

Equipment for Powder Coating

About two years ago my brother showed me the ceramic powder coated exhaust system on his street rod. Both the inside and outside from the manifold through the tail pipe had been coated. The powder coating significantly reduces the exhaust system temperature and keeps its appearance indefinitely. It was really neat but expensive.

A few months ago a friend said that he was having some of the suspension parts on his TR3 powder coated. He also mentioned that one could buy a powder coating system from Eastwood for ~\$150 and get an old oven and you're ready to go.

After cleaning up a brake master cylinder about a month ago I inquired of the Triumph List for suggestions on preserving the appearance. About a half dozen responses said to Powder Coat (PC) it.

*The Triumph List is a network of Triumph enthusiasts linked by email. On a typical day 20 to 30 messages are sent to all subscribers dealing with all aspects of Triumphs. Typically one subscriber will pose a question that is then answered by one or several other subscribers. I find the "how to" and "where to get" subjects most valuable. To sign up for this free service, sent an email to: majordome@autox.team.net with nothing in the text except the two words: **subscribe triumph** You'll get a confirmation email within a few minutes with directions for initiating your subscription. Return the subscription and within a few minutes you'll start receiving mail.*

The list was then polled for information about the Eastwood \$150 gun. Again a bunch of responses from folks who said to buy the \$100 gun from Harbor Freight, it works better. Several of these folks had bought the Eastwood gun and then the HF gun later. They all said it does a great job.

Fred Thomas (FT) (vafred@erols.com) of Stafford, VA then volunteered to send some background literature and some "how to" notes. The notes were excellent. He also included some photos showing a fixture he made to PC wheels and a rack to transfer the pieces to the oven. He also sent several photos of his magnificent TR3 where much of the stuff under the hood is PCed.

Well, that got me started. But first the blasting and paint booth had to be cleaned up. Then the blast cabinet had to be replaced, then the basement ceiling, etc. down the slippery slide.

Why Powder Coat?

Powder coating provides a very durable finish that remains smooth and easy to clean. Things one might want to powder coat are manifolds, carbs, master cylinders, seat sliders, door latching hardware, valve covers, air filter housings, thermostat housings, wheels, suspension components, etc, etc.

The dry powder is sprayed onto the object being painted and then the object is heated in an oven for a short period till the powder melts and flows. One of the neat things about PC is that the parts can be used immediately upon cooling. Instant gratification! Many manufacturers are using PC because it has little environment side effects and significantly reduces manufacturing times.

The Equipment

Everything that you need to do home powder coating, the costs involved, where to get stuff, etc is described here. Much of the equipment has other uses and many of you already have much of this equipment. Everything required is included so that the end-to-end process is covered. A brief "how to" is included at the end.

Degreasing Equipment

One truth about most Triumph parts, half of each part is covered in rust and the other half in grease. The first thing is to get rid of the grease. You can use cans of spray degreaser which actually work pretty well. A 20-gallon parts washer was purchased some years ago from Harbor Freight (<http://www.harborfreight.com/>). They currently have the same thing for \$80. Five gallons of solvent was purchased recently from the local farm equipment store for \$25. The washer has a metal tray about mid way up the tank that was removed so that the parts can be set in the solvent. The tray makes an excellent cover for part of the workbench to protect it when welding.

A three-step degreasing process is used; the parts are first placed in an old 5 gallon drywall joint cement bucket filled with kerosene to get rid of the big chunks of grease and dirt. The parts are then placed in the parts washer to get rid of the remainder. Lastly, parts are toughly washed with dishwashing detergent to get the solvent off. This last step could probably best be done in the dishwasher but have never tried for fear I might be caught.



Blasting Equipment

Surfaces to be PCed must be metal (conduct electricity) and be completely free of grease, rust, old paint, etc. Abrasive blasting is the preferred way to get rid of the corrosion and old paint and to roughen the surface so that the paint adheres. A homemade blast cabinet constructed many years ago had deteriorated to the point it was junk. The small replacement abrasive blast cabinet shown in the photos was purchased from Harbor Freight for \$90. A packet of 10 window shields for \$13 and 25 pounds of glass beads for \$17 were also purchased. Additional glass beads can be purchased in the Columbus, Ohio area from EDCO Tool & Supply or Lorenz Equipment

The molded plastic cabinet contains a socket for an incandescent lamp. The clear plastic lid lifts for access to the interior. The edges of the disposable shield have a sticky tape of sorts that hold them to the underside of the window. The shield becomes etched and cloudy after a few hours use and must be replaced. This cabinet is large enough to hold manifolds, seat slide assemblies, wheels (as shown in next photo) and similar parts up to about 20 inches in length.

