# ONE-STEP ORGANIC PHOSPHATING

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This phosphate pretreatment system is an organic phosphating process, using a single solution of a specially formulated propylene glycol-based compound that acts to both degrease the parts and provide a phosphate coating and seal. This solution is based on an inorganic polyphosphate dissolved in a low-toxicity organic solvent medium. It has a very low vapor pressure and is, therefore, when properly controlled, suited to low-pressure spray as well as dip application.

The solution works by initially degreasing the part and then depositing a thin layer of iron phosphate. A film-forming polymer is deposited concurrently, and this is chemically linked with the metal via the phosphate. This polymer has the ability to absorb oils and greases, thus allowing the solution to be used continuously, without any requirement for periodic dumping.

During the dip or spray phase, degreasing of the metal surface, with the aid of the organic solvent, is followed by the adsorption of the oils and greases by the polyphosphate. The polyphosphate polymer will absorb a maximum of 5.5% of its weight in oils and greases, representing an average oil loading of 1.5 grams per square meter (or 15 grams per hundred square feet) of treated metal surface. The final structure of the organic polyphosphate surface comprises a very thin layer of amorphous organic modified iron phosphate covered by a non-porous polymeric film. This is in contrast to a conventional phosphate process that produces a porous phosphate coating.

Heat curing (or sufficient air drying) is required to set the phosphate coating, as it is this process that drives off the remaining solvent and causes the free acid groups in the polymer to react with the substrate to produce the three-dimensional structure that captures the oil.

The organic phosphate solution can be applied by either spray (flow-coat) or dip techniques. Both systems have been widely used. In both systems, the parts are exposed to the phosphate solution for 60 seconds, followed by drip-off, then blow-off, and finally drying.

Although the spray system equipment is similar in appearance to a conventional iron phosphating tunnel, there are a number of differences that are critical to the successful operation of the system, including:

- Operating at very reduced spray pressure;
- reducing the number of risers;
- using stainless steel for all tanks, piping, pumps, and any parts which come in contact with the phosphate solution;
- and controlling ventilation so that fumes do not escape from either end

of the tunnel or from the dip tank itself. Exhaust fumes are held to a minimum.

The solution is tested every six weeks for oil content, resin content (polymer), and phosphoric acid. Additions are made as called for by these tests. This is in contrast to a conventional phosphate process where rigorous process control testing is required (at least once daily).

This process eliminates the wastes normally associated with phosphate treatment systems. No sludge is generated, so there are no waste disposal costs, and no down time is required for desludging of tanks:

- No water is used in this process;
- daily process control monitoring is not required;
- and the process operates at room temperature.

This process is capable of treating a range of different metals, including steel, aluminum and aluminum alloys, cast iron, and galvanized steel. Improved corrosion protection, in comparison with conventional iron phosphating without a chrome passivating stage, is achieved in salt spray tests (300 to 500 hours with topcoat).

One potential barrier to uptake of this system is the higher up-front chemical cost. This high initial cost, however, is offset by much lower capital cost (single-stage installation), greatly reduced energy usage (no heat), and elimination of sludge and waste water disposal.

This process is well suited to small- to medium-sized operations. It is economically competitive at treating up to 30,000 square feet per eight-hour day.

Water-emulsified metal-forming oils should be avoided, or at least parts using them should be thoroughly dried before treating with the phosphate solution

The process will not remove silicones, calcium stearate, and hard, high melting waxes.