

# Painting and Powder coating of galvanized steel

1 Access bridge, Netherlands



2 Finishing of galvanized articles



Hot dip galvanizing by itself is a long lasting and cost effective means of protecting steel from corrosion. When organic coatings such as paint or powder coatings are applied over hot dip galvanized steel, the resulting combination is known as a duplex coating.

These coatings are used to:

- Add colour for aesthetic or safety purposes.
- Increase the economic life of a structure.
- Provide additional protection in aggressive environments.

Paint coatings may be applied soon after galvanizing or later in the lifetime of the structure when the galvanized coating has weathered, or later still when further protection is essential to maintain protection.

When paint is to be used to further extend the life of a galvanized structure, it is often most economic to defer painting until a long maintenance-free life has been achieved from the galvanized coating.

## Preparation of galvanized steel

As with all protective treatments of steelwork, it is of great importance that preparation of the

galvanized surface is carried out in a thorough and considered manner. In particular, failure to degrease the galvanized steel surface properly is the most common source of failure of duplex coatings.

As with many other substrates, organic coatings cannot usually be applied directly onto galvanizing (although some direct application organic systems are starting to emerge). The reasons for the need for effective surface preparation in most cases are quite straightforward. When the steel is withdrawn from the galvanizing bath it has a clean, bright, shiny surface. With time this changes to a dull grey patina as the surface zinc reacts with oxygen, water and carbon dioxide in the atmosphere to form a complex but tough, stable, protective layer which is tightly adherent to the zinc.

This weathered condition takes time to develop and this depends on the climate around the

galvanizing. Typically, the time can vary from six months to two years or more. During this transition of the zinc outer layer into its final state simple oxides and carbonates form which do not adhere strongly to the surface.

As most duplex coatings are applied whilst the galvanizing is in this condition the surface layer must be modified by chemical or mechanical means. Coatings may be applied directly to the initial pure zinc surface or to the weathered surface but the results are not always consistent and "taking a chance" is not recommended.

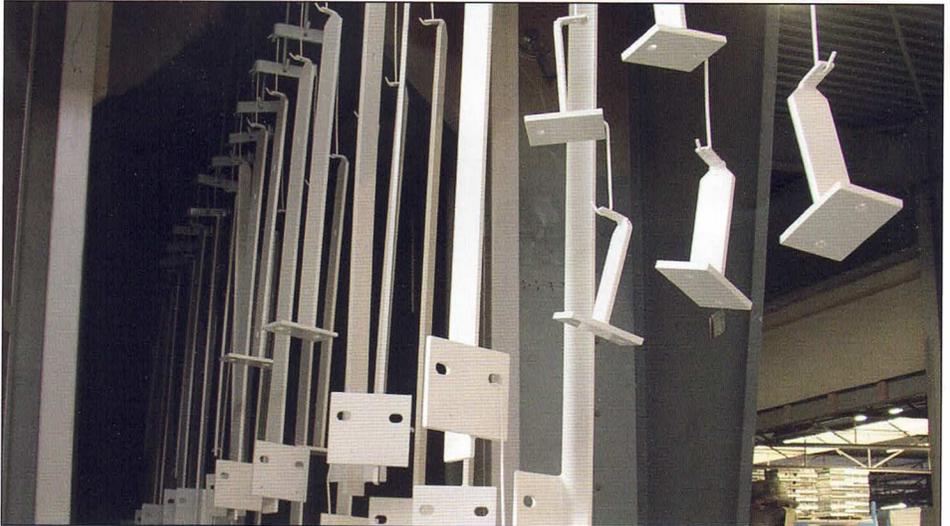
Where the aesthetic requirements for a duplex system are particularly high, a degree of surface finishing or fettling may be required on galvanized coatings as small surface projections may become more obvious by the application of an organic coating. This is particularly the case for powder coating systems.

2005

3 Manual application of powder



4 Powder coating of galvanized articles



Care must be taken when surface finishing a galvanized component because the zinc coating may be damaged by heavy or excessive grinding.

### Guidelines: Pre-treatment for Painting

Although pre-treatment of galvanized components is best carried out immediately after galvanizing, before the surface has become contaminated in any way, this is not always practical. Pre-treatment can be carried out later but it is vital that the surface is adequately cleaned to remove all traces of contaminants such as oil, grease and dirt. The cleaning operation must leave no residues on the cleaned surface and any wet storage staining should be removed using a stiff brush.

There are four recognised methods of surface pre-treatment that produce a sound substrate for paint coating:

- T-Wash (or its proprietary equivalent)  
Despite the fact that this preparation process has been available for some considerable time, T-Wash is still generally considered to be the best pre-treatment method for painting galvanized steel. T-Wash is a modified zinc phosphate solution, which contains

a small amount of copper salts. When applied, a dark grey or black discolouration of the zinc surface will result. T-Wash must not be allowed to pool on horizontal surfaces or this will prevent maximum paint adhesion. Any excess should be removed by water. T-wash is most suitable for application to new galvanizing.