The bottom of the cabinet slopes to the center forming a hopper. The end of the gun siphon hose picks up the beads from this point so the abrasive is continuously recycled. There is a plug in the bottom to drain the abrasive. The abrasive can be drained into a bucket periodically and then poured through a screen to remove the larger pieces of debris that might plug the gun. The cabinet should be located where the small amount of abrasive that leaks out during use can be tolerated.

The large hose clamps that secure the gloves work loose because the surface is smooth and slightly sloped. Covering the surface the gloves clamp to with masking tape fixed this. The siphon tube is loose and too long. It appears to be a standard tube used for hand blasters. That tube was replaced with a short length of 3/8 copper tubing that was secured with a clamp (holes for small bolts drilled through cabinet) such that the end of the tube is at the bottom of the hopper. Works slick.



Larger pieces are blasted in the back yard using a small portable blaster (Lowe's ~\$25). An old plastic 5-gallon drywall joint cement bucket makes an excellent hopper. 100-pound bags of blasting sand cost \$4.50 at the local masonry supply store. This sand is not recycled and leaves a bit of a mess on the ground. Before getting this new cabinet, four TR6 wheels were blasted. The project took at least 4 hours and 400 pounds of sand. It probably could have been done commercially at a cost of about \$50, which probably would have been a better choice. A blasting hood (~\$18 from Harbor Freight) makes the outside blasting job just about bearable. A breathing apparatus should be used to keep the silica out of the lungs (The same filter used spray painting is a good choice here).

Air Compressor

Like the song says, you can't have too much fun. Also, you can't have too many Triumphs or too big of an air compressor. The compressor air output at a specific pressure, typically 90 psi, should be used rather than horsepower rating to compare different units because the stated horsepower can be very misleading. Units that provide ~ 7 CPM @ 90 psi are available from Harbor Freight and the local farm product stores (Tractor supply Company, Quality Farm & Fleet) for about \$300. This is about the largest unit that can be operated practically from 115 volts. These units usually have a 20-gallon horizontal tank. This size compressor is sufficient to power the blast cabinet with the smaller diameter tip. It will also power the typical hand blast gun. This is the size I have.

The next size up is the vertical units typically with 60-gallon tanks that cost \$500 to \$600. These units deliver 10 to 13 CFM @ 90 psi and require 230 volt power. (The components necessary to add a 230-volt circuit will cost \$25 to \$50 if you install it yourself.) These larger compressors really help with the blasting ---- makes it go much faster. Something in the 13 CFM range is probably the optimum choice for the home auto restorer if the budget can stand the cost.

The best choice if funds are available is the two stage units costing \$900 - \$1000 that typically deliver about 16 CFM @ 175 psi. This allows a much higher-pressure distribution with the pressure reduced at the blasting site with a regulator. These higher-pressure units make impact wrenches really work.

Oven

The last step in the powder coating process is to bake the object at 350 to 400 degrees for 15 to 30 minutes. During this part of the process the powder melts and flows over the object. The size of the oven determines the biggest size object that can be PCed. (Eastwood sells an Infrared lamp for \$450 that can heat small areas at a time of larger objects.) Gas ovens must not be used since the vapor given off when the part is cured might ignite.

A friend donated a used 30-inch kitchen range. The burner and broiler elements are not required and were removed. Garage sales and appliance dealers should be a good source for such an oven. The oven requires a 230-volt circuit. The components to wire a new circuit cost \$25 to \$50.

The powder gives off a fairly strong odor when heated so the oven should be placed in a well-ventilated area and breathing the fumes should be avoided. My oven is located in the basement workshop near a fairly strong exhaust fan. A nice breeze flows across the oven from an open window on one side to the exhaust fan on the other side keeping the smell out of the workshop as well as the rest of the house.

