ADVISORY NOTE #44.1

TEMPORARY PROTECTIVE COATINGS ON STEEL ARTICLES

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TEMPORARY PROTECTIVE COATINGS ON STEEL ARTICLES

INTRODUCTION

Some steel raw materials are coated in order to provide short-term corrosion resistance from production until the fabrication stage. This includes blue and other coloured paints, lacquers, and oils. To make galvanizing of the steel possible, this protective coating must be removed regardless of the type of the coating and its properties. Contamination on the surface of steel products prevents zinc from meeting the steel surface, and consequently prevents the metallurgical reaction and proper formation of the galvanized coating.

The degreasing and pickling pre-treatment steps in the galvanizing process can remove some of the temporary coatings from the steel surface. However, all lacquer coatings and some paints leave the caustic bath with some of the coatings remaining on the surface. AS/NZS 4680 advises that carbonaceous films such as oils, grease, paint and welding slag should be removed by other methods prior to pickling but that the responsibility for removal of the impurities is subject to agreement. Best practice and reduced cost is always that these impurities are removed by the fabricator.

Some temporary coated products are through welded in the fabrication stage before being sent for galvanizing. In a few cases, the coating has a formula that enables welding through it. Since not all the coatings are weldable, unsuitable coatings should be removed before welding otherwise weld defects occur which will affect both the quality of the weld and the galvanized coating.

LACQUER COATINGS

The lacquer coatings (also called Japan black, black japan, Japan lacquer and Brunswick black) is usually a lacquer or varnish suitable for wood and steel substrates but known especially for use on iron and steel products. It is extensively used by piping manufacturers around the world and is usually formulated with bitumen. In most cases the lacquer is applied only to the external pipe surface, but it is also commonly applied to the internal sections of tees, elbows and similar fabricated sections.

Bitumen paint has various applications and has been used to protect concrete structures, felt roofing, sheet metal roofing, drinking water reservoir, silos, and pipes. It has also been commonly used as a coating over galvanized steel at the air/ground interface to provide additional corrosion protection.

Features of the bitumen-based lacquer coatings are:

- The high bitumen content in the coating provides a protective finish that is durable and dries quickly
- Bituminous coatings have good resistance to dilute acids and alkalis, salt solutions and water
- Optically formulated bitumen paints are non-toxic and therefore may be used to protect the surface that encounters drinking water

Lacquers are not resistant to vegetable oils, hydrocarbons, and other solvents. The coatings may become brittle in cold weather and soften in hot weather. Also due to the thermoplasticity of the bitumen paint, its resistance decreases with increasing temperature.
REMOVING LACQUERS BEFORE GALVANIZING

Even smaller spots of the lacquer remaining on the surface can introduce a defect into the galvanized coating, leaving bare spots that will require repair (Figures 1 and 2).

Figure 1 A bare spot caused by the lacquer not being removed prior to galvanizing.

Figure 2 A more extreme example of uncoated steel after galvanizing. Lacquer coatings are not always easily seen by galvanizing employees, especially if the joining elements have a similar colour.

Figure 3 A typical pipe with partial removal of a lacquer coating. In many cases the removal in the pre-treatment phase of galvanizing cannot be easily assessed by visual inspection.

It is essential that the coating is removed from both the internal and external surfaces by the fabricator if the finished product is to be galvanized successfully (Figures 3 and 4). With tees and elbows the coating must be removed prior to fabrication to allow easy access to the coated surfaces. The most economical, fast and efficient way to remove lacquer from the steel surface is grit blasting, especially when the surface is relatively large. If the surface of the tube is to be painted after galvanizing, or has other aesthetic requirements, then a chemical clean may be recommended as an alternative. This is because some cold formed tubular sections that have been grit blasted can lead to a phenomenon known as “fishboning” where the coating is marked by circumferential lines in the coating that typically cannot be removed by grinding (see FISHBONING and figures 13 and 14). A tube exhibiting the “fishboning” surface condition in the coating is normally fully compliant to AS/NZS 4680 and will provide normal corrosion protection.
If welding is necessary before sending an article for grit blasting, grinding the areas near the joints will be required to remove lacquer from that specific area (Figure 6). The welding should be limited to the area to be welded since non-uniformity from grinding will be noticeable even after galvanizing, especially in curved articles where it is hard to preserve the curvature of the pipe during grinding. It is important the ground back area is sufficiently distant from any weld spatter to ensure the coating does not get trapped under this spatter.

