# 2.1 Surface Requirements of Steel for Galvanizing

## 1. General

The chemical composition and the condition of the steel which forms the base material are vitally important for successful hot dip galvanizing. They affect the thickness, structure and quality of the galvanizing. For best results it is just as important for the customer to ensure careful preparation of the steel components as it is to ensure that the construction and design are suitable for galvanizing.
A metallurgically clean steel surface is an absolute necessity for satisfactory hot dip galvanizing. However, steel surfaces are normally covered with contamination or corrosion products as a result of their chemical composition, manufacture, subsequent treatment or their previous use.
Contamination can be caused by a variety of materials including oils, grease, soaps, dust, old coatings or the remains of manufacturing aids. Corrosion products include rust and scale caused by oxidation of the steel surface. Preliminary treatment by the galvanizer of the material to be hot dip galvanized leads to the complete removal of corrosion products on the steel surface which can be removed by pickling in dilute hydrochloric acid, but this may not be the case with other contaminants.

Also, irregularities in the surface of the steel such as scratches or grooves may cause the zinc coating to react more strongly with the base material, making these areas more conspicuous after hot dip galvanizing.

## 2. Removal of Contamination

### Oil and Grease

Although many galvanizers have degreasing baths, it is best if fabricators nevertheless ensure that oil and grease are removed from the surfaces of articles to be galvanized, or use light emulsifiable oils and grease. If oil and grease remain on the steel the galvanized coating may not form in these areas.

### Welding Slag and Welding Aids

When coated electrodes are used during welding a glass – like slag can occur at the weld seam and this can be removed only with difficulty. The supplier should remove these deposits as they may also result in defects in the galvanized coating.
Gas welding does not produce a prominent layer of slag, but very small brownish glass – like spots may remain on the weld seam, depending on the weld process and the size of the work. There is a concern with slag consisting predominantly of manganese silicates which, in some cases, can also result in a defective galvanized coating.
Very small residues of manganese silicate create a particular problem as they are hardly noticeable but adhere very strongly to the steel. In some cases it may be necessary to use a compressed air needle on the welded seams or to lightly grind them.
Weld sprays are often used to ensure that weld spatter, which can easily occur during welding, does not burn onto the surface of the workpiece. The area of the weld is sprayed before welding with an almost invisible film which ensures that weld spatter does not come into contact with the base material. Weld sprays are barely visible to the naked eye

**Figure 1: Residue etched into the area around the weld seam of a greased container (in this instance before galvanizing) may create problems.**

**Figure 2: Flaws in the galvanized coating due to weld slag not being removed.**

**Figure 3: Flaws due to paint markings.**

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**Figure 4: Old and new material galvanized together (rust spots are still visible).**

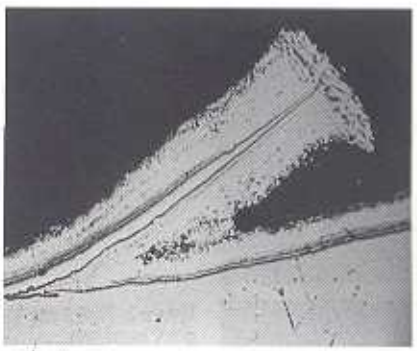

**Figure 5: Section through a striation (x 200).**

but they can also produce galvanizing defects in the immediate area around the weld seam. If weld sprays must be used then it is recommended that only grease-free or silicone-free sprays be used, and then used extremely sparingly.

### Shot Blasting and Shot Blast Residue

Steel fabrications are sometimes shot blasted after manufacture. If they are hot dip galvanized after blasting, care should be taken that any residue from the blasting is completely removed from the corners and angles of the structure, since this can also effect the galvanizing process and create defects in the coating.

### Old Coating and Markings

Steel fabrications are often identified by means of coloured marks and old steel components may already have been painted. Complete removal of these residues is essential and should be done by means of blasting, grinding or even by burning off or by using special paint strippers. If this is not done, defects will again occur in the galvanized coating (fig. 3). Water based identification markers are available which will be removed by the pickling process, and they are strongly recommended.

Today, increasing numbers of gates, railings and fences are being renovated, restored and galvanized before being re-installed. Here it is particularly important to remove the old coating, especially in the corners and angles. Riveted bands or similar fastenings with crevices from which it is difficult to remove the old paint are a particular problem. Painstaking work is necessary but will be worth it.

## Surface Roughness

The composition of the steel influences the formation and structure of the zinc coating but it is not often realized that the surface roughness affects the thickness of the coating as well.

As a rule, surfaces with a very rough surface finish, such as steel which has been blasted with a very sharp edged material, form thicker coatings than usual since the rough texture of the surface presents a greater surface area to react with the molten zinc and additionally draws a larger amount of the molten zinc with it when the components are withdrawn from the galvanizing bath.

Using old rusty material in conjunction with new material can also produce clearly visible differences in the coating after galvanizing. This is because the molten zinc will not evenly cover the very rough surface structure of an old rusty component (fig. 4).

Extremely smooth surfaces such as plain drawn, ground or polished surfaces may in certain circumstances also result in heavier coatings as they encourage the formation of very thick zinc-iron alloy crystals which are responsible for the formation of thick coatings.

## Materials

The use of different steels may produce a patchy type of galvanized coating even within the same fabrication due to differences in the chemical composition and thus cause a variable zinc-iron reaction. This is also true if individual components of some other metals are included in a steel fabrication. In some cases the galvanized coating on these materials may be defective or no coating at all may be present. In these circumstances prior consultation with the galvanizer is recommended.

## Scale, Creasing and Rolling Striations

Problems caused by rolling e.g. scaling, striping, creasing and striations may occasionally occur on the surface of steel sections. These surface defects are barely visible to the naked eye but during the hot dip galvanizing process liquid zinc penetrates such areas of overlapping. And then the edges are raised due to the formation of zinc-iron alloy coatings and become clearly visible (fig. 5). They then become very obvious on the hot dip galvanized surface in the form of striations.

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