CORROSIVE PROTECTIVE COATINGS

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CORROSION PROTECTIVE COATING

Approximately 90% of all carbon steel fasteners are plated, coated or furnished with some other type of supplementary finish. Although the principal reason is to protect against corrosion, such treatments also enhance appearance, control installation torque-tension relationships, minimise thread seizing, and assist product identification.

COATING

Coatings are adherent layers applied to the surface of a base metal. For commerical fasteners, practically all deposition is accomplished by electroplating, hot-dipping or mechanically. Other processes such as spraying molten metal, vacuum metalising, chemical vapour deposition, ion plating, enameling and dip and bake are special purpose and economically impractical for stock commercial fasteners.

METALLIC COATINGS

Zinc is by far the most widely used plated metal followed in popularity by cadmium and aluminium, which has modest use. Copper, tin, nickel, chromium, lead and silver are used to a lesser degree – all for special reasons.

ZINC

Zinc is favoured as a plating metal because in the Galvanic Series it is less noble than carbon steel, stainless steel and most other nonferrous metals used in fastener applications. In an electrochemical reaction, the plating metal corrodes, and through its sacrifice, the base metal remains protected. Only after the plating metal has been significantly lost to corrosion does corrosion of the base metal begin. Other plating metals are more noble than carbon steel. When the base coating is breached, the base metal comes under immediate attack.

Zinc is the popular fastener coating also because it is the least expensive, has good appearance, can be applied in a broad range of thickness, by self passivation has good-to-excellent corrosion resistance, and is relatively nontoxic. Zinc plated fasteners may require more tightening torque to develop equivalent preloads in threaded fasteners. Also zinc coatings without some supplementary protection develop a dull white corrosion product on their surface which is nicnamed “white rust”. Because of its unsightly appearance, most zinc plated fasteners are given chromate treatment, which is a chemical conversion process to cover the zinc surface with a hard non-porous film. This added coating effectively seals the surface, protects it against early tarnishing, and reinforces the fastener’s resistance to corrosion attack. Chromate coatings are available clear, iridescent, or in a variety of colours.

PLATING THICKNESS

As a general rule, fastener service life, in a corrosive atmosphere, is proportional to the thickness of its plating. The thicker the plating the longer it will survive.

Electroplated fasteners have plating thicknesses ranging from a “flash” coating of insignificant thickness to a “commerical” thickness of 0.0002in. 5µm, through to 0.0005in. 12µm. Thicker electroplatings are possible but, from an economics viewpoint, quite impractical.

Hot-dip galvanising produces much thicker coatings, which in engineering standards are expressed in terms of mass of plating metal deposited per unit area of a coated surface. Standard hot-dip galvanised fasteners have an average thickness coating of .002/ in^2 (50µm in thickness). Heavier coatings to .003 (80µm) are feasible, but such coatings may necessitate adjustments in mating thread fits to a degree that the fastener’s strength properties may be adversely affected.

Mechanically plated coating thicknesses are available through the full range offered by either electroplating or hot-dip galvanising.