



## **CLEANING PAINTED METAL BUILDINGS**

### **BACKGROUND**

With the purchase of a painted metal building, the owner has invested in a structure that can be expected to remain both functional and attractive for many years to come. The painted panels are generally made of either hot-dip galvanized or cold rolled steel that has been painted under controlled conditions on a coil coating paint line.

In a coil coating process, the coated steel is first thoroughly cleaned and rinsed so that a uniformly clean surface is provided for the subsequent painting steps. Next, a pretreatment is applied to the coated steel surface. This is a very thin layer of treatment that chemically bonds to the galvanized or cold rolled steel surface and provides a surface to which paint can bond. A paint system normally consists of primer and topcoat. In the next step, a layer of primer is applied to the chemically treated surface. The primer provides flexibility to the paint system as well as corrosion resistance since it contains corrosion inhibitors. Finally, the topcoat is applied to complete the paint system. This layer contains the color pigments as well as ingredients, which provide the desired gloss and protection for ultraviolet radiation from the sun. At each step of the process, the paint is applied with carefully controlled thickness and cured to ensure the desired properties.

The attractive appearance of a painted building is the result of an engineered product manufactured under carefully controlled conditions. To maintain this attractive appearance, occasional cleaning will be required.

Care must be taken to ensure that the cleaning methods and solutions employed only remove unwanted material without damaging the underlying paint. It is the purpose of this leaflet to provide recommendations for cleaning painted metal buildings.

### **COMMON PROBLEMS REQUIRING CLEANING**

All painted buildings chalk and retain dirt to some degree and need cleaning/washing from time to time. However, if there are more severe appearance problems, simple cleaning and maintenance is not sufficient and such problems may require more aggressive cleaning and repainting. Based on the problems occurred we can differentiate between:

- I. general maintenance cleaning and washing
- II. thorough cleaning for repainting

#### **I. GENERAL MAINTENANCE CLEANING AND WASHING**

During general maintenance cleaning it is not recommended to use strong cleansers and scouring powders as these may damage the paint. Never use a hard bristle brush; use only a very soft bristle brush or a **soft cloth** and wash the surface thoroughly with clean water after cleaning.

Simple maintenance of the prepainted panels on the building involves washing with water from time to time. This is not usually necessary for installations where the panels experience rainfall such as a roof, however on the roof panels the removal of loose debris such as leaves, dirt or building effluent (dust or other residues around roof vents), etc., is important. Even if these residues do not contain corrosive chemicals, they prevent the quick drying that is vital for a long-life roof. Additionally, in protected exposure areas, such as the soffit and wall sections beneath eaves, washing every six months is beneficial to remove corrosive salts, mildew and debris from the surface of the panels, and even more frequently in coastal areas where marine salt spray is prevalent or where high levels of industrial fallout occur.



Removal of the dirt restores much of the building's brightness and the original color. Rust problems can be unsightly, but may only need cleaning or minor repair while cleaning.

The selection of a cleaning method will depend on the type of contaminant to be removed. Common types of contaminants associated with painted metal buildings include:

- **Airborne Dirt** can collect on the building along with greasy, organic residues, which cannot be removed by rainwater.
- **Chalk** is a natural white by-product of ultra-violet degradation of the paint system. Over a period of several years, a light white chalky film is produced on the surface of the paint film, which makes colors appear lighter and reduces the natural gloss of the original paint.
- **Mildew**, or more generally, biological growth, commonly appears on surfaces which remain moist for extended periods such as north walls, under eaves or sheltered areas.
- **Rust Stains** may be caused by rundown from swarf and steel debris left on the building following erection, unprotected cut edges, or similar situations. These sources of rust stain should be eliminated prior to cleaning.
- **Graffiti** on pre-painted buildings is especially difficult to remove since it requires removing one kind of paint without harming the original paint and finish.

#### **APPLICATION METHOD**

The two basic application methods used in cleaning buildings are spraying and wiping. Spraying can cover large areas more easily. Wiping can provide improved cleaning since it also involves physical abrasion.

On pre-painted buildings, the abrasion of wiping can easily cause roughening of the surface and change the appearance visibly. Avoid abrading the paint unless preparing to repaint the surface. Wiping should be low pressure with a soft sponge or cloth.

