

Fastener Finishes

The “finish” of a fastener is the term used to describe the surface coating applied to the fastener. The function of the surface coating may be to protect the fastener against corrosion or to provide a decorative finish, or both. Australian practice is to specify the following finishes for the majority of carbon steel fastener purchases.

- ❑ Plain (natural) or black
- ❑ Zinc electroplated
- ❑ Hot-dip galvanised

Plain or Black

Carbon Steel fasteners described as plain or natural in finish are in the as manufactured state and are metallic grey in appearance. Fastener manufacturing processes normally result in a coating of residual light oil on finished product, which prevents the fastener corroding on the shelf but provides virtually no corrosion protection in service. High tensile fasteners will be black in colour because of an oxide layer usually imparted at the end of the heat treatment process, after which a coating of light oil is applied. Exafasts’ high tensile bolts are blackened in a superior high temperature process that results in a more consistent appearance. However, like all high tensile fasteners in the black state they have minimal resistance to corrosion in service.

Zinc Electroplated

Zinc electroplating is a method of depositing zinc metal on the surface of another metal such as steel by immersing it in a plating bath and passing an electric current through it. A zinc coating provides corrosion protection to steel because it corrodes in preference to the steel; it is what is known as a sacrificial coating. When zinc corrodes it develops a white powdery appearance commonly known as “white rust”. To delay the appearance of white rust a chromate surface treatment is usually applied to the zinc. There are a number of types of chromate conversion coatings, each with a different appearance and offering differing levels of corrosion protection. Zinc plated commercial fasteners in Australia are usually stocked in either a clear chromate finish (also known as blue or bright zinc) or yellow iridescent (known as yellow zinc or dichromate). There are several other chromate conversion coatings specified for certain applications including olive drab, commonly used in the defense industry and black, which is often specified in the automotive industry.

All zinc plated fasteners in the Exafast range are plated in accordance with Australian Standards; AS4397 for imperial products and AS1897 for metric. Coating thickness is typically between 4 and 8 microns. Although the chromate conversion coatings outlined above usually impart a pleasing luster to a zinc plated fastener, it should be remembered that in performing its function of protecting the fastener from red rust, the zinc will corrode and its appearance deteriorate over time.

A Note on Hydrogen Embrittlement:

Hydrogen Embrittlement is a phenomenon that can occur in high strength carbon and alloy steel fasteners (including Grades 8 and 10, Class 10.9 and 12.9) which have been electroplated. It involves the “trapping” of hydrogen inside the fastener which causes microcracks, which can enlarge rapidly under load causing a brittle failure. The built up hydrogen can be dissipated by baking the fasteners in an oven immediately after plating. All Exafast zinc plated bolts of a susceptible grade are treated in this way with full traceability on the process.

Hot-Dip Galvanised

This coating is achieved by dipping fasteners in a bath of molten zinc at a temperature of approximately 450°C. Excess molten zinc is removed to prevent fowling of threads, usually by a spinning process. The protection offered to the carbon steel fastener by the zinc coating is a result of the same sacrificial corrosion process as for a zinc electroplated finish. A hot-dip galvanised coating offers significantly more corrosion protection than zinc plating simply because the zinc coating thickness is typically 5 to 10 times as much. Hence a galvanised fastener is generally preferable to a zinc plated one in applications exposed to the elements.

The high coating thickness on a galvanised fastener, typically in the order of 50 microns, brings with it some problems. Firstly, allowances must be made for thread fit. This is achieved by tapping nuts oversize. Galvanising also appears as a “rough” finish, which may preclude it if appearance is important.

Exafast’s fasteners are galvanised according to the requirements set down in Australian Standards ASB193 and AS1214.