



## Life's a Gas

**Q** Dear Joe Powder,  
I want to develop polyester-based powder coatings for Auto-OEM application. The customer requires 500 hours gasoline resistance. How can I improve gasoline resistance?  
Kind regards,

Pratik B.  
Mumbai, India

**A** Dear Pratik,  
This is a very good question and a challenge indeed. My first suggestion is for you to formulate a polyester-urethane powder coating. Polyurethanes inherently have better chemical resistance than their straight polyester counterparts. In addition, you can vary the urethane content of the formula by the hydroxyl number of the polyester. Higher OH number polyesters require a higher content of urethane crosslinker which in turn provides better chemical resistance. You should be able to exceed the 500 hours gasoline resistance with a polyurethane formulated with a high urethane content.

If you want to stick with a straight polyester, you can increase chemical resistance with a higher than usual acid value polyester. Typical carboxyl polyester resins designed for TGIC or Primid (HAA) cure have an acid value of about 30-35. Using a polyester with an AV of 50-54 will increase the concentration of crosslinker and hence provide higher chemical resistance. I'm not sure if that would be good enough for the 500 hours of gasoline, so you would have to evaluate it.

Best regards,

- Joe Powder

## A Riveting Problem

**Q** Hi Joe:  
This is truly a real "riveting" story. I've got two hole problems I'm looking for some help with.



**Problem #1:** We subcontract a local powder coater to paint various shapes and sizes of aluminum sheet metal parts that are eventually fastened together at our facility. Our paint type is a textured TGIC polyester in a custom gray color. The size of the parts ranges from approximately one square foot up to about 20 square feet, and the thickness of the aluminum varies from 0.032 up to 0.125 inches. We specify that all threaded holes and studs must be masked to protect the threads. They use a (silicone?) plug to fill the holes and boots to cover studs. Most of the time this works well for us, but on occasion we see paint build up around the plugged holes as shown in the photo above, which causes interference problems with the mating part. The excess paint chips that are removed also cause a contamination problem for us. Any ideas on root causes and how to eliminate or minimize?

**Problem #2** is somewhat related. It involves the same vendor, the same parts, and the same powder. The vendor charges extra for plugging holes so we do not specify plugging on plain through-holes, such as those used for rivets. The problem is our assemblers are not able to install the rivets in the "grip" hole due to the paint film thickness. Our design engineers specify rivet hole size based on the rivet OEM's recommendation but do not take into consideration the film thickness of the paint. I don't have a lot of

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data, but this problem is much more prevalent, and is more of a problem on smaller rivet holes.

For example, on one problem set of parts we fasten them together with a 1/8 inch rivet. The rivet OEM specifies a hole size of 0.129 to 0.133 inches on the “grip” hole. So our engineers specify a 0.129 inch hole in one part and 0.156 inch on the mating part. Our assembler has no problem inserting the rivet through the 0.156 inch hole, but typically has to drill out the 0.129 inch hole to get the rivet through before popping it. Are there any design guidelines you are aware of regarding an allowance for paint film thickness for non-threaded holes?

Thanks in advance.

**John B.  
Cleveland, OH**

**A** Hi John,

A riveting problem, indeed. Let me see if I can help.

My first impression with Problem #1 tells me the issue could be with reusing dirty plugs. It is costly to toss plugs before their time and also a hassle to clean them. Regardless, your requirements demand better quality on the holes. A couple years ago at a conference, a chemicals supplier gave a presentation on a product specifically designed to strip coatings off plugs and hoods. It could be possible that the residual powder ring left on the rim of the holes is influenced by the type of masking plug being used. Plugs are available in both silicone and polyimide forms. The polyimide ones are more rigid and have a higher heat resistance. I would imagine that they repel a coating better as well.

Another thought, perhaps unpopular with your coater, is to remove the plugs before the parts enter the oven. This would take a steady hand, steadier than pulling the plugs after the parts have exited the oven and cooled. This would incur higher labor cost I suppose.

Have you inspected your coater’s facility and process? I think a review of their operation would tell you volumes regarding what may be the root cause.

As for Problem #2 - It sounds like either the coater has to plug the holes or you have to make them slightly larger to accommodate the coating that gets onto the edge of the hole. A bigger hole may not be the answer if the coating thickness varies beyond your tolerances.

Let me know if you have any ideas you would like to bounce off me.

Best regards,

*- Joe Powder*

*John’s Response:*

Hey Joe,

Thanks for the reply, we appreciate the help. We work very closely with our applicator and visit his facility frequently.

Regarding the hole size problem (Problem #2), do you happen to know what type of hole clearance designers typically use on powder coated parts? For example, a 3/8 inch bolt can use a “normal,” “close,” or “loose” fit type hole. (reference: <https://www.amesweb.info/Screws/ClearanceHolesInchFasteners.aspx>).

Thanks again for your help,

**John**

Hi John,

Thanks for the follow-up. Let’s dissect the issue.

A “normal” fit max is 0.416 inch. That would accommodate 20.5 mils of powder coating  $(0.416 - 0.375)/2$ .

A “close” fit max is 0.397 inch or 11.0 mils of powder coating.

A “loose” fit max is 0.438 inch or 31.5 mils of powder coating.

I think a “close” fit is acceptable and achievable, especially if everything is kept relatively clean.

Let me know if you have anything else to ponder.

Best regards,

*- Joe Powder*

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**Editor’s Note:** Letters to and responses from Joe Powder have been edited for space and style.

### Not Your Average Joe...

Each issue, we take the padlock off the PCI® Test-Lab door for a few minutes so our favorite technical editor and “powder guru” Joe Powder can run in the yard. When he’s not gnawing on a rawhide bone, he loves to answer readers’ questions. Go ahead and send him one at [askjoepowder@yahoo.com](mailto:askjoepowder@yahoo.com)... he doesn’t bite. Maybe it’ll end up in the next issue!