

stripping

BURN-OFF OVENS FOR CLEANING PAINT LINE COMPONENTS

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Most finishers have experienced one major problem with finishing systems—keeping paint racks, fixtures, hooks, parts, load bars, grating and other paint line components clean. Grounding and transfer efficiency of the line is maintained when finishers can keep the racks, hooks and fixtures free from coatings. Overspray contamination and safety are just a few reasons finishers should be concerned about maintaining clean components of a system. But how should these parts be cleaned? Chemicals? Sand blasting? Mechanical stripping? Fluidized bed? Baking Soda? Cryogenics? All of these methods have major drawbacks, ranging from intense labor costs, high energy costs and damage and degradation of parts to expensive waste disposal.

BURN-OFF OVENS FOR CLEANING

While there are a number of ways to keep paint line components clean, the burn-off oven has become a standard in many facilities due to the ability to clean many parts at once with little or no pollution or hazardous waste (Fig.1). Other advantages are: minimal labor, energy efficiency, and quick turnaround. In-house cleaning allows for more control, less damage to parts, less need for duplicate racks and time saved from packing/unpacking parts for outside cleaning. Burn-off ovens provide an easy and efficient method for cleaning many different sizes of parts as well as sensitive reject parts such as aluminum and thin sheet steel. Operating costs can be quite low as some ovens are particularly energy efficient.

Burn-off ovens were developed in the early 1970's as a means to clean organic material from metal without the environmental problems associated with the methods of the day. Typically, parts were burned on an open flame and the smoke and fumes were released into the air. This resulted not only in pollution of air and ground water, but also damage to parts from the high temperatures. This practice also presented a danger to personnel. Clearly there was a need for a better way to strip parts safely and without pollution. While these ovens were a huge step forward, today's ovens have evolved far beyond the "hot boxes" of the 1970's and 1980's.

HOW BURN-OFF OVENS WORK

Burn-off ovens are typically made up of an oven shell, a main burner, an after-burner, controls, water suppression system(s), roll in cart, exhaust stack and a pressure relief door. While some manufacturers use lightweight materials, the



Figure 1. Hybrid Radiant Tube Oven System.



Figure 2. Proper parts loading.

better ovens have at least 11 Ga. steel for durability. Burn-off ovens take a lot of abuse, so the more heavy-duty the materials and components, the better.

The process of stripping material with heat is called “pyrolysis,” a form of incineration that chemically decomposes organic materials by heat in the absence of oxygen. While burning the material off the part is the goal, care must be taken to control the temperatures so that the substrate and the oven itself is not damaged. This is done

through controlling the oxygen in the main chamber of the oven, which operates in a slight negative pressure or vacuum. This limits the chance of fire and flame. As the oven heats up, the organic material on the part will want to ignite and flare up. Controlling this is done through use of water suppression systems. These systems detect when there is an over-temperature condition in the main oven chamber. A fine mist of water is injected into the chamber through a number of nozzles installed throughout the oven main chamber. The water immediately turns to steam due to the high temperatures and will expand rapidly and displace oxygen. This rapid displacement smothers any flareup or fire within seconds.

Some ovens are very tightly controlled to within 3°F of the setpoint. It is critical to have a tight control as large fluctuations in temperature can be damaging to both parts and the oven system as well. New designs on the market today offer very efficient and tightly controlled burner designs, such as the Hybrid Radiant Tube Oven System (Fig.1). This design offers efficiency of up to 93% while offering plus/minus 10°F temperature uniformity. Energy consumption is minor in these very efficient systems, and many customers enjoy tremendous savings in time and energy when replacing the older oven designs with the latest technology.

Control systems on the newest oven designs are user friendly and efficient as well. An example is the “One Touch Control” system. This unique control provides a selection of programs on the control panel. The operator simply makes a choice and presses the “START” button. The profile selected will automatically take the oven through the program for the ramp up to temperature in both the main chamber and afterburner. This system will detect and monitor the load, and will adjust the burn cycle as required for that particular load. When the oven determines the parts are clean, the shut-down process will proceed automatically.

