# Ask the Experts

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*Your questions answered by pci member experts.*

***You have questions, we have answers. In each issue of*** **PCT,** ***our extensive network of powder coating experts provides information to help you with your powder coating challenges. Let us know what's keeping you awake at night, and we'll do our best to help you get a good night's sleep!***

## Repairs in the Air

***I am a contractor who has been tasked with providing field repairs to an AAMA 2605 compliant powder coated part installed on a building. I am not sure where to start. Are there any specific procedures that I should follow?***

Yes, it is possible to provide field repairs for architecture components that were originally powder coated to the AAMA 2605 standard. In short, it is the same as for any architectural metal coating by utilizing proper preparation, pretreatment, and a comparable liquid coating to match the weathering performance of the initial powder coating as closely as possible. First, make sure whoever is doing the repair is a certified liquid applicator who has experience in the application of liquid PVDF coatings. For small repairs, wipe the area with a non-silicone solvent and then sanded with 400-grit sandpaper. Wipe again with the solvent and then tack off using a lint-free tack cloth. Next, a chromate wash primer per the manufacturer's recommendations is applied and allowed to cure. Finally, the PVDF liquid coating, that is color and gloss matched per the manufacturer's instructions, is applied and allowed to cure.

For larger repairs, first, remove any mastic or sealant and wipe the area with a non-silicone solvent. Mask the surrounding areas to avoid any damage outside the impacted area. Next, sand the area to remove all of the powder coating, exposing the substrate. Use a metal filler as needed and allow it to dry. Sand the metal filler smooth and wipe the area with the non-silicone solvent. Use the tack cloth to remove any dust. The next step is to apply a polyester stopper per the manufacturer's recommendations. Sand with 400 grit sandpaper, wipe with the non-silicone solvent, and tack the area off. Apply a chromate wash primer per the manufacturer's recommendations and allow it to cure. Finally, apply the PVDF liquid coating that is color and gloss matched, per the manufacturer's instructions, and allow it to cure. Remove the masking and reapply any mastic or sealant as required.

## It's Getting Hot in Here

***I was considering installing an infrared (IR) oven for our new system. However, I have heard that IR can only cure the product where there is a direct line of sight. Can you explain this better so I can make an informed decision?***

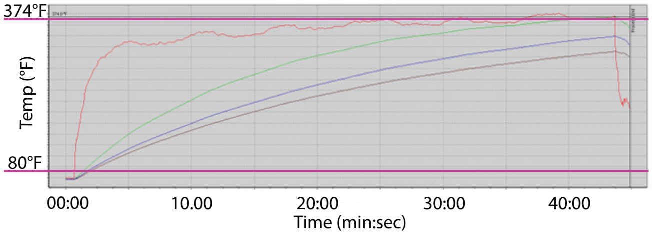
Infrared is electromagnetic energy and is on the same spectrum as visible light. So yes, it is a form of light energy. Infrared radiates energy, meaning it affects matter by hitting you, your part, or whatever else is in its line of sight—just like you feel the warmth standing in the sunshine and the coolness standing in the shade. Another good example is fire. You feel the radiant energy from a distance and the closer you get to it the more intense that energy becomes.

Does that mean infrared in process heating can only heat what it sees? Sort of. Yes, line of sight is the medium that the light energy uses to "see" the part. However, in a powder coating oven, there are other physics at play. The most important is conduction. This is when the matter is heated through "direct contact" with the hotter matter. Using the fire analogy again, if an iron fire poker is left in the fire, the heat will travel or "conduct" up the rod until it is fully heated.