Powder Coating System

The next photo shows the Powder Coating System purchased from Harbor Freight. The metal box contains a high voltage power supply. From the arc it draws I would guess it supplies 10,000 to 15,000 volt. Don't worry, it won't hurt you; it can supply very little current or power. If you touch it by accident, you may dirty your shorts, but will likely have no other effects. It is much like a hug static electricity discharge.

The powder container is at the top of the gun. The gun requires a 10 to 15 psi air supply at very low volume. When the trigger is pressed, air enters the bottom of the powder cup stirring up a cloud of powder that exits into a tube at the top of the powder container and then down and out the front of the gun. An anode at the end of the gun that connects to the high voltage supply charges the powder particles as they exit. The other power supply lead is connected to the object being painted. The powder exiting the gun forms a cloud that is attracted to the oppositely charged target. The powder that strikes the target sticks because of the electric charge.



This powder coating system currently costs \$80. A spare moisture separator (the black thing at the bottom of the gun) as well as some spare paint cups were also purchased for \$6 each.

Paint & Supplies

Eastwood (www.eastwoodco.com) sells a variety of powder paint for \$8 per half pound. They say a half-pound covers the same area as two or three aerosol cans. FT provided about 25 pounds bulk powder in an assortment of colors for less than half the Eastwood price. The colors included Black (gloss, semi gloss and flat) silver, a high temperature silver for exhaust manifolds, aluminum, and clear. Small quantities of other colors can be purchased as required from Eastwood. The 25 pounds is probably more than is necessary to restore one car.

The paint must be kept dry and protected from large temperature changes. The powder arrived in plastic bags and was stored in plastic food storage containers. (My teenage friend commented that the local police would be all bent out of shape if they saw me dividing up plastic bags of white powder). These containers were also covered with plastic bags as a double security. Small quantities of the most frequently used colors are kept in the spare paint cups.

The PC is somewhat thicker and harder than regular paint so one must be careful to mask off machined surfaces and threads. High temperature tape is available that is unaffected by the oven temperature. FT suggested that regular masking tape be used; it leaves a sticky surface that is easily removed with a prep solvent or mineral spirits. He was right; the tape turns a little brown and stiff but no problem. The tape is best removed before the part cools.

Reusable silicon plugs seal threaded holes and other areas where you don't want the paint to go such as the bore of a hydraulic cylinder. Eastwood sells an assortment of 30 plugs for \$20. FT suggested Argon Masking Products in Mansfield (1+ 800 644-4161) where an assortment of hundreds of plugs were on sale for \$50 including tax, shipping and COD charges. The adjacent photos show the assortment and a PDWA with silicon plugs in all the holes.





Painting Location & Fixtures

The painting process leaves a powder residue in the surrounding area. There can't be too much of a breeze or the powder will be blown off the target. FT uses a rotating table with a windscreen around about half of the sides. I think he uses this outside or maybe in the garage. Outside certainly isn't practical in the Ohio winters.

A small closet is used here for both blasting and painting. A large vent fan, several florescent lights and a couple rotating fixtures with hooks were installed as part of the basement cleanup mentioned earlier. A board and newspaper are placed over the blast cabinet when painting. There is a layer of furnace filter at the vent input to catch the over spray so that it doesn't mark the house siding below the vent. The rotating hooks make it easy to spray all sides of an object. This arrangement is used for spraying both regular paint and powder.

The photo shows the PDWA in the process of being PC clear coated. Note that it is hanging from a rotating fixture in the ceiling. The vent is behind with the vent door open and a pretty dirty filter is in the exhaust opening. The PDWA has been coated with the white powder that will become clear when cured in the oven.



There must be an electrical connection to each piece being PCed. In this case, the wire holding object provides the electrical connection. The ground from the power supply is clipped to the end of this wire. Steel wire works fine even though it is a relatively poor conductor since the current flow is miniscule. The Wal-Mart hobby department carries a suitable wire made for tying flower arrangements. Most hardware stores carry 19 or 20 gauge steel wire that also works well. Heavier wire can be used if required to support heavy objects. Note that the wire is coated the first time it is used and shouldn't be used again to provide the electrical connection.

In most cases the objects are wired below an oven rack that is hung from one of the rotating hooks for painting. The rack and parts are then transferred to the oven for curing. The next photo shows master cylinders and hydraulic pipes ready for PCing.



