HDG DATASHEET: 12
Hot Dip Galvanized Castings

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Galvanizing of castings is covered by EN ISO 1461 : 2022. Immersion of a casting into a bath containing molten zinc produces a hot dip galvanized coating that offers long term maintenance free corrosion protection, the coating being robust due to the metallurgical bond formed with the steel through the formation of a series of hard, wear resistant zinc-iron alloy layers which are covered by an outer layer of softer pure zinc which cushions against impact.

Types of Castings

Cast iron is an alloy of iron and carbon with additions of other alloying elements such as silicon. Their carbon content is very high resulting in a low melting point and as a result, they exhibit excellent fluidity and so are ideal for casting. While this allows for precision castings to be produced, cast irons have poor mechanical properties when compared to conventional steel grades due to their high carbon content. The composition of cast irons may also affect the coating formed, with a thicker coating often being achieved due to the casting's elevated silicon content.

Cast steel may be used when design considerations point towards a casting being the best solution but where improved tensile properties are required. The chemical properties of cast steel will be similar to that of steel sections and the mechanical properties will be vastly superior to those of cast irons.

Cast Iron

There are four main types of cast iron each having a carbon content of 2% or more and typically having a silicon content in the range 0.5-3%. Such castings can be readily hot dip galvanized but there are two important considerations.

1. Cast iron must be blast cleaned prior to being sent for hot dip galvanizing so as to remove all mold residues and surface contaminants which might not be removed by the normal pretreatment process prior to hot dip galvanizing.

2. Cast irons (particularly grey cast iron) can be susceptible to thermal shocking if it is subject to a sudden temperature change. It is therefore important that where cast iron articles are sent for hot dip galvanizing, the galvanizer is made aware of the nature of the product so that suitable precautions can be taken.

Grey Cast Iron

Grey cast iron typically contains over 3% carbon with an addition of 2% silicon which promotes the formation of graphite in the form of flakes. The graphite flakes cause grey cast iron to have poor mechanical properties although it has good machinability.

Spheroidal Cast Iron

Spheroidal cast iron has a similar composition to grey cast iron with a high carbon content of over 3% and a silicon content of over 2%. However, additions of magnesium and cerium are also made in order to promote the formation of graphite in the form of spheres rather than flakes. The form of the graphite results in the spheroidal cast iron having much improved tensile strength and ductility when compared to grey cast iron.

White Cast Iron

White cast iron typically has a high carbon content of about 3.5% but a much lower silicon content of only 0.5%. As a result, carbon is present in the form of iron carbide rather than graphite. The iron carbide causes white cast iron to exhibit good wear resistance but low ductility.

Malleable or Blackheart Cast Iron

Blackheart cast iron is produced by taking a white cast iron containing circa 2% carbon and 1% silicon and heat treating it for a long period of time. The heat treatment process converts the iron carbide into florets of graphite. The change in microstructure produces a casting with increased tensile strength and ductility while some grades may have good wear resistance.

Design of Castings

Care needs to be exercised in the design of cast iron sections. Small castings of simple shape and solid cross section do not present any problems for galvanizing provided the material and surface conditions are suitable. Larger castings should have a balanced design with uniform section thicknesses to avoid distortion and thermal stress cracking. Always use large fillet radii, large pattern numbers and avoid sharp corners and deep recesses. The rough surface finish which castings tend to have may result in the coated article not having a perfectly smooth finish, as the coating will follow the contour of the cast surface, with a thicker galvanized coating than on rolled sections being achieved.

Fig1: 'A hot dip galvanized casting'

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