

Fuel for thought: Tips for buying a burn-off oven

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Powder coaters know that one of the greatest selling points of the finish is its environmental friendliness. But what about keeping things clean inside the application atmosphere? It doesn't take long for powder to build up on hooks, racks, and other fixtures. Finishers may turn to various stripping methods to get rid of the buildup, but one of the most popular devices is the burn-off oven. This article gives pointers about various features of burn-off ovens, including structure, insulation, controls, fuel source, exhaust stacks, accessories, size, and service so that when it comes time for you to buy one, the only thing taking the heat are your hooks and racks.

Most coaters recognize one major problem with finishing systems in general: Keeping racks, fixtures, hooks, and parts clean. You can maintain grounding and transfer efficiency in your coating line when you prevent coatings from building up on racks and hooks. Overspray, contamination, and safety are but a few reasons you should be concerned about maintaining clean racks and hooks.

Although you can clean hooks, racks, fixtures, and reject parts in a number of ways, the heat-cleaning oven—commonly known as the *burn-off oven*—has become the standard in many businesses because it's capable of cleaning many parts at once with little or no pollution or hazardous waste. Other advantages include

- Minimal labor
- Efficient energy use
- Quick turnaround

In-house cleaning, when compared with sending parts out to be cleaned, allows for

- More control
- Less damage to parts
- Less need for duplicate racks
- No time lost in packing and shipping parts

Consider features of various burn-off oven models

Burn-off ovens provide an easy, efficient method to clean parts. These ovens can even clean sensitive reject parts such as aluminum and thin sheet steel. The operating cost is typically less than \$30 per cycle. As with most products, high-end and low-end burn-off ovens are available. Customers should consider the following features before buying a burn-off oven.

Construction. The overall structure of the burn-off oven is critical. Look for heavy-duty construction with an enclosure made of at least 11-gauge steel. The nature of the burn-off process means the oven takes a lot of abuse. The high heat (800°F), humidity (water suppression systems), and the possible inclusion of some acids result in an atmosphere that can promote corrosion. Some manufacturers make burn-off ovens with a coating on the inside shell to prevent corrosion. Here's something else to take into account. Personnel don't always maintain equipment correctly. Sometimes they're careless when loading and unloading parts. A burn-off oven with a well-built design can reduce maintenance and repairs, and consequently have an extended service life.

Insulation systems. The insulation system on a burn-off oven should be designed to hold heat for maximum efficiency. Insulation should be rated no less than 2,300°F in the main chamber and 2,700°F in the

exhaust stack. Some ovens use cardboard types of refractory insulation, made of a hard, cementlike material. This cardboard-type refractory insulation can dry out, become brittle, and crack after a short time. Repair can be costly and difficult. Soft, blanket-type insulation systems provide long service life and easy repair. Any insulation system in a burn-off oven is subject to damage from the roll-in cart, overhanging parts, and operators' carelessness. Most ovens offer at least some protection in the way of expanded metal or perforated steel. Some manufacturers offer optional stainless steel walls (see Figure 1), although warping can be a problem as well as the added expense of the walls. Your best bet is to train personnel to take care when loading the oven (see Figure 2).

Controls. Controls are some of the most important features of a burn-off oven. In the early 1970's, when ovens were introduced, they offered only a basic control over the burning process. However, this was a step forward. Before burn-off ovens, customers burned parts on an open flame behind their plant; burn-off ovens, even preliminary models, at least offered customers a way to control temperatures and pollution. Over the years, technology improved ways to strip parts with tight temperature tolerances. Some oven manufacturers still offer timers on some small oven models to control the potential for runaway fires with heavy use of water. Unfortunately, these timers can create a seesaw effect at which point the parts catch fire, temperatures soar way above the set point, and then water floods into the oven to try to control the fire. This damages and weakens the parts and shortens the service life of the oven. Most larger ovens, however, come with alternate control methods.

One of the best control methods is known as *micro-ramping*. This process brings the oven temperatures up at a precisely controlled and specific preprogrammed pace. If the oven detects any variation in the preset temperature at that time in the program, the water system

injects a small amount of water into the main chamber. This water immediately turns into steam, expands, and suffocates the flare-up. The key is to detect and extinguish flare-ups immediately to prevent the entire load from catching on fire. You can also attach a flexible thermocouple to a part for even tighter control. The thermocouple helps control the water system by monitoring the part temperature as well as the microramp profile. Another type of control method can be found on the *rate control* oven. This is an automatically set, self-adjusting oven that monitors the product being burned off and makes adjustments accordingly to prevent overheating. Sensors in the oven determine whether burn off needs to continue at a consistent temperature or slow down, based on whatever product is being burned off.

