# ELECTRICAL GROUNDING

Inadequate ground is the most frequent problem which we encounter in troubleshooting a powder coating system. A sufficient ground path must be provided for all equipment associated with powder application, the parts to be coated and any manual operators. The reasons are simply safety and efficiency.

## Safety

Grounding is necessary to carry charge away from the application equipment to prevent static discharge or sparks which provide an ignition source and may lead to a dust explosion. This is one of the most serious safety hazards associated with powder coating. It is not limited to corona systems since tribo is also an effective charging process. All automatic powder systems must be equipped with spark detection equipment to shut down the spray guns in the event of a discharge. (Its important to note that poor ground is not the only possible spark source. Others include faulty spray guns or charging equipment.)

The grounding of spray gun operators helps to prevent shocks as well as sparks. Our bodies can collect charge and deliver it in the form of a spark, just as we do in dry winter months when we walk across a carpet and touch a conductor. The result is a shock accompanied by a small spark discharge..

Conductive shoe soles and grounding straps can help prevent shocks from static build up in operators.

## Efficiency

Good ground is required to carry away charge which is delivered to the parts by the powder or through ionized air. This allows more powder to be deposited and better penetration into Faraday areas. Overall, however, good ground improves transfer efficiency.

As powder builds up on the surface of the part, charge separation begins to occur in the part. That is, in the case of a negatively charged powder, positive ions in the part flow toward the powder coated surface and electrons carrying a negative charge flow to ground. In order to continue powder attraction to the part the ground circuit must stay intact. Thus ground maximizes the powder (charge) holding capacity of the part. If minimal ground is improved even greater efficiencies are possible.

## Causes of Poor Ground

Most ground problems are the result of poor **design** or inadequate **maintenance**. Some powder booths, for example, may not provide enough air movement to capture the over sprayed powder. Powder which drifts out of the booth canopy may settle on the conveyer or load bars. Powder is a very effective electrical insulator and it will interfere with ground if deposited at contact points. This is especially true if coated hooks or hangers go through the oven and the powder is cured in place. If loadbars hang too low into the coating booth they too will get powder coated.

Another important design design feature involves hook/hanger configuration. S shaped hooks, depending on size, may provide only a single contact point and allow the part to change position. V shaped hooks, for example, can offer at least two contact points and hold the part more firmly in place

to prevent undercoating with powder. When possible the hooks/hangers should be designed to shield the contact point from coating. Hooks/hangers made from square stock should be turned on an angle to have a sharp contact point.

It is also important to maintain maintain metal to metal contact at all points. This is usually done by cleaning the hooks/hangers , via burn off, chemical stripping or blasting. In such operations it is important to maintain a cleaning schedule which matches production. Infrequent hook/ hanger cleaning is the major cause of poor ground. Following burn off it is also important to insure that any residue or ash is removed. This ash may also be an electric insulator and as such it will interfere with ground. Another important consideration to prevent powder build up on hooks/hangers is the practice of fully loading them to keep empty hold points from being coated.

Maintenance of proper gun placement and aiming as well as booth capture air flows will also prevent a build up of powder on hooks/hangers. Cleaning excess powder off of the conveyer is also a good practice. We also frequently find that gun control panels or booths are not properly grounded. These come with ground cables and they should be used rather that depending on the connections to the control cabinet.

**Testing** for sufficient ground can be done with a volt ohm meter (VOM) or, **preferably with a Megohm meter or megger**. It is important to follow the entire ground path. For parts, it is best to start with the conveyer and check every link in the chain to the part, i.e. from conveyer to loadbar (if used), from loadbar to rack/ hook and from hook to part. This procedure will tell you if and where any problems exist. It is also suggested to check directly from a known good ground to the part via the entire ground path. The National Fire Protection Association (Bulletin Number 33, Chapter 13) states that less than one megohm is necessary to minimize the chance of sparks. For efficient coating, however, less resistance, in the neighborhood of 0.5 megohm, is best.

While testing, if a wire lead is attached to ground and directly to a clean part, the effect of good ground can actually be seen by coating the part with this connection in place. If the noted improvement in deposition/ thickness or penetration is dramatic then the benefits of good ground become more clear. If the improvement is slight, but resistance readings are one megohm or higher, chances are still good that better ground will improve harder to measure characteristics such as transfer efficiency and consistency.

Symptoms and Solutions

As discussed above, symptoms of poor ground include shocks to operators, arcing which may shut down automatic coating systems, low film thickness, poor Faraday penetration and poor transfer efficiency. Excessive coating build up on fixtures often shows up as sporadic results, e.g. low film thickness on three quarters of the parts on a rack or rack to rack differences in the above characteristics.

Good ground starts with the earth connection. Good ground starts with the earth connection. Some people use water pipes with reasonable success, however, the optimum ground is achieved by driving a copper rod into the soil to a depth of 8 to 10 feet. This should then be connected to the conveyer, preferably at multiple points for insured good contact.

Minimizing connections between the conveyer and the part can be very helpful in optimizing ground. A solid rod obviously has fewer contact points to worry about than a chain of multiple connectors.

The addition of a well grounded rub bar or brush above the booth helps to insure contact with fixtures in the event that the conveyer is not providing adequate ground due to a build up of lubricants and

contamination.

The maintenance of good powder containment and even removal of powder already deposited on unwanted areas via air knives will help to avoid powder build up on contact points.

Modified hook/hanger designs to encourage contact, especially for light weight parts, and to shield contact points from powder spray will pay benefits in improved ground.

And finally, the recommendation to frequently clean hooks/hangers cannot be overstated. This may require a larger inventory to replace hooks/ hangers that are being cleaned.

Benefits

Hopefully, the benefits of these efforts will now be obvious. We usually see a safer workplace, less touch up and recoats and less powder into the reclaim system. All of these have a positive impact on the bottom line.