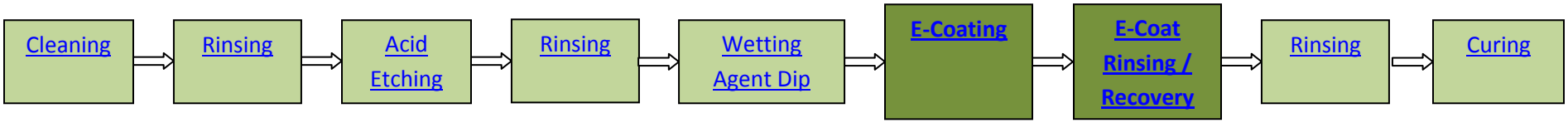
Electrophoretic Painting Process (E-Coat)



Overview of E-Coating

The E-coat process is best described as a cross between plating and painting. It is a process where a metal part is immersed in a water-based solution containing a paint emulsion. An electric voltage is applied to the part causing the paint emulsion to condense onto the part. A part can be painted both inside and out, wherever the liquid is able to reach a metal surface. The coating thickness is limited by the applied voltage. As areas of high voltage build a coating they become insulators thus allowing lower voltage areas to build up. Finally, the interior of a part can be coated since the exterior is fully insulated by the coating.

Following the painting tank, a rinse tank removes the residual emulsion from the part and recycles it back to the paint tank by ultrafiltration. The E-coat is cured by heat and the curing time and temperature is determined by the E-coat chemistry; epoxy, acrylic, etc.

The preparation steps for E-coat are identical to plating steps in that the metal surface must be chemically clean.

Typical steps in an E-coat process for metal parts:

1. Cleaning (typically an alkaline cleaner, but substrate dependent)
2. Rinsing
3. Acid etching
4. Rinsing
5. Wetting agent dip
6. E-coat
7. E-coat rinsing and recovery
8. DI Rinsing

9. Curing with either convection or infra-red oven (or both)

Wetting agent dip

Some E-coat manufacturers recommend a wetting agent dip in the tank immediately before the E-coat tank. This is typically to prevent bubbles from adhering to the parts as they go into the e-coat tank. Any bubble attached to the part surface will prevent E-coat deposition and will cause a paint defect in the finished part.

E-coat rinsing and recovery

An advantage to the E-coat process is the ease of recovering the E-coat that gets carried by the parts to the E-coat rinse tank. The E-coat rinse is constantly filtered through an ultrafiltration unit which separates the E-coat emulsion from the carrier solution and returns it to the E-coat tank. Most of the E-coat is recovered in this way.

Curing of E-coat

Since E-coat is essentially liquid paint once it has coated a part, it will require a curing cycle based on the type of paint chemistry being used. As an example, an acrylic-urethane type E-coat will require a curing temperature of 320 F for 20 minutes (metal temperature, specified for Electroclear 2800, product of PPG). As with paints, the energy used to cure the E-coat will depend on the part size and part geometry. Simple geometries may be able to be cured completely with the use of infra red heating since the infra red is line-of-sight and heats the metal surface without needed to heat the whole part. For complex geometries, a convection oven is typically needed to fully cure the E-coat in all areas of the part.

Since the E-coat chemistry can be a chemical cross-linking process, the full cure requires both time and temperature to obtain the optimum coating properties.

More information on infra red curing can be found in the powder coating drying and curing process description.

Extreme example of E-coating a complex part