

PAINTING—SURFACE PREPARATION

This technical note provides information on various methods of paint removal and surface preparation to help maintain and conserve places on a Heritage Register. Some methods are not suitable for historic places as they may damage significant fabric and remove important paint schemes or finishes.

Background

Paint removal can be laborious and slow, and technique is more important than method. Different paints respond better to different methods. It is helpful to identify the type and thickness of paint and the nature of the substrate before deciding on the removal method. It may be necessary to try several techniques, or a combination of methods to achieve success. Response tests should be made over small trial areas to see if the paint can be lifted and to ensure the substrate will not be damaged. If the wrong removal technique is used it can make the removal of the paint more difficult. Where the problem appears complex or where the building fabric is of considerable historic value, specialist advice or services should be sought.

Topics covered include:

- water washing
- steam stripping
- chemical paint removers—solvent, alkaline, poulticing
- abrasive methods—manual, mechanical
- hot-air paint-stripping
- burning-off methods
- specific problems—timber, brick and stone, plaster, metalwork
- graffiti.

Water washing

Low pressure water washing can be helpful in removing paints but care is needed to prevent water being absorbed into the substrate. Where moisture is able to penetrate behind a paint film that has been lightly scored or is flaking, adhesion will be weakened.

If only a small section is to be removed from an otherwise sound area, there is risk that moisture may become trapped and spread behind the good paintwork causing blistering.

If the surface requiring repainting is sound, cleaning with water and detergent is most often all that is needed to prepare it for repainting. Loosen surface material using

water—the exterior can be hosed down but not soaked. Using a medium-soft bristle brush, wash the surface using half a cup of household detergent in four litres of water in accordance with the manufacturer's instructions. Rinse surface thoroughly and allow it to dry before further inspection to determine if repainting is necessary.

Soda, soft soap and other highly alkaline soaps will leave harmful residues and attack new paintwork. Non-ionic detergents are more suitable, i.e. liquid laundry and automatic dishwashing detergents.

Limewash, whitening and soft (size-bound) distemper can usually be removed with warm water. With other water-thinned coatings, adhesion is likely to be loosened when thoroughly wetted. Copolymer emulsion paints can be softened with hot water then sponged, scrubbed or scraped off.

Trial samples

A trial of the paint removal process should be undertaken before proceeding with paint removal across the whole surface. It may be necessary to try several techniques. Response tests should be made over small trial areas in an inconspicuous place to see if the paint can be lifted and to ensure that the substrate will not be damaged.

Do not complete the sample area if first signs show the paint removal method is harming paint layers or building materials.

Steam stripping

Steam—in conjunction with a solvent stripper—can be effective in removing multiple applications of old emulsion paint, including polyvinyl emulsion that has resisted other forms of treatment. Steam stripping can be faster and more effective over large areas than water washing methods. However, it can also be slow and laborious in removing multiple layers of some types of old encrusted paint and results are sometimes patchy.

Water-thinned paints are softened by steam and then removed with a sponge, brush, scraper and water.

Chemical paint removers

There are two main types of chemical stripper: solvent (non-caustic) and alkaline (caustic). Both are available in liquid, gel and poultice form. Manufacturers provide instructions on application, removal and methods of disposal.

Chemical paint removers are flammable and are a health risk. Chemicals can burn on contact with the skin. Vapours and sprays are toxic if inhaled. Operators should work in well-ventilated areas, and wear protective clothing including gloves and facemasks.

Solvent (non-caustic) removers

Solvent removers are usually based on methylene chloride; waxes are included to retard evaporation. Proprietary brands are either water-rinsable or spirit-rinsable. The paint remover is applied with a brush; the solvent swells and softens the paint, which is then removed with a scraper. Proprietary brands of stripper vary and some can be more useful than others in removing a particular type of paint. They are very effective in removing oil-based paints but can be less effective with other types of paint.

Several applications may be necessary where old hard paint has built up in a number of coats and in these circumstances the stripping can be very slow. Preliminary scraping can sometimes be helpful.

Where a surface is to be repainted, waxy residues must be removed according to the manufacturer's instructions. Water-rinsable removers contain an agent that enables the wax to be removed by a thorough wash down with water. With other types, wax deposits are removed with a rag soaked in white spirit followed by a gentle rub down.

Alkaline (caustic) removers

Alkaline removers are based on caustic soda, potash, washing soda or similar material. They are effective but they can create severe problems and should only be used where paints cannot be removed by other means. They are easily absorbed by porous surfaces and the harmful residues are difficult to remove. Application should be restricted to small areas.

