Zinc Flake Coating

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Zinc Flake Coating was developed in the United States in the 1970's as a response to problems associated with traditionally used coating systems such as electroplating and galvanising. Electroplating only provides relatively low corrosion protection. Both electroplating and galvanising generate hydrogen during the application process, creating the risk of hydrogen embrittlement particularly in high strength products. There is no acid washing in the cleaning process of zinc flake coating, reducing industrial waste and potential risk to the environment.

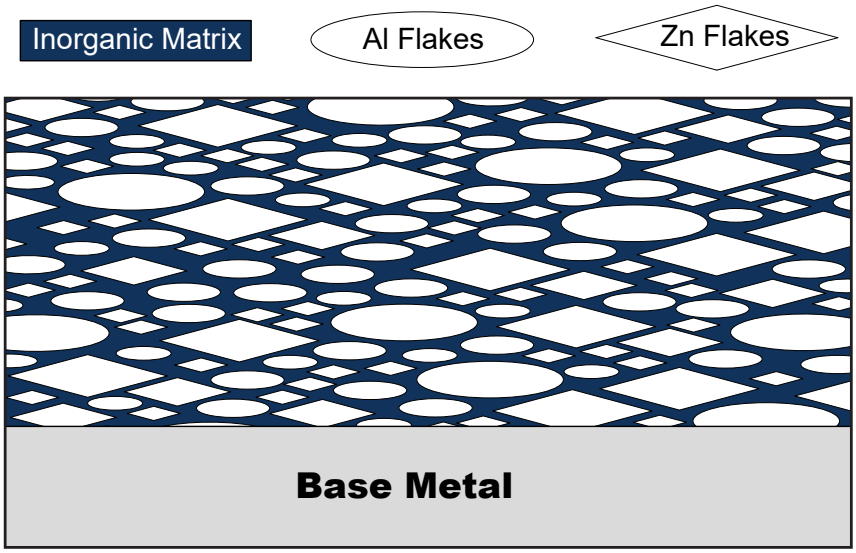
Zinc Flake Coating consists of a mixture of zinc and aluminium flakes which are bonded together by an inorganic matrix. These coatings are **non**-electrolytically applied, which provide increased protection against corrosion. The coating thickness is usually between 5 µm and 20 µm, but can be increased for specific demands. The thickness of zinc flake coatings should **not** be compared to that of electroplated zinc (around 5 µm) or hot dipped galvanising (around 45 µm). The zinc flake coatings acts as both a sacrificial coating combined with a protective barrier whereas the electroplated zinc and hot dipped galvanising act as sacrificial layers only.

The zinc flake coating thickness can also be specified to allow for thread tolerance requirements providing more flexibility in fastener engagement requirements.

Cathodic Protection

Galvanic corrosion occurs when two dissimilar metals that are in electrical contact are immersed in an electrolyte. The more active (less noble or less passive) metal of the two becomes an anode and corrodes at a faster rate than the less active (more noble or more passive) metal which is the cathode. The cathode is thus protected by the sacrificial anode, in this case the zinc and aluminium layer.

Schematic Zinc Flake Layer



Additional top coats (Organic or Inorganic) can be applied to:

- Increase corrosion resistance.
- Change the finish colour. (Without the addition of a colour top, coat the appearance is silver-grey).
- Modify the Torque/Tension relationship of fasteners (by adding a lubricant to the matrix).
- Lower electrical conductivity by using an Organic top coat.

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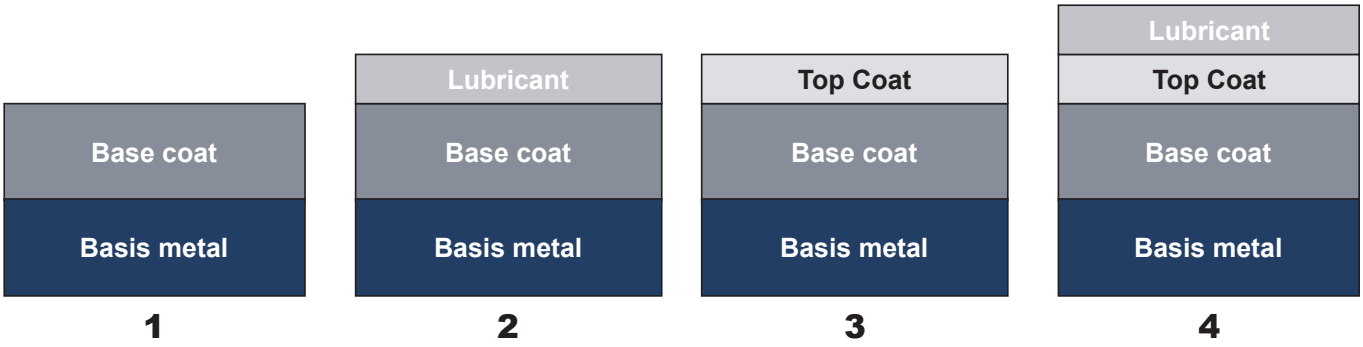
There are four basic ZINC FLAKE coating systems



Key

1. Only base coat
2. Base coat + lubricant
3. Base coat + top coat
4. Base coat + top coat + lubricant

The Standard used is ISO 10683 Fasteners — Non-electrolytically applied zinc flake coating.