PROTECTING THE ENVIRONMENT

When parts are processed in a burn-off oven, smoke and fumes are produced. Containment and treatment of these emissions are achieved through use of an “afterburner.” Afterburners (or oxidizers) are simply a means of breaking down hydrocarbons to carbon dioxide and water vapor through high temperatures. Typically, afterburners will operate at a minimum of 1,400°F. Most air quality agencies also require a minimum dwell or residence time in the afterburner as well. Most oven manufacturers meet or exceed these requirements. Oven size and afterburner capacity determine how much paint, powder, etc. (i.e. combustibles) that can be processed. Usually the amount is anywhere from 30 to 80 lbs. per hour. Some oven manufacturers can provide a “high fire afterburner,” a variable firing rate system that further reduces energy consumption while still controlling



Figure 3. Footprint drawings should be provided to determine the space required for installation.

emissions from the oven. Various permits that may be required from local, regional or state agencies. A “Permit to Install” and/or a “Permit to Operate” are typical. Standards for air quality vary. Hard copy data might be required and oven manufacturers offer chart recorders that can be installed. These recorders can be supplied in either paper or paperless styles.

SIZING AND INSTALLATION

When determining the best size of an oven, one must consider the length, height and width of the working environment. Actual working area might be considerably smaller than

the listed interior space of the oven main chamber. Dimensions and number of the parts to be cleaned determine the size of oven required. Parts should be loaded into the oven with air flow in mind. In other words, the more compact the arrangement of parts, the less efficient the cleaning capacity. Air flow around and between parts also aid in faster cycle times. Weight and density of parts will have some effect on the cycle times and the quality of cleaning.

Installing a burn-off oven is a simple process. The oven should be set on and lagged down to a level cement pad or floor (Fig.2). Water, gas and electrical utilities will be connected to the oven and the stack will be set in place. Typically the stack will be made up of galvanized or stainless steel sections with insulation sleeves that will line the interior of the stack. The afterburner temperatures can get to 2,000°F so care should be taken to prevent any hazardous situations such as wood ceilings, flammable materials, etc. Code requires that the stack should extend 4 ft. above a flat roof with no obstructions within 18 feet of the stack. If the oven penetrates a peaked roof, the stack must extend 4 ft. above the peak providing the stack is within 18 ft. of the peak. A space allowance of at least 2 ft. to the rear and both sides of the oven is necessary for maintenance. The front of the oven should be clear to accommodate the roll out cart system. The cart system is designed for easy loading of parts into the oven main chamber. Footprint drawings should be provided to determine the space required for installation (Fig.3).

WHAT CAN BURN-OFF OVENS DO FOR ME?

While no cleaning method is perfect, burn-off ovens have become the easiest, least expensive and safest way to strip coated parts. Chemical cleaning is hazardous and expensive due to the cost of the product, the danger to personnel and environment, and the disposal and labor costs. Other methods, including sand blasting, fluidized beds, cryogenics, etc., all have major drawbacks. The burn-off process, over the past 30 years, has provided a way to minimize these costs and problems.

Burn-off ovens clean with heat to strip virtually all organic materials from paint and powder coating lines. These parts include hooks, racks, load bars, grating, baskets, trees and spring-steel fixtures as well as reject parts. Aluminum and thin sheet steel parts can also be cleaned in some oven systems that pro-

vide tight temperature control. Any metal that will not hold up to temperatures under 900°F should not be processed in burn-off ovens. Also, Teflon and materials that give off corrosive gases when burned need to be investigated before being processed in burn-off ovens.

With some powder coatings, a residue of titanium dioxide (TiO₂) will remain on parts after cleaning. A power wash may be required as secondary cleaning for these parts. Most of the ash on parts simply falls off of the part after cleaning to be vacuumed or swept up and discarded.

Burn-off oven processing produces clean parts resulting in a much more efficient coating system. Parts are typically cleaned more often when a burn-off oven is installed in house. Overspray is minimized and coating quality is improved. Waste disposal, labor, material and transportation costs are all reduced leading to higher productivity and profitability. With thousands and thousands of burn-off oven installations around the world, many companies are enjoying the benefits of keeping their paint line components and parts clean while seeing a very quick return on their investment.

Scott Heran represents the fourth-generation of ownership at ACE Equipment Company, which in 2009 will celebrate 90 years in business.

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