

Galvanizing

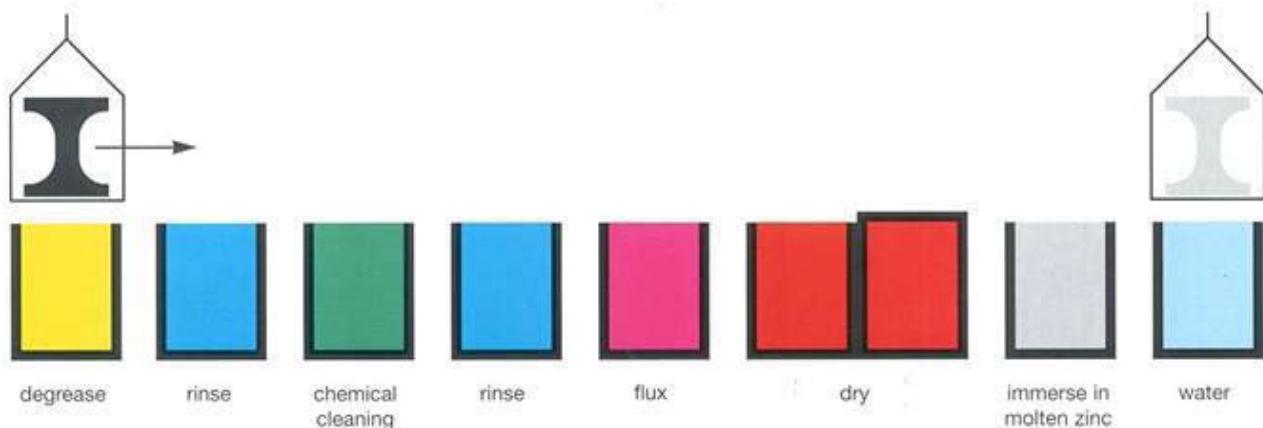
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Galvanizing is a common way of providing corrosion protection to carbon steel. The term is often used to describe zinc coatings in general.

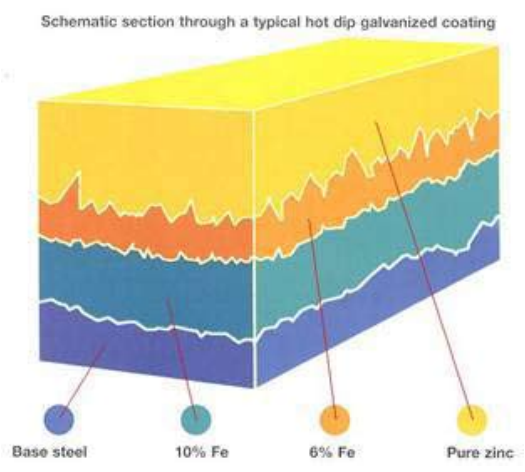
Zinc corrodes in preference to steel and hence sacrifices itself to protect the steel. The corrosion products from the zinc are deposited onto the steel, resealing it from the atmosphere and stopping corrosion. Corrosion rates are very low, and are linear. Thus it is possible to predict performance for a given environment. For a typical interior condition with occasional condensation, the corrosion rate is between 0.1 & 0.7 $\mu\text{m}/\text{year}$. This equates to a theoretical life of 120 years for a coating thickness of 85 μm (see below). On the other hand, the corrosion rate in a swimming pool can be 4 $\mu\text{m}/\text{year}$ giving a life of only 20 years.

It may be seen then that galvanizing is not a substitute for stainless steel, which has an indefinite life. It is however a way of giving efficient protection to steel, particularly to fabrications where the protection is required to the finished article, and not just the component parts.

The method most usually specified to achieve this is 'hot dip' galvanizing (HDG). The process involves degreasing the work, chemical cleaning and then immersion in a bath of molten zinc at a temperature of 450 °C. As the work is immersed, zinc wets the surface, and a reaction takes place to form a series of zinc/iron alloy layers, bonded to the substrate.



When the work is removed from the bath, some pure molten zinc will remain on the top of the layers of alloy, solidifying as the work cools, and resulting in the familiar light spangle appearance.



