

ARMORGALV™ -- New Precision Galvanizing Technology
Clean, Green, and Cost Effective
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A new precision zinc galvanizing process has been developed by Distek Ltd., providing superior wear and corrosion protection on steel and iron parts. The process eliminates environmental problems with traditional hot dip galvanizing and zinc electroplating processes, and the hazards of chrome and cadmium in the coating itself. It is marketed in the USA under the trade name “**Armorgalv**”. It was developed to replace cadmium and chrome use in plating, and hot dip galvanizing. The process is described in **ASTM A1059**.

History

In 1995 Distek Ltd., an Israeli company, announced the development of a new environmentally friendly coating process, zinc thermo-diffusion galvanizing (“TDG”), and began licensing the process to other companies. There are more than 30 sites in Western and Eastern Europe using the process. Distek NA, LLC supports the process in the USA. Agritek Industries, Inc. is a licensee of Distek, providing TDG coating services.

The Zinc Diffusion Coating Process

The Distek ArmorGalv™ process creates a zinc metal layer alloyed to the part surfaces, utilizing a special zinc powder formulation. Parts are coated by adding the parts and a precise measure of the zinc mixture to a drum, which is sealed and heated in a specially built oven. The drum rotates slowly in the oven, while it undergoes a specific multi-stage heating and cooling cycle.

Depending on the parts to be coated, maximum process temperatures may be set to as low as 320 C, or up to 440 C. (Much lower than hot dip galvanizing, where pot temperatures typically reach 445 C – 455 C.) Following the oven process, parts are finished with a chrome and cadmium free passivation wash.

Following passivation, the parts may be used as is. For added protection, a variety of processes may be appended directly to the end of the process line, from simple chrome/cadmium free dip sealers to a variety of “spin-dip” coatings.

The process allows parts with light surface corrosion or stamping oils to be directly coated without pre-cleaning, eliminating problematic alkaline and acid washes.

Other than a small amount of zinc phosphate in the rinse water, there are no emissions or hazardous waste streams to contend with. The small amount of unconsumed zinc powder which remains after processing the part is captured in the finishing equipment and recycled.

The process is energy efficient, and consumes power only when in use. There are no tanks or pots which must be kept heated when the process is not in use. The process may be quickly and efficiently turned off or on as needed.

Thermo-Diffusion Zinc Galvanizing Technology

Other formulations of the proprietary Distek zinc powder are available which provide variations in coating characteristics, including the ability to add certain colors to the coating during the oven process.

Zinc Diffusion Coating Characteristics

Overview:

While the coating metallurgy is similar to hot-dip galvanization, with the formation of gradient layers of a zinc/iron alloy, the longer heat cycle and proprietary zinc mixture create a much deeper diffusion of zinc into iron. The resulting crystal structure is different than that formed by hot dip galvanizing or electroplating, with a much greater surface hardness (exceeding Rc 45). It provides durable abrasion and wear protection, and an excellent bonding surface.

The resulting parts have a uniform coating thickness, which may be selected between 12 and 150 microns (0.5 to 6 mils). Corrosion protection up to 1500 hours in a salt mist chamber can be achieved. The coating is completely chrome and cadmium free, and Rohs compliant for European use.

The coating may be applied to a broad variety of parts, including many materials, shapes, and thicknesses which were not previously thought suitable for hot dip or electro galvanizing.

Suitable part types include:

- Threaded products
- Pipe and fittings
- Hollow and tubular products
- Stampings (as thin as 20 gage), including those with small cutouts and holes
- Castings and forgings
- Welded assemblies
- Springs
- Assembled movable parts (chain, shackles, latches)

Suitable materials include:

- Steel sheet, tube, & wire (including spring steels, most alloys, stainless steel)
- Cast and ductile iron and steel
- Sintered (Powdered Metal) parts

For powdered metal parts, an unusual feature of the zinc diffusion process is that the metal structure will be fully saturated with zinc, providing greatly improved corrosion and wear resistance, and added strength, while preserving dimensions.

Technical Characteristics of the Thermo-Diffusion Coating:

- follows the contours of the surface very closely and accurately, preserving fine details such as threads, markings, and other fine relief
- harder than other zinc coatings and offers a good resistance to abrasive wear

Thermo-Diffusion Zinc Galvanizing Technology

- provides an excellent substrate for additional surface treatment (e-coat, wet coat, powder coat, polymer over-molding, rubberizing, etc.)
- provides both barrier and sacrificial protection against corrosion
- Unlike hot dip or electro galvanizing processes, there is no hydrogen embrittlement.
- Maximum process temperatures may be set as low as 320 C to protect tempered parts.
- corrosion resistance is significantly higher than electro plating and hot dip galvanizing in industrial and marine atmospheres
- strong adhesion to base metal due to mutual diffusion of zinc and iron -- Zinc penetrates to the base metal to about 1/3 of the coating thickness
- The coating produced by the Distek process is described in ASTM-1059 A/M, and also meets requirements for ASTM A-123, ASTM A-153, EEC Standard BS EN 13811:2003, and Israeli Standard 4271.
- Rohs compliant
- Coating is an iron-zinc inter-metallic compound of varying compositions, mainly FeZn7 (1-phase). Density of the phase is 7.2 g/cm³, and its micro-hardness is about 4500 MPa.
- Due to the presence of iron in the coating, brown film can appear on the surface of the coated article when exposed to high humidity or condensate. It is caused by the release of iron ions from the coating. These ions are easily washed away by water or rain. The coating corrosion products are colored brown. The brown stain is not indicative of penetration of the coating, and may be inhibited with an inexpensive, non-metallic dip seal coat if desired.

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