

Phosphate Coatings of Engine Components

Gray, ductile and malleable iron castings all lend themselves readily to 'phosphating'. Phosphating is a conversion process where the surface of the casting is transformed by a chemical treatment of phosphoric acid into iron-containing phosphate crystals. There are three common types of phosphate coatings - zinc phosphate, iron phosphate and manganese phosphate. Phosphating is performed for a range of reasons, some of which are:

1. To prolong the life of the organic coatings.
2. To facilitate superior paint or solid film lubricant resin bonding (e.g. MoS₂ Films, Teflon® Coatings).
3. To improve corrosion protection by providing a good base for absorbing and retaining rust preventing materials (e.g. oils, waxes, etc.).
4. To provide an excellent base for lubricants and drawing compounds.

Manganese Phosphating

Manganese phosphating is a process used to produce a crystalline, oil absorptive coating with excellent wear resistance. These coatings are applied to facilitate initial break-in of new parts such as piston rings, camshafts, cylinder liners, differential gears and transmission gears. The etch pattern produced by manganese phosphate on the surface of parts greatly improves oil retention and prevents galling of contact surfaces. In addition to their anti-friction characteristics, manganese phosphate coatings exhibit excellent corrosion resistant properties when used with a suitable post rinse and rust preventative oil. For decades, the Defence Industry has specified manganese phosphate as the corrosion resistant coating of choice for a large percentage of steel and iron ordnance components.

Characteristics of the Manganese Phosphate Coating

Manganese phosphates are applied by immersion and, depending on the type of parts being coated, they may be processed on racks, in baskets or in tumbling barrels. Coating thickness and density vary depending on a number of factors including surface finish, type of alloy and prior heat treatment.

Grain refiners can be incorporated into the phosphating cycle, and are used prior to immersion in the manganese phosphate solution. This is done to influence the deposition of small crystals and control microfinish. In general, grain refiners tend to lower coating weights slightly.

Treated surfaces characteristically have a matte and slightly textured finish and range in colour from dark gray to black. On cylinder liners, the phosphating is applied after the bore has been bored and honed, which usually makes it difficult to see the bore crosshatch on the finished item. Phosphated liners can be honed without any difficulty or concerns other than the loss of the coating in the bore.