The Actual Process

The first step is to degrease the object. If it is really greasy, it should then be heated in the oven at about 350 degrees for about 20 minutes to bring more of the grease to the surface and then washed in a strong detergent and blown dry. Then to the bead blaster to get rid of any rust and remaining paint. I've had some problems with the little beads getting in the paint later so when finished blasting I wash with a metal prep etching solution

(phosphoric acid) and then rinse thoroughly with clean water and then blow dry. This was my idea --- not suggested by FT or others. (My daughter works for a company that uses PC on metal electronic enclosures. Their processes for new metal is to wash it in a phosphate solution, rinse thoroughly, blow dry and then PC.) After wiring the object under the oven rack it is thoroughly wiped with a tack cloth (from NAPA or your favorite auto finish supplier at \$1 to \$2). This step is very import, especially on flat surfaces where a piece of sand looks like a boulder under a high gloss PC finish.

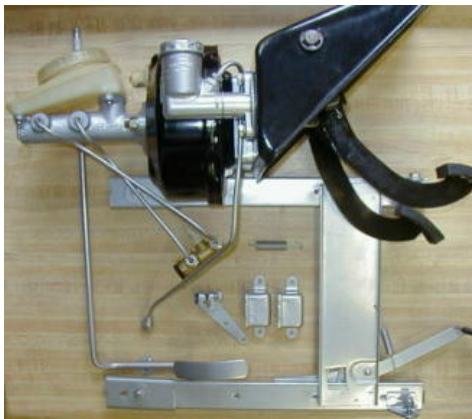
Next, the rack is hung from one of the rotating hooks in the paint closet ceiling, the vent door opened, the vent turned on and the closet door closed to limit the air supplied to the vent. (This produces a very slight breeze, not enough to disturb the powdering process but enough so that no powder comes back on me so I didn't usually use a breathing mask. FT read this and commented that the powder is pretty nasty stuff and one should always wear a mask. So now, **I always wear a mask when spraying powder.**) Newspaper is placed under the rack and the ground wire is attached to the wires from the objects.

About an inch of powder is placed in the bottom of the cup and the gun is turned upside down so the cup can be attached without spilling the powder. The air supply is adjusted to about 10 psi. (When the gun is triggered the pressure drops to about 5 psi which seems to work fine.) FT suggests using rubber dishwashing gloves to prevent getting shocked if the gun anode is touched accidentally. I find gloves rather clumsy and getting shocked from time to time makes the job exciting.

Next, the power supply is powered up and the foot pedal electrical switch is pressed, and we're ready to go. When the gun is triggered, a small cloud of power exits the gun. The gun is held 6 to 8 inches from the target and moved around until all areas are coated. (The gun should be kept level or pointed down. If the gun is pointed up, the outlet tube may come in contact with the power in the cup resulting in a glob of powder exiting the gun.) The inside corners tend to get less powder so these areas are coated first by holding the gun very close. The rack is rotated as required to cover all sides. If you mess up and get piles on the powder on the top, the powder can be blown off with the air gun and recoated. (I have an air gun permanently connect and about 10 psi works fine for this.) After all areas are uniformly coated the foot switch is released and the power supply is turned off. The tip of the gun is then touched to the clip on the end of the ground wire to discharge the gun. You'll get a nice half-inch arc if everything is running right. It's a good idea to double check at this time to make sure everything is coated properly. There is no rush and there is no problem with turning the power back on and spaying some area again.

Next, the rack with powdered parts is transferred to the pre-heated oven. The curing should be done at 350 to 400 degrees. It's wise to get an inexpensive oven thermometer to make sure the oven thermostat is calibrated properly. Heat thin sheet metal for about 15 minutes, heavier objects such as hydraulic cylinders and wheels for 25 minutes. When done, turn off the oven, crack the door and let cool slowly. Objects of small mass cool quickly. Larger objects such as hydraulic cylinders may take half hour or longer.

The following photos show some of the first things PCed. The brake servo was sprayed with engine paint rather than PCed out of fear that the heat would damage the rubber diaphragm. Everything else was PCed. The small box-like things are relay cases. The internal electrical parts were removed before the cases were blasted and PCed. The wiper motor cover was finished in black wrinkle and the associated gear assembly in aluminum.



