TECHNICAL NOTE
Dull Grey Appearance

Issue 1, April 2017

Preface

This document is intended to inform readers about potential surface conditions resulting from batch hot dip galvanizing through the provision of visual and written guidance. AS/NZS 4680 provides guidance in the area of allowable surface conditions after galvanizing, however identification of a non-conforming surface condition of a galvanized article will depend on the stated end use of the product and the extent and nature of the damage to the coating. This document is not intended to replace guidance provided by an expert, such as a galvanizer or accredited hot dip galvanizing inspector, who may be consulted when issues with the surface condition arise.

Description

A dull grey appearance consists of darker grey areas over the surface of an article which may occur as a localised patch or extend over the entire surface of an article. A dull grey appearance is also known as a matte grey finish and can appear in conjunction with other surface appearances, such as mottle or spangle (see *Mottled Appearance* and *Spangled Appearance*). This document describes a dull grey finish over an entire galvanized surface, with shiny and dull regions on the same article covered in *Differing Appearance*.

Cause

A grey finish indicates the presence of zinc-iron alloy layers at the surface of the galvanized coating, resulting from the continued growth of the zinc-iron alloy layer either while in, or after withdrawal from the molten zinc. The duller coating can be caused by:

- Steels with a high reactivity due to certain combinations of silicon and phosphorous, which are more reactive and usually form thicker and more brittle coatings
- Slower cooling rates of galvanized articles, with steel held at higher temperatures for longer having more time to form thicker alloy layers

Prevention

The occurrence of dull grey surface finishes can be minimized by:

- Using steel of Category A in Table 9.1 of AS/NZS 2312.2, with silicon and phosphorous contents smaller than 0.04% and 0.02% respectively where possible
- Designing the article for fast and even cooling where possible, with adequately sized holes for venting and draining

If the product requires a special initial finish it must be advised prior to galvanizing and preferably prior to fabrication. This will allow the galvanizer to provide guidance regarding the chemical composition of the steel and fabrication process that should lead to the desired result.

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Effect

The finish appears dull and grey on the surface of the galvanized article and usually results in similar or better corrosion protection than a shiny coating. Duller coatings are usually thicker than shiny coatings, as they normally form as a result of more reactive steel. Over time, the overall appearance of galvanized articles will become uniform as the coating weathers with exposure to the atmosphere.

Acceptability

A dark grey appearance is acceptable when galvanizing to AS/NZS 4680 if the coating thickness is above the minimum specified. AS/NZS 4680 gives the following information on the initial condition of a galvanized article:

- Special requirements for the surface condition of an article requiring arrangements with the galvanizer prior to galvanizing (see Note 3 of Clause 7 of AS/NZS 4680).
- Steels of certain compositions or articles that have different cooling speeds can cause a coating partly or wholly grey in colour, which is acceptable provided it has adequate adhesion (see Note 6 of Clause 7 of AS/NZS 4680).
- The coating is required to be sufficiently adherent to withstand normal handling without peeling or flaking, as per Clause 10 of AS/NZS 4680.

Responsibility

The grey appearance can be caused by:

- The steel manufacturer, when steel is provided with a susceptible chemical composition
- The designer, when normal cooling isn't possible due to the design of the article, such as inadequate holes for venting and draining

Remedy

Since the dull grey appearance is the result of alloy layers at the surface from the metallurgical reaction between the zinc and steel, the appearance cannot be changed from a dull finish to a shiny finish. Stripping the coating and regalvanizing may result in a shinier appearance in some cases, but will usually need to be discussed with the galvanizer and incur cost to the customer if the initial coating complies with AS/NZS 4680.

Examples

Figure 1: A dull grey appearance on some steel beams due to the chemical composition of the steel.

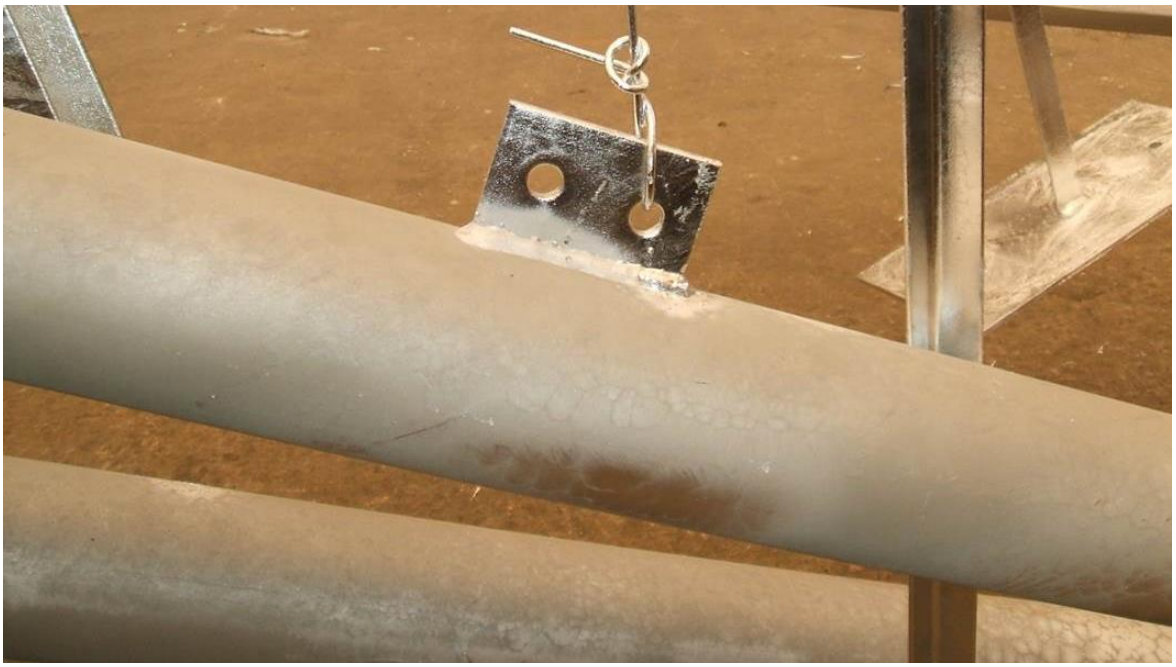

Figure 2: The majority of the pipe has a matte grey appearance, most likely due to the steel chemistry.

Figure 3: A dark grey coating is seen where steel is held at a higher temperature for longer and alloy layers can continue to form. More examples of both shiny and dull regions on the same article can be found in *Differing Appearance*.