Hanger design and maintenance

George R. Trigg  Powder Coating Consultants

Without good hanger design and maintenance your paint department will never achieve its major goals—to put an attractive, protective coating on everything your company produces and to be a profit center, or at least a break-even operation.

Attaining these goals requires nearly 100 percent capacity loading of the system. To do this your part hangers must be designed to carry the greatest number of parts possible (to achieve high line density) and to present the parts so that they are coated to specification.

In addition, the hangers must be designed and fabricated to keep the hanger structure from getting coated with paint and to maintain a good ground point on multiple passes through the system.

Many factors are involved in hanger design; it is not just a matter of welding some rods together to carry the parts. Safety, part orientation, system productivity, and maintenance must be considered, as they will later in this article.

Hanger design is further complicated because it is not a hard science: Coating requirements usually change over time and vary from part to part; line loading varies depending on parts; and application equipment is often purchased with an incomplete understanding of what is needed.

To create a good hanger design, you need experience, a thorough understanding of your coating requirements, and probably most important, a good imagination. This is a tall order, but the alternative to good hanger design is poor coating, an inefficient painting operation, unnecessary overtime—or all three.

Safety

In terms of hanger design, safety and high productivity go hand in hand: A hanger design that produces a good contact point will result in a safe coating system and one that coats parts to specification. The contact point is the key: If contact is not maintained, the coating will be below specification. And, as the ground contact deteriorates, the likelihood of fire and explosion increases.

The hanger should be designed so that the contact point (hook) is hidden from the powder as it is being sprayed. This will keep the contact from losing ground on its first pass through the application area. The hook should have a sharp surface where it touches the part. If a horizontal opening is available, cut a piece of flat stock at 45-degree angles to create a hook shaped like an arrow tip. This design creates a sharp point. A side benefit is that the part will vibrate a bit as it travels through the system, and this vibration will maintain the ground point. If you need a horizontal hook, consider making it from square bar stock turned like a diamond so the sharp edge is the point where the part rides.

Hangers are expensive to make. But using light-gauge stock to cut expenses may not be cost effective: A hanger that is too light will bend easily and drop parts, or hold them in the wrong alignment. S hooks are ready-made hangers. If you can use them in your plant, consider yourself fortunate.

As you might expect, the more you deviate from a sharp contact, and the more the contact is exposed to the coating, the more likely you are to lose ground. In addition, the more links you have between the hanger and parts, the greater is the potential for loss of ground. Design your hangers so they have the fewest number of links possible.

Part orientation

Part orientation is extremely important in an automated application system. It is imperative that a constant distance be maintained between the spray gun and the part throughout the application area. If the hanger sways or the part is not perpendicular, the area closest to the spray guns will be sprayed heavily, and the area farthest from the guns will be sprayed lightly.

The more sophisticated the application equipment, the more consistent the part orientation must be: A ¼-inch variation in orientation between hangers can cause coating thickness differences on parts. If your product demands a consistent appearance, then hangers must maintain part orientation strictly.

Part orientation is important during pretreatment as well as during powder coat application. Spray pressures can cause parts to become misaligned if the hanger doesn't support them. In addition, if the spray pressures twist the hanger or the part on the hanger, the part will not get cleaned and phosphated properly. If this situation is not corrected prior to coating, the coating will not meet standards. Also, if the
cleaning and phosphating line is an immersion bath, the hanger must hold the parts to prevent them from floating off. If the design of the parts is complicated, cleaning solutions can be caught in the parts momentarily and then drain off into the succeeding pretreatment stage (this is called dragout). This will eventually contaminate pretreatment stages downstream and dilute their charge. In addition, if the solutions remain trapped, powder cannot be applied properly and voids will develop in the coating. To avoid this, it may be necessary to design holes in the part so that the solution will drain out before the part is powder coated. If that is not possible, you may have to install a tilt or blow-off system in the pretreatment line.

System productivity
The hanger structure must not rob paint from the part in an electrostatic system. You can have the neatest hanger in existence, but if it is too close to the part, it—rather than the part—will attract the powder. This will waste powder by creating powder buildup on the hanger; it will also coat the part insufficiently. You need to design 2 inches of distance between hanger supports and the part unless insufficient spray is not a problem at that location on the part.

As mentioned earlier, if at all possible, the hanger structure should be hidden from the spray guns to reduce powder waste and potential loss of ground. A hanger system designed this way also provides a benefit in terms of hanger maintenance: If the contact point is well hidden and the hanger structure is not heavily coated, the time between clean-off cycles can be greatly extended.

Hanger maintenance
As is true of any other kind of maintenance, hanger maintenance is usually undertaken only as the last resort, often just after the inspector has announced that there is insufficient coating on the ware. The primary issue in hanger maintenance is cleaning, and the most effective cleaning method for powder paint is a burn-off system.

Burn-off systems. These can operate on-line or off-line. They all work in similar fashion: Hangers are subjected to high temperatures, usually ranging from 1,200° to 1,300°F, for 4 to 8 hours, depending upon the amount of powder buildup on the hanger. On-line systems usually require an exceedingly slow line speed. As a result, they are not practical for all finishing operations.

A negative side to the burn-off method is that the high temperatures used during burn-off may distort the hangers. If you use burn-off for hanger maintenance, you may have to make your hangers from a heavier gauge material so that they won't get distorted.

A high-pressure wash often is used to clean residue from the burned-off hangers. Or the hangers may be rinsed as they pass through the wash and phosphatizing line. The drawback to this method is that it usually contaminates the first and second pretreatment stages. These then need to be replenished more frequently than they would otherwise.

Salt systems. Molten salt or cold salt solutions are also used to clean hangers. Some areas of the country, however, discourage the use of liquid cleaners because of potential hazard and disposal problems. In addition, if hangers have a heavy buildup of powder, these cleaning methods can be slow.

Blow-off and vibration methods. If handling uncured parts is not a problem in your shop, you can use these cleaning methods. They require transferring the uncured ware from a paint hook to a curing hook. Then the powder is blown or vibrated off the paint hook and reclaimed.

Hanger integrity. Hanger maintenance involves more than cleaning powder buildup from hangers. As an integral part of your hanger maintenance program, you should have checking (test) fixtures made to the correct hanger design and regularly test them to make certain they are in alignment with the original design. Sometimes the burn-off operation or a conveyor wreak will warp or damage the hangers. Therefore, you should inspect the checking fixtures right after they go through the hanger cleaning operation. If hangers can't be restored to their original state after being cleaned, your parts will not be coated to specification.

Observation
Hanger problems tend to have a creeping effect. A bent hook here, a missing hanger there, and you don’t notice a change in productivity. But if this is not corrected, your shop suddenly has a bad case of industrial flu: Line loading plummets because of bad hangers, and the reject rate soars because the parts are no longer hanging the way they should.

To avoid this, you have to make it your business to notice what’s happening in the system. As you walk by the conveyor, look down the line of travel and see if all parts are hanging true, and when you pass near the spray booth, listen for the crack of electrostatics. If you have an automatic system, check to see if the ultraviolet detection system is on bypass. If the parts are hanging out of alignment, or you can hear the electrostatic discharge, the detection system probably on bypass, which is dangerous. It is frequently an indication of dirty or bent hangers, or both.

You might think that it would be easier to install a ground fault detector rather than pay attention to these details. This device, however, has had only marginal success in alerting finishing personnel that the system has lost ground. It is no substitute for personal observation of the system.

“Do it right the first time” is a cliché. But it, along with “then keep it right,” provides the foundation for designing and maintaining an effective hanger system.