Recoating

FT says that pieces can be coated up to three times after which the part must be stripped. He also says that a very sharp abrasive such as "black beauty slag" must be used to strip the powder coating. I spent several hours stripping a TR6 carb float chamber without this abrasive --- what a mess.

Some paints such as silver must be clear coated to avoid deterioration from UV. This is a two-step process, a coat of silver and then a coat of clear. I haven't done that yet. A second and then a third coat were put on the pedal bracket. A few areas were missed the first time and the second time a few areas were too thin and turned out rough. The third time gave barely acceptable results. This part is hidden; otherwise it'd been stripped and done again.

Cleanup

An air gun (~30 psi) is used to blow the powder off the powder gun. The cup is removed first and each end of the gun is tapped into the cup to recover as much powder as possible. The gun is then held part way down in the trashcan and the remaining powder is blow off. The sheet of newspaper under the spraying area is folded in to retain the powder and thrown away. Any remaining powder is then cleaned up with the shop vac. The entire cleanup process takes less than 5 minutes. No expensive smelly solvents either.

More Experience:

Since writing the above the starter, heater valve, radiator protector and bumper brackets, air filter housing, anti roll bar and front grill have been PCed. The following contains additional tips from this experience.

Water Trap

I forgot to mention to be sure to have a water trap in your airline. Many regulators are combined with water traps. Some are also equipped with lubricators for pneumatic tools. Don't use any lubricants with painting blasting or air-drying equipment. Water really screws up blasting and painting so be sure to use the trap there. It's also helpful to have the trap in when trying to blow something dry; sometimes without the trap the air line is like a water hose. One thing I've found is that the water trap is not very effective once it is full of water so it is a good idea to drain it before starting any new work.

Blasting

Several friends ordered the Harbor Freight blast cabinet described earlier but it was out of stock and back ordered for several months. They cancelled the orders and instead ordered model number 38440 for \$100 (\$10 more). This cabinet is probably better value in that the light is a long florescent tube and the cabinet is metal.

When blasting a lot of air enters the cabinet through the blast gun and all this air must leave the cabinet (or there will be dire consequences). There is a screened vent hole in the rear for this purpose. A byproduct of the blasting is dust from the removed rust, paint and grime. Some of this dust escapes through the vent hole. The power vent above the blast cabinet collects the dust in a filter and exhausts the excess air outside (when I remember to turn it on). If I don't turn it on, dust settles in the workshop, which is noticed in short order by the spouse (it's her workshop too).

Some of the abrasive also escapes through the vent hole that I vacuum up from time to time. A hole has developed in one of the gloves that allows a small amount of abrasive to escape and collect under the arm opening (also noticed by the spouse). Time to order a new set of gloves.

The dirt in the abrasive causes dust to settle on the window shield necessitating frequent cleaning. The abrasive is now so dirty that it should be replaced. I'd guess that you get about 12 hours operation out of 25 pounds of glass beads. A new bucket of 50 pounds cost a little over \$30.

Connecting the shop vac to the blast cabinet vent can solve much of this dust problem --- a future project.

The light is not very effective because it is at the back of the work --- another future project --- two small spotlights in the front to highlight the work.

Powder Dust

Another source of dust is the powder. Again, if I remember to turn on the vent, the dust is collected in the vent filter. The wife has had bad experiences with paint over spray so she isn't too interested in the following logic: "The powder must be heated to several hundred degrees before it flows. Otherwise, it is no different than the other dust lying around the house." (This is probably a poor choice of words that I was wise enough to not use with the wife.)

Rough Paint

Two attempts were made to PC the air filter housing with silver. The silver is subject to UV damage so it must have a second coat of clear. When the clear was applied, some parts of the surface turned out rough. After the second attempt failed, a number of test pieces were done using various temperatures and thickness of powder. The result is that the system is relatively insensitive to curing temperature. Settings from 300 degrees to 425 degrees produced a smooth finish. However, too thin a layer of clear powder will result in a rough surface at all temperatures.

The last attempt worked pretty well doing the following: Wire the cover to the rack such that it hangs face down. Turn the rack upside down with the cover setting on the rack face up. Apply the clear coat very thick, then turn rack over and rap the inside of cover with a small stick to cause any excess powder to fall off, then cure in the oven with the piece hanging down from the rack.

