Troubleshooting Guide for Powder Coating
WHY POWDER COATING?

INTRODUCTION

Thermo setting powder coatings are now generally recognized as having a significant role in the metal finishing industries world-wide. Powder coatings have been a commercial reality now for close to thirty years.

Powder coatings are used for the same key reasons as any surface finishing process:

- To protect the substrate they have been applied to
- To enhance the appearance of the item they have been applied to.

- The key benefits of powder coatings are often summarized by the five E's of powder coating.
  - