

Curing Epoxy Powder Coating on Metal with a High Density Infrared Heating System

Application

A manufacturer of automotive and appliance decals curing a clear, epoxy powder coating as a protective top coat over dried silk screened inks on metal sheets.

Problem

Temperature Requirements - The metal sheets had to be heated to 350°F (177°C) to flow and cure the powder coating.

Slow Curing Time - The powder coating manufacturer recommended 20 minutes to flow and cure the powder coating. The existing batch oven took 60 minutes to complete the process.

Limited Production Output - The slow curing time in the existing batch oven severely limited production output.

Uniform Cure - Part-to-part temperatures had to be precisely controlled within $\pm 10^\circ\text{F}$ (-12°C) of the 350°F (177°C) temperature requirement to produce a uniform cure on every metal sheet. The uniform cure was required for both protective and cosmetic reasons.

Line Speed - The manufacturer needed a line speed of 15 feet (4.6 meters) per minute to meet production requirements.

Labor Intensive - The existing process required four operators to load and unload the parts from the powder coating station and batch oven.

Limited Floor Space - The manufacturer could allow 40 feet (12 meters) of floor space to accommodate an in-line curing system. Gas convection ovens evaluated by the manufacturer required 300 feet (91 meters) of space.

Solution

Heat - A High Density Infrared Heating System supplied the heat to flow and cure the clear, epoxy powder coating.

Heat Zones - The system was configured with three heat zones, each with thermocouple feedback to monitor the system temperature.

Power Control - A Three Phase, Phase Angle SCR Power Controller controlled the power to the quartz lamps in the system.

Process Control - A PLC and Color Touchscreen connected to the heat zone thermocouples and SCR Power Controller provided closed loop control of the process.

Benefits

Precise Temperature Control - The closed loop control of the High Density Infrared Heating System maintained the part-to-part temperature at $\pm 10^\circ\text{F}$ (-12°C) of the 350°F (177°C) temperature requirement.

Faster Curing Time - The time to flow and cure the epoxy powder coating was reduced from 60 to less than 3 minutes per metal sheet.

Increased Production Output - The manufacturer increased production output by 500%.

Consistent Quality - The precise temperature control provided with the High Density Infrared Heating System consistently produced parts that were uniformly cured and of high protective and cosmetic quality.

Reduced Labor Requirements - By installing the High Density Infrared Heating System in line with the powder coating station, the manufacturer reduced the number of operators required to load and unload the product from four to two.

Repeatable Process - Program recipes developed for the PLC System to control different batch types, making the curing process repeatable for different part types and eliminating the need for operator control.

Well-Utilized Space - The High Density Infrared Heating System did not use floor space in excess of the 40 feet (12 meters) available for an in-line curing system.

Line Speed - The required line speed of 15 feet (4.6 meters) was achieved.