



United States Steel Corporation

# Technical Bulletin Construction

## CLEANING PAINTED METAL BUILDINGS

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### 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 GALVALUME®<sup>1</sup> Coated Sheet 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 coated 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 baked 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 Technical Bulletin to provide guidelines for cleaning painted metal buildings.

### COMMON PROBLEMS REQUIRING CLEANING

All painted buildings chalk and retain dirt to some degree. Mildew builds up especially in damp areas. A building may start to look old or dull even though it still has a long life left. Often, the only thing the building needs is cleaning. 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. However, more severe appearance problems may require cleaning and repainting.

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.

<sup>1</sup> GALVALUME® is an internationally registered trademark of BIEC International, Inc. and some of its licensed producers.

- **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 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 prepainted buildings is especially difficult to remove since it requires removing one kind of paint without harming the original paint and finish.

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.

## CLEANING PAINTED SHEET

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When a building needs painting, it must first be washed. Use the procedures recommended for dirt, mildew and chalk removal 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 later in this Bulletin.
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.

## APPLICATION METHOD

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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 prepainted 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

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A variety of cleaners remove dirt, mildew and chalk:

- $\frac{1}{4}$  cup phosphate-free laundry detergent per gallon of water
- 1 ounce liquid dishwashing detergent per gallon of water
- $\frac{1}{4}$  cup household bleach per gallon of water
- $\frac{1}{4}$  cup household ammonia per gallon 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 Kynar® and plastisol topcoats.
  - Alcohols are the least aggressive solvents.
  - Petroleum solvents (kerosene, naptha, 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 or GALVALUME® Coated Sheet 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

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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 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. SMP and polyester tend to retain dirt more than fluorocarbons. Plastisol chalks so heavily that the dirt is often washed off with the chalk, by rainwater.

## CHALK

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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, Plastics chalk more than polyesters, which chalk more than SMP's, which chalk more than fluorocarbons. Chalking on darker colors is more noticeable than on lighter colors. There are significant variations by paint brand within each category.

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.



Figure 1. Effect of cleaning dirt off a building

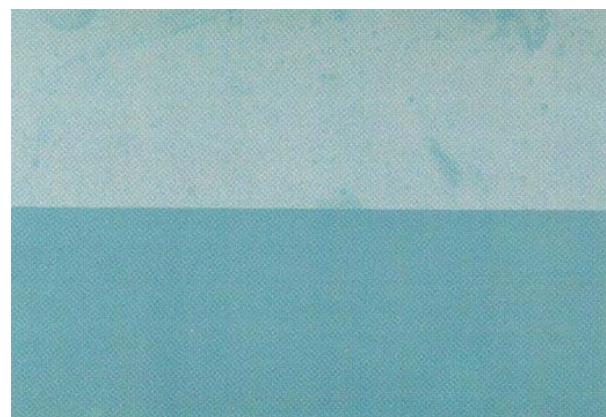


Figure 2. Effect of chalk on color

## MILDEW

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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.

Remove mildew by wiping or by using a power spray. Then wash the area with an antiseptic cleaner such as bleach described above. Rinse the area thoroughly. Eliminating the cause of the mildew prevents its return.

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.

## RUST REMOVAL

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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 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 – After removal of steel debris left on a building, cleaning permanently removes the stain.
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.

The preferred treatment is a phosphoric acid-based cleaner, such as ABR 50. 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 GALVALUME® Coated Sheet Steel or hot-dip galvanized steel is being cleaned, the procedure and warnings are the same.

## **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. With very solvent-resistant graffiti, repainting may be needed.

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.

## **DISCLAIMER**

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For further assistance on the use of steel building panels or related topics,  
contact U. S. Steel Construction Sales Group:

U. S. Steel Construction Sales  
6200 E. J. Oliver Boulevard  
Room 106  
Fairfield, AL 35064  
1-800-633-8226 or 1-888-243-6851  
Ext. 2683

[ConstructionGroup@uss.com](mailto:ConstructionGroup@uss.com)