- Etch primers  
Etch primers have also been used successfully. Their major disadvantage is the absence of any visible colour change as is the case with T-Wash. Therefore, there can never be complete confidence that all surfaces have reacted to the primer. Etch primers are most suited to application on older, weathered galvanizing.
- Sweep blasting  
A mechanical method of pre-treatment is sweep blasting using fine copper slag, J blast or carborundum powder with a blast pressure of no greater than 40psi (2.7 bar). This will ensure that only the minimum amount of oxide is removed and the zinc surface is left in a slightly roughened condition. Care should be taken when carrying out sweep

blasting on very thick galvanized coatings to avoid damage to the coating. The optimum nozzle-to-work piece distance and angle of blasting needs to be identified for all surfaces on the galvanized steel work if optimum results are to be achieved.

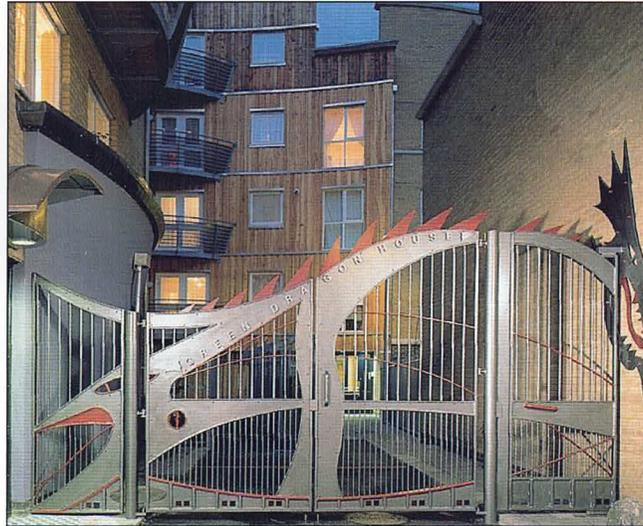
Angular iron blasting grit must not be used under any circumstances. Sweep blasting is often used in addition to the chemical preparation stage.

- Weathering  
This process only becomes fully effective after a galvanized surface has been exposed to the atmosphere for a period of at least 12 months. The surface is prepared using either abrasive pads or a stiff brush to remove all loose adherent materials and making sure that the bright zinc surface is not restored. This is followed by a hot detergent wash and then a rinse with fresh clean water. The surface must be fully dry before any paint is applied. Weathering should not be used as a method of surface preparation in marine environments where chloride levels are high.

5 Walpole Place, Woolwich, London



6 Dragon Gates, London



7 "Bus stop of Desire", Bradford



**Guidelines: Painting**

All paint systems used should be specifically formulated for use on galvanized steel and applied in accordance with the paint manufacturer's recommendations.

The choices of paint systems will depend upon the specific application. Chlorinated rubber and epoxy systems have given good results, and both high and low micaceous iron oxide paints can also be used to provide a wide range of colours. The presence of micaceous iron oxide has been shown to improve adhesion performance of both chlorinated rubber and epoxy systems.

Modified unsaponifiable alkyds can be used satisfactorily. Vinyl acrylated rubber paints have been used with considerable success. They also have a longer life to first maintenance than alkyds.

It is likely that the high build family of epoxy coatings with lower Volatile organic compounds (VOC's) will be the main coating available over the foreseeable future. These coatings, unlike the less highly stressed oleo resinous paints, require far better and more careful pre-treatment of hot dip galvanized steel.

Water borne paint systems may also become more frequently used.

**Guidelines: Powder coating**

Powder Coating is a fast growing method of adding colour to metal surfaces.

Like galvanizing it is carried out under controlled conditions in a factory. For this reason the maximum size of the steel fabrication to be powder coated will be limited, but powder coatings can be applied successfully to hot dip galvanized surfaces.

The thermal characteristics of galvanized steel for powder coating purposes are almost identical to those of un-galvanized steel and there are many examples of steel which has been galvanized and then powder coated. However, the pre-treatment of the galvanized surface will depend upon which of the many powder types such as polyester, epoxy, or hybrid is being used. This usually includes a form of chemical pretreatment such as chromating or phosphating, gentle heat treatment followed by application of the powder. The successful application of powder coating to any metallic surface requires the multistep instructions provided by the powder manufacturer to be respected in every detail. For this reason an experienced or approved applicator should be asked to do the work. As with wet painting, a full range of colours is available.

Powder coating of galvanized steel for architectural applications is covered at present by BS 6497:1984(1991), however, a new European standard EN 13438, has recently been adapted and will replace BS 6497 in the near future.

It is important for the galvanizer to be advised that work is to be subsequently powder coated and post-galvanizing treatments agreed with the powder coater.

**Photos:** Institut Feuerverzinken/SDV

**Photo 7:** Martine Hamilton-Knight