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<p>The thickness of the galvanizing is largely determined by the thickness of the base material. BS EN ISO 1461 gives requirements as shown. It is possible to achieve thicker coatings but in most cases this is not necessary. In any case it involves further pre-treatment of the steel which has a cost implication.</p> <p>Dipping twice does not increase the thickness since no reaction takes place the second time, and the new zinc simply drips off.</p> <p>In most cases, unless quantities are very large, it is sufficient to specify a mean coating thickness of 610 g/m² with a local minimum of 505 g/m².</p>	<p style="text-align: center;">BS EN ISO 1461: coating minimum masses/thickness on articles that are not centrifuged.</p> <table border="1" data-bbox="794 443 1476 768"> <thead> <tr> <th rowspan="2">article & its thickness</th> <th colspan="2">local coating (minimum)</th> <th colspan="2">mean coating (minimum)</th> </tr> <tr> <th>g/m²</th> <th>µm</th> <th>g/m²</th> <th>µm</th> </tr> </thead> <tbody> <tr> <td>steel ≥ 6mm</td> <td>505</td> <td>70</td> <td>610</td> <td>85</td> </tr> <tr> <td>steel ≥ 3mm to < 6mm</td> <td>395</td> <td>55</td> <td>505</td> <td>70</td> </tr> <tr> <td>steel ≥ 1,5mm to < 3mm</td> <td>325</td> <td>45</td> <td>395</td> <td>55</td> </tr> <tr> <td>steel < 1,5mm</td> <td>250</td> <td>35</td> <td>325</td> <td>45</td> </tr> </tbody> </table>				article & its thickness	local coating (minimum)		mean coating (minimum)		g/m ²	µm	g/m ²	µm	steel ≥ 6mm	505	70	610	85	steel ≥ 3mm to < 6mm	395	55	505	70	steel ≥ 1,5mm to < 3mm	325	45	395	55	steel < 1,5mm	250	35	325	45
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<p>Centrifuging</p> <p>This term is also called ‘spin galvanizing’ or ‘centrifuge galvanizing’, and is used to describe the process for HDG threaded components and other small articles. The procedure is to dip them into the zinc bath in a perforated basket. After coating, the basket is spun at high speed to throw off the surplus zinc and so result in a thinner, more uniform coating. The performance figures given above are for non-centrifuged HDG.</p>																																	
<p>Painting and powder coating of galvanized metal</p> <p>When paint or powder coating is applied to a galvanized surface the resulting combination is known as a duplex coating. Such coatings are used to a) add colour, b) increase the economic life, c) provide additional protection in aggressive environments.</p>																																	
<p>Paint systems should be specially formulated for use on HDG and used strictly in accordance with manufacturer’s instructions.</p>																																	
<p>If powder coating is specified, the galvanizer must be informed, and post HDG treatments agreed with the powder coater.</p>																																	
<p>Galvanizing fasteners (nuts & bolts)</p> <p>If it is specified that nuts and bolts are to be galvanized, then care must be taken that the correct items are supplied. Electroplated items look very similar and can be mistaken for HDG. They have a coating only 5-10% of HDG and their life is shortened correspondingly. Similarly, sherardised items are also inferior to HDG. They can however be recognised more readily as they are a dark grey. There are two grades of sherardising and neither is equivalent to HDG (see table).</p>																																	
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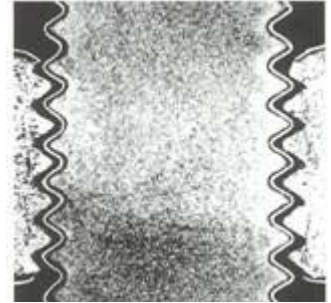
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Detailing threads

If threaded items are to be HDG then it is important to make allowance for the coating. Obviously if the nut and bolt are plated then they will not fit as before. It is usual practice to HDG both items and then to re-tap the thread on the nut oversize after galvanizing. The zinc on the bolt then also protects the ungalvanized thread on the nut. The additional thickness is equivalent to 4 times the galvanizing thickness. In practice, for HDG items, the oversize allowance is 0.4 mm.

It is not necessary to adjust the size of punched holes etc to allow for HDG.



Other coatings

As mentioned above, small items, particularly threaded fasteners may be obtained with a coating that is zinc (electro) plated, or sherardised. Many commercial fasteners and fixings are supplied sherardised. This gives a degree of protection but should not be relied on as the main protection in an aggressive atmosphere.

Welding HDG

HDG steel can be welded satisfactorily, although some adjustments may be required to the welding settings. Welding speeds are slower, and there is more splatter.

To maintain fume levels within acceptable levels, extraction should be provided when welding galvanized steel in confined areas, as indeed it should when welding uncoated steel. Wherever welding takes place, due note must be taken of the relevant COSHH regulations.

All welds of HDG articles should be protected against rust as soon as possible since the protection from the galvanizing will have been removed.