They are not suitable for gesso, plywood, veneers or hardboard. They can be harmful to brickwork, stonework, metal and most types of plaster or putty. They may raise the grain of timber and may also darken or bleach some woods.

These removers are effective on oil-based paints—they break down the oil or resins that bind the paint. The softened paint is then removed by scraping or scrubbing with a hard brush and water. This is followed by a thorough wash down with several applications of clear water to remove all traces of alkali that may attack subsequent coats of paint. The surface is tested for any

deposits that may remain by placing pink litmus paper against the damp surface. If the paper turns blue the surface should be washed again with water containing a neutraliser such as acetic acid.

Caustic removers are available in liquid, paste or blanket form. The stripping blanket prevents the paste from drying out, and the paint sticks to the blanket which facilitates removal. This can be useful where paint is embedded in crevices.

Dipping wood in a caustic tank will destroy natural oils in the timber and glue, and can cause cracking, shrinkage and the opening up of the joints. Proper neutralisation of the alkali is important. This method is not acceptable for significant heritage-listed buildings.

Poulticing

This may be necessary for stubborn areas of paintwork where paint is embedded in pits and grooves such as brickwork, stone ashlar and timber beams. The poultice may be made up by using powdered clay, such as attapulgit or sepiolite, which is added to water and mixed to a paste together with a solvent stripper. Once applied the mix is covered with a thin plastic film that helps to impede evaporation of moisture in the paste. The paste is removed with a knife and the surface is washed down thoroughly with clear water. A sponge or bristle scrubbing brush may be necessary to remove any paint residues. Proprietary caustic-based poultices are also available.

Abrasive methods

Any abrasive method of paint removal requires a great deal of care in its execution. Sandblasting, water blasting and harsh mechanical sanding can irreversibly scar or damage timber, plaster and masonry surfaces, and release toxic lead fumes or dust into the environment.

Manual abrasive methods

Paint was often applied to original surfaces without prior sanding. If the paint or varnish has become brittle it should flake off when scraped. For small areas, hand scraping using a paint scraper or putty knife should be considered before mechanical methods. Hand sanding using wetted medium-coarse glasspaper wrapped round a wood block is suitable for removing a thin film of paint from timber. The careful use of carborundum blocks and water is laborious but often effective.

Mechanical methods

Mechanical methods should only be used as a last resort and only if removal of paint can be done without risk of damage to the substrate, as the surface can easily be removed in the process. The system is sometimes used to remove multiple layers of old paintwork or certain two-part paints that do not respond to other forms of paint removal.

Hand-powered tools used with sanding attachments such as disc and drum sanders, flap wheels or rotary strippers are generally only suitable for flat surfaces or for fences or claddings that are to be stained rather than repainted. Working along the grain is important; scratches and ripples on the surface are a common problem.

Blast cleaning with high pressure air and water abrasive systems is likely to cause damage to the heritage-listed place and should not be used.

Hot-air paint stripper

This system is similar to the burning off method but fire risks are less as the temperature is lower. Hot air is produced by an electric filament and the heat can, in some cases, be adjusted with temperatures ranging from 20- 600 degrees. This tool is designed to soften and blister oil-based paints and varnishes. The paint is then scraped away with a stripping knife or scraper. For awkward crevices and delicate work, a shave-hook is used.

Hot-air strippers are not suitable for removing water-based paints, some primers and undercoats, or for removing paint from metal or plaster. They should only be used on masonry when thick layers are to be removed. Special nozzles should be used on window frames and the glass should be protected against heat cracking. Do not use this method on frames containing old glass, as this is irreplaceable. The method is fast and effective on wood surfaces but if hurried it is easy to damage mouldings with the scraper. The absence of flame decreases the risk of fire damage but the surface of wood can become slightly scorched if the tool is directed too long in one place.

This system has been known to ignite flammable materials such as dust in sash boxes.

Inappropriate use of heat guns can irreparably damage timber or start fires by igniting dust or other matter that may have built up inside the walls of the building. Considerable care needs to be taken if adopting this method of paint removal.

Burning-off methods

Fire risks are high with this method and it is not recommended for historic buildings. The risks involved in using this method on older buildings are so great that some contracts ban blowlamps and blowtorches on site.

Blowlamps or blowtorches are used to soften paint before scraping with a knife, scraper or shave-hook. The method is quicker than other forms of removal but poses serious risks to an older building where fire hazards may be greater.

The method is effective on oil-based paints but not water-based coatings. It should never be used to remove flammable coatings (for example, some

cellulose enamels). With some emulsion paints minute explosions can be caused, resulting in showers of hot particles. Paint is difficult to remove from crevices.

