings, including historic ones. The application of an impermeable coat of paint is one of the simplest and most effective ways to waterproof a building. However, this is only a temporary solution and, in the long term, it often ends up compounding the moisture problem. In short, the application of an unsuitable paint can damage the building. **Why is this so?**

"Breathability refers to the ability of a material (such as paint) to allow moisture to move freely through its structure and, more importantly, to allow moisture within its structure to evaporate."

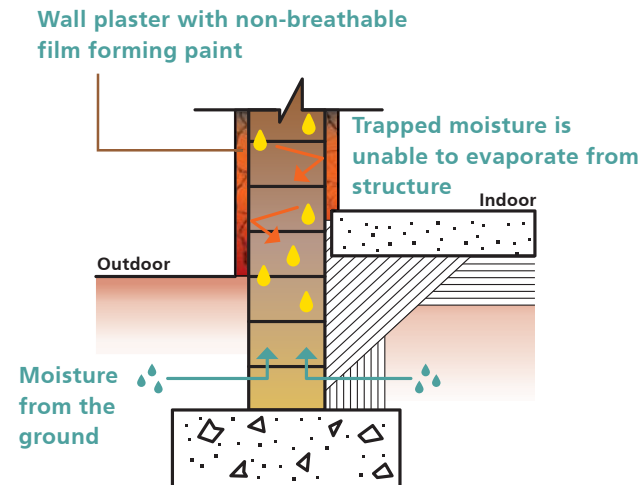


Wall with breathable mineral paint promotes free movement of moisture within the structure. Moisture evaporates, keeping wall dry and healthy.

One main reason is that buildings go through significant movements, both structural and thermal. Such building movements often cause a wall's waterproof coating to fissure and/or crack, and water penetrates through these crevices. As the moisture is unable to evaporate through the cracks as quickly as it is drawn in via capillary action, it is trapped within the wall behind the coating.

The trapped moisture builds up over time and can cause adhesion failure between the wall and the paint. This lack of adhesion in turn causes paint and plaster to flake, and the paint layer will eventually detach from the wall.

If there are metal reinforcements within the wall and column structures, trapped moisture, which arises as a result of condensation due to a warm exterior and a cool interior, can cause the metal to corrode. As rust (iron oxide) has a greater volume than the original iron, the build-up of bulk may physically force apart adjacent areas, leading to plaster and concrete spalling.



Wall with non-breathable paint traps moisture. The wall is constantly wet. Soaked plaster eventually spalls and paint blisters.

Since captive moisture can lead to serious deterioration of the building plaster and paint layers, the use of breathable paint for historic buildings is therefore very important.



From left: Bulging column caused by trapped dampness within; signs of metal corrosion within damp structure; and spalling plaster and flaking paint.

But There Are So Many Types of Paint!

The following three types of paints are the most commonly found in and used on Singapore's National Monuments:

1. Limewash;
2. Mineral silicate paint; and
3. Synthetic resin paint.

1_Limewash



Limewash was the most widely used paint up to the late 20th century. Limestone is crushed, heated to form calcium oxide, which is then slaked with water to make lime putty or slaked lime (calcium hydroxide). The lime putty is subsequently left to stand for several months before it is diluted further with water to make limewash.



Limewash finish is commonly seen in heritage buildings overseas.

Unlike modern paints, limewash is absorbed into the wall material or substrate when it is applied onto a wall surface.² It then hardens by drawing carbon dioxide from the atmosphere to form calcium carbonate crystals. This reaction forms a protective coating on the wall and gives the wall a matt appearance. When limewash is used on a porous surface whose substrate material is damp, the colour of the surface deepens.

²*Substrate refers to the underlying material on which the finish is applied. In this context, it refers to the wall structure.*

Limewash can be coloured with pigments. Coloured limewash can be used internally or externally, and works best on porous surfaces such as traditional lime plaster. The pigments selected should not react with or be not affected by the high alkalinity of the limewash, and pigments with lightfast properties are preferred.³

³*Lightfast pigment refers to colourant that resists fading when it is exposed to light.*

Limewash offers excellent protection to buildings. Its high alkalinity property inhibits mould growth. When limewash is applied over a substrate (such as lime plaster), it keeps the substrate unharmed by shedding away first when exposed to weather conditions. As a result the limewash requires regular maintenance and renewal.