For either method, **check the cleaning solution on an unexposed area to be sure that it will clean as required and will not damage the paint more than is acceptable.**

#### **TYPES OF CLEANERS**

A variety of cleaners remove dirt, mildew and chalk:

- 15ml phosphate-free laundry detergent per liter of water
- 8ml liquid dishwashing detergent per liter of water
- 15ml household bleach per liter of water
- 15ml household ammonia per liter of water
- Solvents or solvent cleaners

It is important to rinse cleaners thoroughly. Detergents, ammoniated cleaners and bleaches leave corrosive residues if not rinsed properly. Solvent and detergent residues attract dirt. Cleaner residues can resemble chalk and are usually unsightly. When cleaning compounds remain on the building, it will not only get dirty faster but may also be subject to more rapid corrosion.

Powder and liquid laundry detergents are excellent general cleaners. The low concentration dishwashing detergents are milder and could be all that is needed. The specific brand is of minor importance although house brands may require a higher concentration to work well. Do not use phosphated detergents.

Some mildew will not come off even with strong detergents. In these situations bleach may be helpful. The colorfast bleaches used in powdered detergents may be helpful, but can be too mild for stubborn mildew stains. Household bleach should work well on heavy mildew.

Ammonia is especially good at cleaning greasy dirt when solvents are inappropriate. Always dilute and mix it in well-ventilated areas.

Solvents are the most effective choice for grease removal. When detergents cannot remove the grease, solvents are the best alternative. There are three serious limitations to the use of solvents:

1. Solvents are flammable. Always use with adequate ventilation. Keep away from open flames, sparks, electrical motors, or any other source of ignition. Do not use solvents for large cleaning operations.
2. Solvents can remove paint. Always test the paint to determine if the solvent will damage it. The following presents some guidelines:
  - Polyesters and silicone-modified polyester (SMP) topcoats are less solvent sensitive than PVDF and plastisol topcoats.
  - Alcohols are the least aggressive solvents.
  - Petroleum solvents (kerosene, naphtha, mineral spirits, turpentine, Xylol, Toluol) and chlorinated solvents are moderately aggressive.
  - Ketones, esters and paint removers are very aggressive to paints. When using them, expect to at least see a dulling to the finish.
3. Most solvents are toxic. Take great care in limiting working exposure. Use proper disposal methods.

Any of these cleaners may be used on unpainted metal buildings. When cleaning bare hot-dip galvanized steel, solvent cleaners can damage paint if spilled on adjacent painted areas. If this possibility exists, test the solvent on those areas to determine the paint's resistance to solvent damage.

## **DIRT RETENTION**

Two types of dirt accumulate on buildings: dry soil and greasy or organic residues. The dry dirt, by itself, washes off with rain or high-pressure water spray. Greasy residues do not wash off in rain and hold dry soil and chalk tightly to the surface. These residues originate from automobile exhaust, fireplaces, ventilation fan oil, pesticides, and various other common



Figure 1 Effect of cleaning dirt off a building

sources. This is the kind of dirt that requires cleaners to remove. Detergents, ammoniated cleaners and solvents are particularly effective on this greasy kind of dirt.

Figure 1 shows the effect of cleaning dirt from a building panel material. Lighter colors show dirt more than dark colors. Polyesters tend to retain dirt more than fluorocarbons (PVDF). Plastisol chalks so heavily that the dirt is often washed off with the chalk, by rainwater.

## **CHALK**

Chalk is a white by-product of ultraviolet light (UV) degradation of the paint system. It makes colors look lighter, reduces the natural gloss of the paint and deposits on lower building materials. Chalk builds up over a period of years because rainwater only partially washes it off.

The rate of chalk buildup very strongly depends on the type of resin and pigment color in the topcoat. In general, Plastisols chalk more than polyesters, which chalk more than fluorocarbons (PVDF). Chalking on darker colors is more noticeable than on lighter colors. There are significant variations by paint brand within each category.