Stripping lacquer off the steel surface may also be possible using paint strippers which are available in hardware stores. The chemicals are applied on the surface to soften the coating and make it easier to be removed, but this is costly on a large scale and it is easy to miss areas.
TEMPORARY PAINT COATINGS

In Australia it is common for tubular products to be supplied with a ‘blue’ paint. Other colours are also in the market but are not common. The local tube manufacturers supply a thin, readily removable coating (typically of 10 – 14 µm thickness) and these will all come off in the pre-treatment baths. However, the removal of the paints will result in slower preparation of the surface than uncoated steels.

Some temporary paint coatings are applied by offshore manufacturers and these can be thick and difficult to remove. Coatings as thick as 70 µm have been seen by Australian galvanizers and the removal of these coatings using the caustic and acid dipping pre-treatment steps adds considerable cost and delays in the galvanizing process.

Paint coatings contaminate the galvanizers cleaning baths, lowering efficiencies for recycling and increasing waste.
Some blue paints on imported tubes are very difficult to remove in the pre-treatment steps and result in significant uncoated areas. The only solution is to blast the steel prior to galvanizing.

As pre coated tube takes longer to prepare for galvanizing it is not uncommon for these products to cost more to galvanize. “No oil or paint” options are available from all tube manufacturers, alternatively stripping the pre-coated tube by blasting is easily available.

**OTHER COATINGS**

If the steel has been previously painted or galvanized it will require stripping prior to the normal cleaning processes being carried out.

Galvanized coatings can be blasted or stripped in the galvanizer’s acid bath, depending on the coating thickness.

Paint coatings of unknown origin or type will always require blasting to remove the existing coating. If the coating is thicker than 15 µm it will be usually be more economical to be blasted.

**FISHBONING**

Fishboning is a surface condition known to occur in some blasted tube sections. It can also occur in unblasted tube, particularly in very large diameters. The effect is believed to be caused by changes in the surface chemistry or hardness resulting from the cold forming process used in tube making and brought out, in particular, by blasting the steel surface prior to galvanizing. It can vary in effect from very light and unobtrusive to strong markings. In most cases it is impossible to grind the surface after galvanizing to completely remove the appearance of the fishboning without reducing the coating thickness below the requirements of the standard. The markings will be more visible if the galvanized coating is to be painted. The ‘as galvanized’ coating thickness will normally meet the requirements of AS/NZS 4680, and durability is unaffected.
It is not possible for a galvanizer to detect the surface condition prior to galvanizing and, in most cases, the fishboning effect cannot be removed by stripping and regalvanizing. The effect can be minimised through handling techniques in the galvanizing process, but these techniques require excellent venting and draining design.

If the tube is to be painted after galvanizing, particularly for aesthetic applications, it is recommended that consultation with the galvanizer occur prior to blasting of the tube.

**SUMMARY**

Before galvanizing, any form of the previous coating should be removed to allow the cleaned and fluxed steel surface to come into contact directly with the molten zinc. This results in a reaction between the zinc and steel to become metallurgically bonded forming zinc-iron alloy layers forming the galvanized coating. Lacquer coatings won’t come off easily in the caustic bath and therefore should be removed before the degreasing step as a safety precaution. In general grit blasting is a favoured approach to remove these bituminous coatings. However, when only cleaning a small area, grinding and paint stripper are other solutions.

Temporary paint coatings (usually blue) supplied by Australian tube manufacturers can usually be stripped by the galvanizer in the normal pre-treatment process, although they do increase the processing time. Other paint coatings can be stripped, although the galvanizer should be consulted prior to fabrication to ensure they are processable by normal methods.
REFERENCES