There is a danger that the paint itself may catch fire but also that rotted timber below the paint film may ignite without being immediately noticeable—timber may smoulder unseen for several hours. Electrical insulation may also be damaged. Stripping a sash window can be particularly dangerous where dust in the sash box may be ignited and not be visible. It is easy to scorch wood and crack glass.

Specific problems

Timber

Solvent strippers are successful in removing oil paints, tar and some emulsion from timber surfaces. Used in poultice form they help to dislodge paint embedded in grooves. After stripping, the residues should be washed down with white spirit as water can raise the grain and darken the timber.

Rubbing down should follow the direction of the grain. Wire wool is best avoided for this purpose as fragments of metal can become lodged in fissures and, where moisture is present, can cause staining.

Mechanical methods— such as grit blasting—will spoil the surface of the timber and should never be used on an older building.

Brick and stone

Moisture in an older wall can become trapped behind a paint film and weaken its adhesion. Alkali from lime mortar and soluble salts may also attack oil-based paints.

All methods of removing paint from brick or stone will damage the base material to some extent. Although removing the paint should benefit the wall, the ideal course would be to allow the paintwork to weather and disintegrate naturally. During the intervening period, a coat of limewash of a similar colour will improve the appearance of the wall.

With many modern paint types, breakdown of paintwork on damp or eroded brick or stone is likely to occur within five years. Solvent strippers can be successful in softening many types of modern paints. Poultice treatment may be necessary where paint is embedded in grooves. Deposits can be removed with water under minimum pressure. Layers of paint can be difficult to remove from very porous brick or stone. Hot air, alkaline strippers and air-abrasive methods may damage the substrate.

Plaster

To remove paint from plaster, keep water to a minimum; prolonged soaking will soften plaster, especially gypsum-based plasters.

Water washing, hand sprays, and steam and solvent strippers help to loosen paintwork. The choice depends upon the type of paint to be removed. It is an advantage when repainting old plaster—particularly decorative work—to use limewash, whitening or soft distemper (size-bound, non-washable). These can be washed off between applications. This will prevent a build-up of paint and a loss of detail.

Metalwork

For non-ferrous metals, solvent strippers based on methylene chloride are more effective if applied in poultice form and left in position for about two hours. Residue is removed with white spirit.

For ferrous metals, solvent or alkaline type strippers or mechanical systems should be used. An alkaline (caustic) stripper in poultice form can be successful—it slows down corrosion and does not roughen the surface. Neutralising with acetic acid is necessary after application. If the caustic solution becomes embedded in crevices and joints it may be difficult to neutralise and corrosion is likely in these areas if moisture penetrates.

Mechanical methods include the use of a chipping hammer or mechanised needle hammering—both methods are slow. Air and waterborne abrasives are useful on cast iron. A fine grade of crushed copper slag is normally used as the grit. The surface of the metal should be primed immediately after blasting to prevent rust formation. Grit blasting will destroy a smooth surface on wrought iron. Paint and mill-scale can also be removed by using the oxyacetylene flame-cleaning system.

Graffiti

There is no general solution to the removal of graffiti but it is important to begin treatment as soon as possible so paint does not have time to harden. Seek advice before proceeding with any treatments.

Longstanding aerosol paints are almost impossible to remove from porous surfaces such as brickwork and stonework. There is also a risk of spreading the paint and increasing absorption in the process. Cleaning with an air-abrasive pencil using a suitable fine abrasive—followed by toning down the cleaned patch by rubbing with stone or brick dust—may be successful. A solvent-based (non-caustic) poultice should be tried—if this fails an alkaline (caustic) remover in poultice form might be effective. The brick and stone must be thoroughly washed afterwards. A second poultice (without the chemical incorporated) can be applied to help draw out the residual salts.

Anti-graffiti coats are available to protect walls but can create problems by trapping moisture and salts behind an impermeable membrane.

Caution

When considering repainting and preparing surfaces for repainting, consider that buildings constructed before the 1960s will have one or more layers of lead-based paint. Paint removal will require dealing with toxic substances, along with the hazards of paint removal tools and chemical strippers. Anyone carrying out paint removal work should also be aware of local and state health and environmental regulations for hazardous waste disposal.

Lead concentrations in paint

Paints containing high concentrations of lead were used extensively on the inside and outside of houses built before 1950. Some of these earlier paints contained up to 50% lead. Until the late 1960s, paint with more than 1% lead was still being used. In 1992, the National Health and Medical Research Council (NHMRC) set 0.25% as the maximum allowable amount of lead in domestic paint. Dry sanding, especially with a power sander, can spread contaminated dust. Heat removal methods can cause toxic fumes. The greatest care is needed when disturbing old lead paint because this is when it is most dangerous.

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