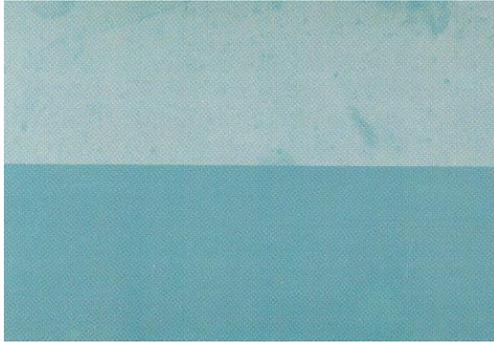


Figure 2 Effect of chalk on color

Chalking increases with greater exposure to the sun. Parts of the building, such as the roof, south side of the building, and areas not shaded from the sun along with buildings in southern climates, may experience greater degrees of chalking. Generally high-pressure water spray is all that is required to remove chalk and restore the building's original appearance. Figure 2 shows the large effect of chalk on color.

## **MILDEW / FUNGUS**

Mildew build-up, or more generally biological growth, on buildings requires a long wet time and a source of nutrients to form. There is a sufficient supply of organisms in dust to initiate growth anywhere. North walls, under eaves, sheltered corners or areas that have layers of dirt buildup are most susceptible. Dust or airborne organics would be common in animal confinement buildings and provide sufficient nutrients for growth. A visible growth of mildew holds moisture easily. Mildew is also a corrosion issue since the by-products of bacteriological growth are corrosive.

Prepainted steel is no more prone to mildew growth and discoloration than any other building material. Additionally, in cases where the local environment is particularly favourable, lichens may also be occasionally seen, usually across the entire roofing surface. While mildew is generally black, lichen appears green and often leafy. The distribution of mildew and lichens can be in forms of isolated growth, spotty growth and uniform coverage.

To remove mildew it is recommended to carry out the spot test with sodium hypochlorite solution (diluted to 2% solution). The most convenient source of sodium hypochlorite is household bleach (as fresh as possible).

Apply the bleach by wiping or by using a power spray, leave react for 3-5 minutes and then wash off with sufficient amount of fresh potable water. A small amount of non-ionic detergent (for dishwashing) may be added to the bleach if necessary to improve wetting. Rinse the area thoroughly, however avoid any solution being washed into water tanks.

Bleaches can be unsafe to mix with other cleaners. Use premixed laundry detergents with bleach if extra cleaning is needed. Bleach is toxic and corrosive. Avoid eye or skin contact. Keep it off nearby plants, shrubs and grass. When working with solution it is necessary to wear rubber gloves and follow safety instructions from the manufacturer.

Eliminating the cause of the mildew prevents its return. As the fungal growth is a natural occurrence on prepainted steel, cleaning remains the responsibility of the object owner.



## **RUST REMOVAL**

Cleaning red rust and red rust stains from buildings includes the need to eliminate the source of the red rust before cleaning. Otherwise, long term elimination of the red rust staining is an unreasonable goal. In many circumstances, removing the rust is the final step in the repair of a rust source. The effect of red rust staining itself on prepainted products is generally aesthetic, and may not be detrimental to the performance of the product. On prepainted surfaces, red oxides of iron are normally inert substances and do not attack the prepainted finish; the stain is merely absorbed by the prepainted finish. Red oxides of iron are insoluble in water, and the stain will take considerable time to weather away naturally. The product life will be severely affected where attached swarf particles have penetrated the prefinished film and are in contact with the protective metallic coating, although, this generally only occurs in severe cases. On metallic coatings, accelerated corrosion can occur over a small area as the zinc in the metallic coating sacrifices itself to prevent oxidation of both the swarf and, if allowed to continue, exposed areas of the steel base.

The following are useful examples of rust removal.

1. **Rust Rundown** – Rust can stain panels when rust runs down from a higher, rusting panel. After elimination of the upper panel rusting, cleaning permanently removes rust on the lower panel.
2. **Rust from Steel Debris/Swarf** – After removal of steel debris left on a building, cleaning permanently removes the stain. Swarf is the term given to the steel debris arising from cutting or piercing operations when using friction saws, abrasive discs, drills etc., on steel roofing and walling products. Whilst comprising mostly fine steel particles mixed with abrasive media, in this context swarf may also be taken to include any other discarded steel objects such as rivet shanks, nails, screws and nuts, which may come in contact with coated products. Swarf particles, if left on the surface, will corrode and cause rust stains which will detract from the finished appearance of a product. These stains are often mistaken for early deterioration of the roofing and walling itself.
3. **Edge Rust** – The bottom edges of panels that have prolonged wet time will have red rust. After correcting the edge design to allow easy drying, cleaning permanently removes the rust. If it is not possible to correct the design, repainting of the edges following rust removal may be required.
4. **Painting Rusted Area** – Completely remove the rust prior to painting or the paint will not adhere.

