



## Fastener Finishes

The finish of a fastener is the broad term used to describe the coating on the fastener material. Depending on the product application, this can vary from high quality anti corrosive finishes to decorative finishes, which are little more than a coating to give the product a particular colour. At the very bottom end of the finish scale is no coating at all. In this case the product is offered no protection to corrosion from its surrounding environment.

Keeps in mind that most corrosion protection finishes are sacrificial. Their task is to protect the fastener material from corrosion by creating a barrier between the material and the environment. In fact, the fastener finish is attacked and corrodes, but in doing so, it delays the impact of corrosion on the fastener material.

This section of the manual contains a non-technical summary of common fastener finishes specified by customers. In almost all cases the finishes examined are applied to steel material. Materials such as stainless steel and brass, are by their nature, corrosion resistant and usually need no other protection. Finishes would normally only be applied to these materials for decorative reasons.

### Plain Finish.

Customers may describe steel products as plain, natural, self colour or black, or provide no finish description at all

The only exception to this generalisation is where industry knows that the product is only available in one form of coating. Under these circumstances, customers often do not specify the finish. An example of this is the simple description of Nyloc Nuts. The product is always supplied in a plated condition and most of the time customers do not mention finish in their descriptions.

The term plain finish, means no coating at all. Hence most steel products will appear metallic grey in appearance. If high tensile product is involved, it will appear as a black colour, resulting from the heat treatment process. In both cases there may be some light oil present from manufacturing processes.

Plain finish product offers no corrosion protection. In external situations, rusting will commence within days of installation.

### Zinc Plated

Finish rationalisation on the part of local and overseas suppliers, coupled with other factors, has given rise to a significant growth in zinc plated fasteners demand over recent years.

An electroplating process deposits zinc metal on the fastener (the base metal). The zinc coating is very thin, in the region of 0.003 to 0.005 millimetres for standard fastener plating. To a certain extent, corrosion protection is directly related to coating thickness, hence then coatings are able to offer minimum levels of protection.

There are two common types of zinc plating applied to fastener products, but before proceeding to examine each, we need to take a broad look at the features of this finish generally.

Zinc Plating is widely accepted though, for the following reasons.

- \* It is relatively inexpensive.
- \* Because it is thin, the fit of mating threads is not a problem.
- \* It is smooth and looks good.
- \* It is clean to handle
- \* Zinc plating offers an excellent base for subsequent painting.

It does not, however offer a high level of corrosion protection, particularly in outdoor applications.

Zinc is a soft material and as we have seen, it is applied in a very thin layer during the plating process. This coating of zinc is easily scratched, exposing the base metal of the fastener. To supplement the layer of zinc, during plating, a final process known as chromate conversion is carried out. This process applies a thin chromate conversion film on top of the layer of zinc. This film is harder than zinc, and it provides the first barrier between the environment and the fastener material, with the zinc providing the second.

The degree of corrosion protection offered increases as the concentration of chromate conversion increases. Two levels of concentration are commonly used, giving rise to the two forms of zinc plating found on fasteners as follows.

#### **Zinc and Clear Chromate.**

The fasteners industry refers to this finish simply as zinc, bright zinc, zinc plated, clear zinc or zinc and clear. The appearance is silvery and smooth. The product may display a slight bluish tinge resulting from the chromating process.

#### **Zinc and Yellow Chromate.**

This finish is referred to as zinc and yellow, z/chr, zinc and chromate or zinc chromate to mention a few of its names. The chromate conversion is heavier than clear zinc, offering better corrosion resistance.

Customers often refer to this finish simply as zinc chromate. As we have seen, both zinc finishes are chromated, hence the customer description is open to confusion. This confusion is best avoided by questioning the customer and clarifying the final colour of the zinc finish required.

In summary, a yellowish or goldish appearance indicates **Zinc and Yellow Chromate**. A silvery colour, perhaps with a tinge of blue, indicates **Zinc and Clear Chromate**.

#### **Hot Dipped Galvanised.**

This is another of the predominant finishes applied to fastener products. The process involves dipping the product in a bath of molten zinc. The zinc adheres to the fasteners during the dipping. Control of coating thickness and the removal of surplus zinc is usually achieved by centrifuging the fasteners upon withdrawal from the zinc bath.

Hot dipped galvanising (HDG) applies a coating thickness approximately ten times that of zinc plating. It therefore follows that this finish offers roughly ten times the protection of zinc plating.

Because of the coating thickness and the application method, there are some problems to be overcome though.

Firstly, coating thickness demands that an allowance be made for thread fit. This is achieved by tapping galvanised nuts oversize. Galvanised externally threaded fasteners (bolts) cannot be assembled with plain finish or zinc plated internally threaded fasteners (nuts) of standard thread dimensions

Fastener manufacturers have managed this process of tapping oversize very reliably for decades and today there are few instances of assembly problems with hot dipped galvanised bolts with galvanised nuts.

The other matter, which may or may not be a problem, is that of appearance. The colour is silvery but unlike the various forms of zinc plating, HDG produces a finish that is of rough appearance. If finished assembly appearance is a consideration, customers may not be prepared to use this finish.

In terms of cost, HDG is a little higher than plating but this is more than offset by the superior corrosion protection offered.

### **Class 3**

A mechanically applied Zinc/Tin coating which appears much like hot dip galvanising, and having similar corrosion protection qualities. Usually found on self drilling and type 17 cladding screws.

Class 3's advantage over hot dip galvanising is that does not build up in recesses, or corners, allowing good recess driver and socket fit.

### **Cadmium Plated.**

Environmental issues have however, lead to a sharp decline in the use of this finish. Cadmium is a cumulative poison.

In most cases where cadmium plated product is requested by customers, it is through ignorance or confusion. Almost always zinc plated finish is really required. In attending to customers enquiries for cadmium plated product it is always wise to confirm that cadmium finish is really required.

### **Decorative Finishes.**

Finishes within this group are primarily intended to produce a decorative colour rather than provide substantial corrosion protection. Fasteners with decorative coating are normally used indoors hence the lower corrosion protection offered is not usually a problem.

Major finishes within the decorative group are BMA (Bronze Metal Antique), or Florentine Bronze, Nickel Plated, Brass and Black Zinc.

As the name implies, BMA is a finish of the appearance of aged bronze. The product is first copper plated and then subject to a dip in a solution that causes the burnishing of the colour. Black zinc is a zinc-plated finish with the black colour resulting from a black chromate dip. The colour is jet black and shiny.

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