In addition, as limewash has a translucent appearance, several coats of limewash are required to achieve good coverage on a new wall. In some instances, additives such as linseed oil or tallow (animal fats) can also be added to limewash applications to provide additional protection against weather conditions.



“Limewash requires regular maintenance and renewal.”

Limewash trials being carried out on a building facade to select a colour that is closest to the existing limewash.

2_Mineral Silicate Paint



Mineral silicate paint was developed in Germany at the end of the 19th century. As with limewash, mineral silicate paint can be absorbed into the application surface. The paint creates an active pore structure that allows moisture within the building to evaporate, similar to that of limewash.

In addition, mineral silicate paint lasts longer and requires less maintenance than lime wash. Thus, when mineral silicate paint became commercially available, it quickly replaced limewash as the preferred paint type for historic buildings.



From left: Church of St Peter and St Paul and Victoria Theatre and Concert Hall are examples of newly restored National Monuments with mineral silicate paint.

Companies have recently introduced a simple, one-component mineral silicate paint. This paint is made with the addition of a small amount of acrylic which has to be less than 5% for a paint to be categorised as a mineral paint. The acrylic prevents the paint from setting prematurely while still in the mix. If excessive amount of acrylic is added into the paint, the paint becomes film-forming and harmful to the buildings.

To check if a mineral paint is film-forming, the easiest way is to perform a test by applying commercial paint stripper on a dry painted area. A film-forming paint is thick, impermeable, peels off easily and does not bond with the substrate below. In contrast, mineral paint cannot be removed easily because it bonds with the substrate below to form a breathable layer that allows moisture in the substrate to evaporate.

Synthetic Resin Paint



Modern paints are able to withstand daily wear and tear because they consist of durable synthetic resins. These resins can form thick coatings that conceal common surface faults such as cracks and irregular textures. **However, these thick coatings can also reduce and/or eliminate details in decorative elements.**

Modern paints that are commonly used include:

- **Polyvinyl acetate (PVAc) paints** – PVAc paints are usually used for interiors as they are more susceptible to weather conditions. They are more widely used as they cost less than other paints;
- **Acrylic paints** – Acrylic paints give a more durable surface finish than PVAc paints. They are able to withstand external weather conditions and are often used as exterior coatings;
- **Alkyd paints** — Alkyd paints are an oil-based paints and use chemical solvents such as alcohol and spirits to improve the paints' fluidity. However, the chemical solvents emit Volatile Organic Compounds (VOCs) that are toxic and can be harmful to persons with existing health conditions; and
- **Emulsion paints** — Emulsion paints are water-based and are used in building interiors as they are quick drying and emit less odours.

After 50 or more years of use, the problems associated with these modern paints in heritage buildings become apparent. As modern paints are less breathable, they are prone to trapping moisture underneath paint layers which will eventually cause harm and damage to the buildings.

“Synthetic resin paint can form thick coatings that obliterate detailed decorative elements.”

Moisture Accumulation Within Walls



From left: Incompatible paint results in severe plaster and paint deterioration; and accumulated dampness within walls causes embedded metal bars to corrode.

When moisture accumulates within a wall that has been painted with modern paint, condensation problems and associated fungal or algal growth are likely to occur.

In addition, when modern paint is exposed to moisture, it reacts faster than the underlying mineral substrate (for example, lime plaster). The difference in reaction can cause the modern paint to swell unevenly, resulting in surface cracks and flaking paint.



Conclusion

It is thus recommended that mineral paint be used on monuments for more lasting protection. However, for the paint to be effectively breathable and beneficial to the building substrate, **any residual film-forming paint should be fully stripped before mineral paint is applied. This is to allow the new mineral paint to adhere firmly and evenly onto the building substrate.**

DOS AND DON'TS?



DOS

- Do submit to PSM your proposal for approval before the commencement of any painting works.
- Do ensure that the painting works to be carried out are sensitive to the monument's character and history.



DON'TS

- Don't commit to any paint supplier or specialist until PSM has approved the proposed paint works.
- Don't forget that it is an offence to conduct painting work without approval and that PSM can take action against owners for the removal of any painting works that are not approved, at the owner's own costs.





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