

## Staining and discolouration of galvanized steel by rust

### Introduction

Sound galvanized steel with many years of corrosion-free life ahead can sometimes be rust stained or discoloured. This may give an incorrect impression that the coating has failed and is, in some cases, visually unacceptable. This leaflet sets out and illustrates the main causes of staining and discolouration and indicates how the problems can be avoided or the effects remedied.



**Fig 1:** Rust staining occurs when unprotected parts are used in contact with galvanized steel. Here, staining from unprotected washers and fasteners is disfiguring a structure.



**Fig 2a:** When steel is cut or drilled after galvanizing, the swarf must be removed. If it is left on the component rust staining may occur.



**Fig 2b:** This staining is superficial and can be removed to expose a sound galvanized coating beneath.

### Occurrence

The staining and discolouration of galvanized coatings by rust may occur as a result of one or more factors:

- 1: Direct contact of galvanized parts with unprotected or inadequately protected steel (e.g. galvanized steel sections fastened with unprotected, electroplated or painted steel bolts).
- 2: Deposits of iron dust and swarf from other operations or sources onto the galvanized surface.
- 3: Water draining from unprotected or poorly protected steelwork, e.g. from damaged areas on painted steelwork.
- 4: Seepage from pickle residues in welds. During pickling, hydrochloric acid may penetrate into the weld area via pin holes or if the welding is intermittent. Residual salts can sometimes pick up water and cause 'weeping' from the weld areas. This effect is normally limited to a small area, ceases after a short time and is not detrimental to the coating.
- 5: Rusting of areas welded after galvanizing and subsequently left unprotected or inadequately protected.
- 6: Staining of galvanizing can occur when water runs off other materials notably metals such as copper, certain hardwoods, e.g. oak, and indeed whenever water can dissolve materials from one surface and redeposit on the galvanized steel.

### Avoidance

All parts of the structure should receive comparable corrosion protection where possible. Nuts and bolts and other fasteners should be hot dip galvanized to BS 7371: Part 6: 1998. The thinner zinc coatings frequently supplied on steel mesh, sheet, wire and tube will not last as long as those of products hot dip galvanized to BS/IS EN ISO 1461, the standard which covers all structures galvanized after fabrication.

Welds should be continuous and slag-free wherever possible to minimise the retention of pickle residues.

Design structures to avoid run-off water from other metals on to galvanized steel. In particular avoid run-off from inadequately protected steel and from copper.

Where welding after galvanizing is necessary, welded areas should be thoroughly cleaned and the zinc coating restored either with an appropriate thickness of zinc rich paint or with a proprietary repair compound, in accordance with section 6.3 of BS/IS EN ISO 1461.

### Remedial treatment

Discolouration and staining have no effect on the life of the coating. However, affected areas may be cleaned to improve the appearance of the structure. Generally, wire brushing or the use of a scouring powder will remove the stain and leave a sound galvanized coating.



**Fig 3:** Where galvanized structures are welded, the steel exposed must be adequately protected (see text). Where this is not done, severe rust staining occurs as shown in this illustration.



**Fig 4:** Seepage from pretreatment solutions from a weld



**Fig 5:** Water draining from rusting steel (out of picture) causes staining of sound galvanized surfaces of the stairway illustrated here.

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