Removal of any rust source or swarf in the first place is a far better alternative to the repair of damage. The roof should be swept, rinsed, vacuumed or blown progressively to remove loose particles. Maximum care should be taken when attempting to detach swarf/steel debris that has become stuck; this can be done, but do not attempt any action that is likely to remove the paint or metallic coating. Any damage to these coatings may lead to reduced life of the material.

If swarf particles are over-painted, rust bleed-through is likely to occur, therefore all swarf particles should be removed. It should be noted that all remedial actions will not restore the product to its original state. Therefore it is critical to ensure that the occurrence of swarf is avoided.

The preferred treatment is a phosphoric acid-based cleaner, such as ABR 50 (rust remover, Orthophosphoric Acid 85%). Use the cleaner from 10% to 50% strength depending on the severity of the rust and exposure to the building. Typically, using the cleaner at 50% strength means rinsing it off within a hour of application. Lower concentrations will remove the rust



more slowly and will allow the cleaner to remain on the building longer without causing damage.

The cleaner should be completely rinsed off after application. Rinse with tap water very thoroughly. Acid cleaners attack the metallic coatings if left on for a sufficiently long time.

Muriatic acid, used to clean rust from concrete, will damage steel buildings. Never use it to clean rust from a metal building. If cleaning rust off adjacent concrete, protect metal surfaces before cleaning.

Typically, the acid cleaners will not be as effective as other cleaners in removing chalk, mildew and dirt. If dirt and/or chalk removal is needed after the acid cleaning, use an alkaline cleaner such as laundry detergent. If bare hot-dip galvanized steel is being cleaned, the procedure and warnings are the same.

In cases of very severe or extensive staining, where aesthetic factors are important, either replacement or overpainting may be the most appropriate solution.

## **GRAFFITI**

Graffiti on prepainted buildings is especially difficult to remove because it requires removing one kind of paint without harming the original paint. Removal will likely require an aggressive solvent. Test a hidden area to determine the effect of the solvent on the paint. With more aggressive solvents the paint may be unharmed by short exposures, but damaged if exposed for longer times. Graffiti should be removed from all substrates as quickly as possible because if it is allowed to cure over a period of time it can be more difficult to remove. With very solvent-resistant graffiti, repainting may be needed.

There are several graffiti removers available from local hardware stores. Those of a water based nature are likely to be less detrimental towards the environment and safer for use.

Chemicals such as Acetone, Methylene Ketone, Toluene, Thinners or commercial paint strippers **MUST NEVER** be used on prepainted steel.

For unpainted buildings, use the more aggressive solvents: acetone, n-Methyl-2-Pyrrolidinone (MEK), or commercial paint removers. The use of abrasive pads to scrub graffiti may cause shiny spots that can detract from the building's overall appearance.

As a guide, the following procedures should be followed for removing graffiti from affected prepainted steel products:

1. Follow safety directions or contact the graffiti removal supplier (MSDS), wear recommended personal protective equipment (including gloves, glasses and long sleeves).
2. Rinse the graffiti affected area with water to prepare and clean the surface before applying the product and make spot test by starting from the edge of the affected area. Apply the solution to a small region, and allow to sit for approximately one minute.
3. After one minute, gently rub off some of the graffiti that has been sprayed with Graffiti Remover using a clean soft cloth or sponge. The pressure to be applied to remove graffiti will depend on the type of graffiti paint.
4. Rinse the surface with water to minimize residual staining and repeat these steps until the graffiti is removed.
5. Once the graffiti is removed, thoroughly wash the affected area with water to remove any remaining graffiti remover or overspray from the surface of the prepainted steel product.