Heating sources. Natural gas and propane are good fuel sources for burn-off ovens. Burners using these types of fuels operate more economically than those using electricity. Most ovens offer a primary chamber, where the load is stripped; a main chamber, where the heat enters the primary chamber; and an afterburner, where the combustion gases are broken down to mainly carbon dioxide and water vapor. The main burner box should be separate from the primary chamber because the proximity of the main chamber port to the parts could result in uneven heating. Furthermore, the inside main chamber location can result in damage caused by loading or falling parts. Operators need to allow enough space between the part racks and the heating chamber so that the racks don't hit and damage the heat element. Operators may want to consider installing some form of protection over the heat element as a buffer that will prevent accidents caused by racks or forklifts. Operators also need to keep in mind how they've set up the parts on the racks to make the most of heater efficiency.

Radiant tube technology is the most recent refinement in heating source technology. Without a main burner box, no energy is wasted heating up the box. In convec-

FIGURE 1

Burn-off oven insulation system

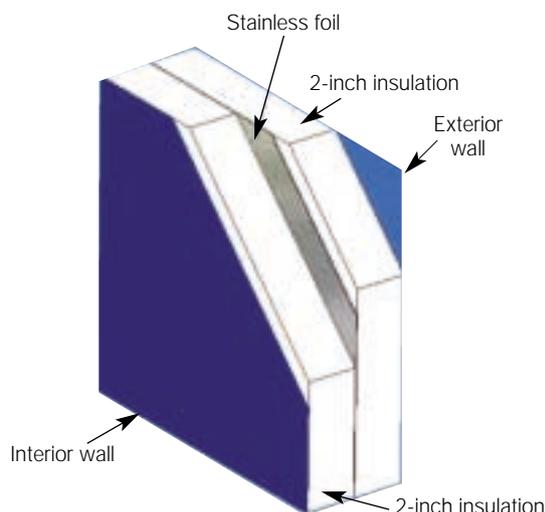


FIGURE 2

Racked parts entering burn-off oven



FIGURE 3

Burn-off oven with inset of radiant tube



tion-only ovens, as air and gas begin to react and create heat, some of the heat escapes to the surrounding main burner combustion enclosure. Consequently, this energy is wasted. In the radiant tube design, the main burner fires directly into the stainless radiant tube. The main chamber (radiant tube) runs from the back wall of the oven to the front, under the load, providing uniform heat and a quick cycle time. The radiant-tube method is energy efficient because radiant energy offers a higher rate of heat transfer than some other methods. Combined with convective heat, the radiant tube oven (see Figure 3) offers fast heat-up of parts and close temperature control. In addition, the radiant tube oven provides a durable design: The heavy-gauge tube is built to last and is easy to maintain.

Exhaust stack and accessories. When you install your burn-off oven, you'll need to exhaust the gas from the afterburner outside your building. Stack sections usually come in lengths of 1, 2, or 3 feet with insulation sleeves. Vendors normally offer galvanized or stainless steel stacking. The stainless steel stacking will normally last the service life of the oven. The National Fire Protection Association requires the stack to extend at least 4 feet above the peak of the roof unless the stack is located at least 18 feet from the peak. Obviously, the lighter the stack section, the easier it will be to install. Even with the insulation sleeves, the stack can get quite hot. Take care to protect personnel and your plant from the heat.

To complete your installation, you usually need

- A weather cap
- Roof flashing
- A storm collar

Determine if you have special needs before you buy a burn-off oven. Ask yourself if you require any safety fea-

tures, such as an electric door lock. Some companies require Factory Mutual or Industrial Risk Insurers equipment. Ask yourself if you need to record times and temperatures. Some vendors offer a standard oven with a few options while others will give you many choices for a customized oven to suit your particular needs.

Size. Although this may seem simple, sizing your burn-off oven is something you should take seriously. Many customers have bought an oven thinking they were getting an adequate size only to find they couldn't fit the largest parts in it. Take care in getting the accurate measurements of the *usable* working space, which is the width, length, and height of the oven over the rollout cart. Don't make the mistake of sizing an oven based on the interior dimensions of the process chamber. A good rule of thumb is to get the actual dimensions of the cart itself and then the height from the top of the cart to the top of the process chamber. In addition, determine the largest part you might want to strip and use that as your maximum size. Remember, it's better to have a little too much room than not enough.

Customer service. As with most products, customer service is important. In this economy, with companies going out of business or being bought, you might want to consider a stable vendor that has a lot of experience in the market. Long-term employees and service personnel are valuable because they've been there and done that and can pinpoint problems quickly and accurately. Make certain your burn-off oven is fully tested at the factory and is ready for installation. Some vendors will assist with the permitting needed in some locations.

The final word

The need to keep racks, hooks, fixtures, and parts clean is obvious. What's also clear is the method of cleaning. Burn-off ovens have been used in the past 25 years as a way to efficiently clean parts with little or no pollution and minimal labor. No other system offers the benefits of low capital expenditure and operating costs, minimal labor and waste, and no consumables. PC

Editor's note

For further reading, see articles listed under the Stripping headings in the "Index to Articles and Authors 1990-2002" Reference and Buyer's Issue, *Powder Coating*, vol. 13, no. 9 (December 2002) and check the *Powder Coating* Web site Article Index at [www.pcoating.com].

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