So then what role does line of sight actually play? Infrared is a light medium, so yes, the infrared waves technically must be able to "see" the part to heat it. Though for curing powder coated parts, conduction also plays a significant and often overlooked role. In a convection oven, for instance, the interior of the part must conduct the heat to its core before the work of gelling powder can begin, as the part acts as a sponge and soaks up the heat. Only when the entire part is at temperature will the surface be hot enough to gel or cure powder, and you can only speed this conduction process through increased temperature. Hidden areas of complex parts are cured via conduction regardless of the heat technology used. Does that mean infrared can cure all parts? Flat parts are always easy to cure using infrared, but complex parts pose the line-of-sight challenges that an experienced oven designer can often overcome. We know that conduction may cure the hidden areas just like in convection. Most importantly, you must have your parts tested with an experienced infrared designer. Line of sight can be a challenge, but it is one of many that must be considered to ensure a highly efficient process.

## Trouble with the Curve

***I have been researching bring-up times for different metals but unfortunately, I haven't found much information online. We powder coat copper 95% of the time. I ran a temperature recorder test and let the oven run at 385 degrees Fahrenheit for 40 minutes, which I thought would be enough time (see the image below). The red line is air temperature. The green line is 0.25 inch copper, the blue line is 0.375 inch copper, and the black line is 0.5 inch copper. As you can see, the two thicker pieces never achieve the temperature as they were around 35 degrees Fahrenheit and 60 degrees Fahrenheit lower than the air temperature at its max point. It seems like they need more than 40 minutes to get to the temperature but to me, it seems too high. When working with a material of this thickness, should I have my oven at a much higher temperature than the target temperature for my powder? What would you consider the bring-up time for the blue and black lines? Thanks for your help.***




Always refer to the technical data sheet (TDS) of the powder coating you are using to find the cure time at the metal temperature. For example, it might state that the powder should be cured for 12 minutes at 340 degrees Fahrenheit. You then need to add the time necessary for the metal to reach that temperature. For your parts, the 0.25-inch metal part required about 30 minutes to achieve this metal temperature. It would then need the additional 12 minutes at this or higher temperature to cure, which it appears that it did. However, the 0.375-inch metal part only achieved this cure temperature after about 44 minutes and the 0.5-inch part never reached it. It is not uncommon for thicker parts to take longer to reach a given temperature.

Running this type of test on your substrates is the best way to determine how long each one needs to be in the cure oven. As an option, you can increase the air temperature of the oven to see if it would reduce the time needed in the oven. A lot of times, it is an experiment to find the correct balance between the temperature of the oven and the cure of the parts.

## Filling Your Tank

***My company has a 15-year-old five-stage iron phosphate pretreatment washer. It is constructed of stainless steel tanks and tunnels and is in relatively good condition. We are considering converting from iron phosphate to newer advanced pretreatments such as zirconium or one of the other thin film treatments to save on energy and the other advantages. Is it possible to convert this washer from iron phosphate to an advanced pretreatment? If so, what do I need to consider in order to make this change?***

Yes, it is very possible, and here are some things to consider:

1. Determine the line speed and calculate the time in each stage. If using alkaline or acid cleaning, choose a cleaner that will clean the incoming substrate in the time allowed. Mild acid and alkaline cleaners will run in the first stage. Cleaning is critical to this stage.
2. Advanced pretreatments such as zirconium or other thin film treatments react in less time than traditional iron phosphates and are many times negatively affected by drag-in of alkaline solution from the previous stages. As such, it may be necessary to put the pretreatment in the fourth stage as a reactive pretreatment, or in the fifth stage as a dry-in-place pretreatment.
3. The old iron phosphate third stage would need to be descaled and oftentimes the piping replaced. If you can descale this tank over a weekend and remove all scale from the drain pans, tank, and risers, this tank could be turned into a rinse tank.
4. Feeding "good water," or RO or DI water, to a halo at the exit of the third stage and overflowing it at a rate that keeps it fresh and counterflowing to the second stage really improves quality.
5. When running this type of pretreatment as a dry-in-place, there would be three counterflowing rinses prior to the pretreatment.
6. All of these options only require one heated stage and significantly reduce maintenance and energy usage.
7. Using the specifications to which you are coating, complete a simulation test with your chemical and powder provider.

*Have a question for our powder coating experts? Send it to asktheexperts@powdercoating.org.*