## **SNOW**

Snow and ice deposits are another examples of objects to be removed from the prepainted roofs. In areas where the roof of a building experiences heavy accumulation of snow, and the snow is on the roof for long periods, there is the possibility of shortened panel life. If the building design allows the snow to melt constantly, the painted panel is in permanent contact with water. The water eventually permeates the paint film and corrosion can be severe, leading to an abnormally short roof life. Another reason for removal of snow from roofs is its weight and risk of building collapse.

These deposits do not require chemical methods for removal. However during physical removal of snow and ice some rules have to be followed:

- Do not use a metal blade shovel to remove snow from roofs. This can cause severe scratching of the paint.
- Use shoes with rubber and clean sole, free from stones and sharp parts when moving on the roofs.
- If it is necessary to remove icy deposits, proceed carefully in order not to damage and scrape the paint.

## **II. THOROUGH CLEANING FOR REPAINTING**

If the service environment is more harsh and aggressive than the coating was designed to withstand, deterioration of the paint coating may occur sooner than might normally be expected. In addition, at some point in the life cycle of the building, it may be desirable to repaint the building. Prior to repainting, the building must be thoroughly cleaned. In this case the cleaning process can and should be more aggressive; otherwise the new paint will not adhere well. It is recommended that the services of a qualified painting contractor be engaged.

Touch-up repair painting may sometimes be required to restore small areas of paint damage. **This leaflet does not apply to touch-up repair.** What looks like a good color match when freshly painted, may turn into a very poor match after weathering. Consult a paint manufacturer for advice on touch-up repair painting of prepainted steel sheet.

**When a building needs repainting**, it must first be washed. Use the procedures recommended for dirt, mildew and chalk removal described in this leaflet with these differences:

1. Clean aggressively so that the paint surface is dulled or partially removed.
2. Good rinsing is critical. Any kind of cleaner residue will cause poor paint adhesion.
3. Removal of waxes is necessary. Solvents are best for this.
4. Remove rust stain as described in this leaflet.
5. Remove loose paint by scraping or by using a high-pressure spray.
6. Use of an alkaline phosphate cleaner (i.e. trisodium phosphate) will improve paint adhesion on a new unpainted building.

It is necessary to mention that when repainting is necessary, the whole visible area should be repainted. It is due to the fact that air drying paints will weather more rapidly and in a different manner to prepainted roofing and walling products. If only partial areas are repainted, they become different in aesthetic appearance in comparison to industrially applied paints.



# **C L E A N I N G   & M A I N T E N A N C E**

**of organic coatings produced by U. S. Steel Košice, s.r.o.**

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Minor scratches which have not exposed the metal substrate should be lightly sanded to provide a smoother surface for repainting. It is important to not to expose any of the substrate. Exposed substrate will require application of a primer. Deep scratches and other major imperfections that have exposed large areas of bare metal, or are badly corroded, should be replaced. Fine scratches in dimensions up to 2 x 0.2mm usually do not need any repair treatments.

If the mill hot-dip metallic coating is not present or is badly corroded, serious consideration should be given to replacing the panels with new material. If it is decided to paint over rusted panels, remove all traces of corrosion products (red, white or black rust) by vigorous wire brushing, taking care to not to remove any of the hot-dip metallic coating. Clean and remove all loose debris. Lightly sand all edges of the areas to be repainted. All exposed metal should be painted with a high quality bare metal primer. Be certain to follow all instructions offered by the manufacturer of any bare metal primer that is used.

Once the surfaces have been prepared / cleaned for repainting, they must be coated within 24 hours with the field applied topcoat. Do not clean a larger area than what can be painted in one day. Severely damaged areas should be painted 2 times.

The surface must be completely dry prior to repainting, which should not be done in the early morning when dew is still present on the metal surfaces. Do not paint when the ambient temperature is below 10°C. Also the temperature may not be too high as all steel roof coating has a tendency to sag on hot steel and can dry too quickly. This can give less good durability and too thin film thickness.

Always follow the instructions of the paint manufacturer for applying appropriate paints.

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#### **DISCLAIMER**

The material in this paper is intended for general information only. Any use of this material in relation to any specific application should be based on independent examination and verification of its unrestricted availability for such use, and a determination of suitability for the application by professionally qualified personnel.