The Coating Process

Before coating, pre-treatment processes including cleaning with an alkaline aqueous solution and shot blasting may be employed. The use of pickling with sulphuric or hydrochloric acids are avoided to prevent hydrogen embrittlement. Because the coating is cured at relatively low temperatures (180-200°C) there is little effect on the metallurgy of the substrate.

Zinc Flake Coating can be applied using the following application techniques:

- Manual or automated spray gun particularly used for larger or cumbersome parts.
- Dip-spinning in a basket. Parts are coated by dipping the basket into a container filled with the prepared coating material and then the basket is spun to remove the excess residue of the coating material. This process is suitable for smaller high-volume/bulk parts.
- Rack-mounted dip-spinning. Parts are positioned and fixed in baskets and then dipped, spun and passed through the furnace with the rack.
- Dip-drain coating. Parts are dipped into the coating material. This is suitable for pipes being coated in a single process. Sufficient openings must be provided to allow the liquid material to drain away and prevent accumulation or air bubbles forming.

After coating, parts are cured inside an oven at a controlled temperature for a set time.

Zinc Flake Coating consists of organic or inorganic top coats that

- Can be coloured, most commonly black, silver, green, blue, red and gold,
- Have low or high electrical conductivity (due to the influence of the organic or inorganic layer),
- Can provide chemical resistance
- Can be manufactured to have predetermined friction properties by integrating lubricants improving threaded assembly characteristics.

There are limits to which thread sizes and tolerance classes that fasteners can be zinc flake coated. Screw sizes lower than M6 and nuts with thread tolerance class lower then 6H are not suitable but patented systems are being developed to improve coating properties.

Contact us to discuss applying Zinc Flake Coating to our products.

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Advantages of Zinc Flake Coating

It is often asked if zinc flake coating is better or worse than electroplated zinc and hot dipped galvanising. The answer is any type of coating should be examined to determine if it's fit for purpose. Below is a table detailing the main advantages incorporated in zinc flake coating.

	Aspect	Zinc Flake Coating Advantages
1	Corrosion Resistance	Zinc flake coating has excellent corrosion protection starting from 450hrs to 1200hrs. Provides cathodic protection as well as being a physical barrier.
2	Risk of Hydrogen embrittlement	Zinc flake coatings have no involvement of acid. Therefore, there is no risk of hydrogen embrittlement.
3	Coating thickness	Zinc flake coating has better process controls and controlled coating variation. Suitable for threaded fasteners.
4	Environmentally friendly	Less environmental impact as the application of zinc flake is a cold process which is free from acid and zinc fumes. The coating is also free from harmful heavy metals including Lead, Cadmium and Mercury. ELV (End of Life) Compliant (EU Directive 200/53/EC) RoHS (Restriction of Hazardous Substances) Compliant (EU Directive 2002/95/EC)
5	Finish	Zinc flake coating has a smooth finish, which can be coloured to improve appearance. Common colours include black, silver, green, blue, red and gold. The finished product can also be made paintable.
6	Temperature	Resistant to extreme temperatures up to 300°C.
7	Chemical resistance	Zinc flake coating has resistance to both acidic and alkaline chemicals.
8	Friction characteristics	The coefficient of friction characteristics of zinc flake coating can be modified and made more consistent to suit different fastener applications by adding lubricant to the matrix.
9	Electric conductivity	Base coat is rated as conductive. Topcoats can be applied to reduce or increase conductivity to suit requirements.
10	Adhesion/Mechanical Damage resistance	Excellent adhesion and good mechanical damage resistance. Ref: ASTM B571-97 - Standard Practice for Qualitative Adhesion Testing of Metallic Coatings.

Hobson Products that use Zinc Flake Coating

Hobson has several products that utilise zinc flake coating for corrosion protection including;

- Class 10.9 and 12.9 nuts, bolts, flange bolts and screws
- Disc springs, washers and grub screws
- Concrete screws.

Hobson utilises zinc flake coating manufactured by the NOF Metal Coatings Group (including Geomet® 500) and Delta Seal (including Delta Protekt®).

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