The recommend curing procedure for the Eastwood powders is to preheat the oven to 450 degrees, and then reduce the temperature to 400 degrees as soon as the paint flows and bake for 20 minutes. The paint seems to flow fine if cured at temperatures over 325 degrees as mentioned earlier. However, I don't know if paint cured at the lower temperatures is as durable. Just to be safe, I'll use the Eastwood 450-400 degrees, 20-minute procedure in the future.

Eastwood Cup Adaptor

I bought a couple containers of paint from Eastwood as well as some of their cups and then made an adaptor to use the Eastwood cups on the Harbor Freight gun as shown in the following photos. This is handy since most of the Eastwood paints are shipped in their cups. The next photo shows the two cups. The HF cups cost \$6 whereas the extra Eastwood cups cost \$2. The HF cups are more rugged and probably the best choice for frequently used colors.



The adaptor was made by cementing the lid (center cut out) of an Eastwood cup into the top of a HF cup. When using the Eastwood cups on the HF gun, the cups should be no more than 1/3 full. The cups that are supplied with paint are about 2/3 full. The excess powder can be stored in small plastic bags for later use.



Pregnant oven

The TR6 grill is about three foot long whereas the oven can only accommodate pieces about 22 inches long. An oven extension was made using one inch foil backed fiberglass furnace duct material. It comes in 4 X 8 foot sheets. I was able to buy a 4 foot square piece from a local heating contractor for \$14. The pieces are held together with duct tape. The result is called the pregnant oven for obvious reasons.

NOTE: This is a description of what I did for my personal use. If you choose to duplicate this arrangement, you do so at your own risk. The extension is flimsy, used at well above the maximum temperature rating for the material and constitutes a fire hazard.

The exterior of the extension gets no warmer than the oven exterior and the configuration can maintain a temperature of 450 degrees. There is a little square door in the front that is opened slightly to get the heat to the front. The normal oven vent under the right rear burner is plugged when using the extension. It's a good idea to have a thermometer near the front to monitor the temperature. The wife wasn't home when above picture was taken so her candy thermometer was inserted through a small hole in the top. This arrangement will accommodate pieces up to about 39 inches long.

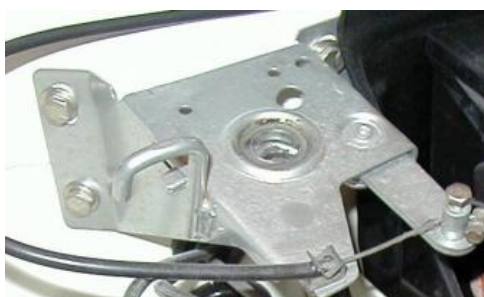
The center part of the grill is shown in the adjacent photo. The oven is not preheated when using the extension. The extension is put in place after the part is positioned. The oven is then turned on and set to 450 degrees. After the oven reaches 450 degrees, it is turned back to 400 degrees and baked for 20 minutes.



More photos

The following shows more PCed parts from my '76 TR6. The starter solenoid is coated with clear lacquer since I didn't want to heat the coil. The starter middle section is coated in black wrinkle.





Blast Cabinet Modifications:

After using the blast cabinet for many hours, two deficiencies became apparent. First, the light was in the left rear corner. I'm right handed so I normally hold the gun in my right hand making the light behind the target and hence useless. This was solved with an 18' florescent lamp attached to the front panel near the top. The other problem was that there was usually a cloud of dust both inside and outside of the cabinet. The air that is forced into the cabinet through the gun exits through all openings carrying dust, dirt and abrasive with it (this was more apparent to others around the household). The dust problem was solved by connecting the cabinet to the shop vac. I made a trap from a cat litter pail to insert in the hose between the cabinet & shop vac. This was to catch any abrasive so it could be recycled. The connections to the trap and cabinet use 2" PVC pipe; a coupling on each side and a short pipe joint between. The end of the Sear shop vac hose is slightly smaller than the inside of the 2" coupling so I glued a piece of pipe into each union and then bored it to the correct size on the lathe. I could just as well have put a layer or two of duct tape around the inside of the unions to make them smaller to fit the hoses. The arrangement works neat -- no dust --- stopped complaints (about that) from you know who. The suction is so great that the gloves stand out inflated when the vac is turned on. The photo below shows the setup on the shop floor before reinstallation in the blast closet

