Cartridge-booth maintenance: How to prolong the service life of your equipment

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Cartridge booths are fairly reliable machines. If properly maintained and operated, they can provide many years of problem-free service. I'll tackle cartridge-booth operation and maintenance in this article. Before I do, though, here is some information about booth design and application that can affect the service life of your equipment.

Booth design
Your booth should be well designed. If it isn't, it'll be a continuous source of problems, and all the maintenance in the world won't help. Following are some areas of cartridge-booth design that affect equipment service life and operation:

Air-to-cloth ratio. This refers to the area of filter media designed to clean a predetermined volume of air. Specifically, it refers to how many cartridges the booth uses to clean the air moved by the booth fan. Typical air-to-cloth ratios are 2.5 to 1 or 3 to 1. This means 1 square foot of filter media is used to clean 2.5 or 3 cubic feet of air per minute. The higher the ratio the lower the service life of the cartridge filters and vice versa, depending on how much powder is being collected by the booth.

Face velocity. This refers to the booth's ability to contain overspray. If air volume isn't adequate enough to create the required air velocity through the booth openings for powder containment, the booth will leak powder into the application area. To maintain a booth with this design flaw, you'll probably have to use a broom to sweep the powder from the plant floor—not much else can be done.

Fan selection. The booth fan should work properly through a variety of filter conditions; otherwise filter maintenance will suffer. For instance, a fan with a steep fan curve at a specific operating volume will drop sharply in performance with minimal change in filter static pressure. As a result, filters will need to be changed more frequently to compensate for the fan's shortcomings, since minimal powder loading of the filter will adversely affect fan performance.

Application issues
The application environment and the material being sprayed also affect your equipment's operation and service life. Some of the conditions that can negatively affect a cartridge booth follow:

Plant drafts. Uncontrolled drafts through a coating area push or pull powder from a well-designed and -maintained booth. To greatly reduce this problem, you should contain or control these air currents. Isolating the powder system from the rest of the plant can correct the situation. However, nothing works as well as prevention: Keep plant doors closed and draft-producing devices—such as fans—away from the powder equipment.

Air-conditioning duct outlets. Drafts from air-conditioning duct outlets can have the same effect on powder booths. Locating these duct outlets in strategic areas around the booth eliminates the problem. Keep duct outlets away from booth openings and duct-outlet air velocity below 50 feet per minute.
Environmental conditions. Temperature and humidity affect the powder collected by the booth. If this powder agglomerates because of high room moisture or temperature, the booth filters, pumps, and fluidizing plates will have trouble handling it. For example, agglomerated powder will clog and create impact fusion in pumps, it will cake on filters and prevent effective filter back pulsing, and it will affect powder fluidization at the bottom of the collectors, preventing adequate powder pumping.

Compressed-air quality. Oil or water in the compressed-air supply can completely ruin a cartridge booth. Oil or water can contaminate the filters, causing them to fail or at least plug up. As a result, the fan can't pull enough air to contain the powder in the booth. In addition, the fluidizing plates become plugged, and the powder pumps clog. This can occur quickly when the compressed air becomes highly contaminated. If this happens, the booth must be completely overhauled, which includes replacement of filters, fluidizing plates, and compressed-air supply lines.

Powder formulation. This can adversely affect the service life of the cartridge-booth filter in several ways. One way involves the particle size of the powder: If the powder is too fine, it can plug the filters (at a given air-to-cloth ratio).

Another way the powder formulation can adversely affect the service life of the cartridge-booth filter involves the powder's cure temperature. Problems can occur in the rotary sieve if the powder's cure temperature is dangerously close to the sieve's actual operating temperature (180°F powder cure temperature and 100°F sieve operating temperature). The combination of the internal heat of the sieve during operation and the ambient temperature causes the powder being recovered to gel.

Cartridge-booth operation and maintenance
Most mechanical devices won't last as long as they were designed to if used improperly. A Ginsu knife would probably still cut a tomato after it was used to saw through one beer can. However, would it still cut a tomato after it was used to saw through 10 beer cans? The point is you can get away with a lot of things once, but you can have trouble if these things occur constantly. This applies to cartridge-booth operation and maintenance. Here are some of the most obvious areas of concern:

Filter installation. Cartridges must be installed properly to provide the long service life they were designed for. Once the old filters are removed, clean the gasket area thoroughly. Check the threaded fastener, and clean or replace it if necessary. When installing the new filter, make sure the gasket is crushed, or deformed, to 50 percent of its original thickness to provide an adequate seal. Handle these filters carefully to prevent damage to the filter media.

Cartridge pulse rate. Adjust the cartridge pulse rate to the original equipment supplier's recommended duration of time, including time between pulses. Done incorrectly, the filters can become quickly clogged by underpulsing or fatigued by overpulsing. Fatigued filters deposit paper or fabric fibers into the reclaimed powder.

Filter seasoning. To season a filter, allow small amounts of powder to build up at low velocity on the filter surface. This buildup serves as the filtering layer because the actual filter media is usually too coarse for the task. The booth manufacturer has a procedure to follow for seasoning the filters. If done improperly or not at all, the filters can prematurely plug and ultimately fail.

Collector powder level. Always keep the powder level in the collector below the filters. This is the most obvious cause of filter problems. If this situation goes unchecked, the filters will quickly plug. Rapid back pulsing after the powder has been emptied will bring these filters back to life. This won't work if you allow the powder level to rise above the filters on a regular basis, however.

Damper adjustment. Some cartridge booths are designed with dampers to control the airflow through the filters. Normally, these dampers are kept almost closed when the filters are new. They are gradually opened as the filters become clogged. This keeps the fan running at the proper static pressure. Running the system with the damper open all the time prematurely plugs the filters. Conversely, running the system with the damper slightly closed all the time won't get the best service life out of the filter.

Filter monitoring. Every powder booth is required to have a filter monitor system incorporated in its design that indicates on a gauge (in inches of water column) how well the filters are working. High readings indicate that the filters are plugged and need replacing. Usually, these systems shut down the booth if the reading gets too high. The gradual change in filter condition won't go unnoticed if you monitor these devices continuously. This will prevent unexpected system shutdowns. Clean the filter monitor system to keep it in good working condition. Contact your manufacturer for details.

Booth opening size. The total area of booth openings can't be increased once the booth manufacturer delivers the system. This is because the fan and powder collection system are sized for a given opening area at a given air velocity through the openings. If the opening area is increased, the air velocity will drop (at a given fan air volume). This will most likely cause the powder to escape from the booth. Contact your equipment supplier if you need larger openings than you now have in your booth.

Nightly maintenance of your cartridge-booth system is required to keep it trouble free. Hoses, transfer pumps, compressed-air filters, sieves, fire-detection sensors, lights, booth, and other equipment must be cleaned and inspected nightly.
Your booth manual contains the details about your equipment. When in doubt, read the manual. This has served me well over the years. Don't fall into the trap of thinking that you know everything about your equipment. Become familiar with your system's intricacies. That way, you can correct problems quickly. And you can do the right thing instead of making the problem worse.

Endnote

1. Fan curve. A graph that measures fan performance in static pressure versus air volume.

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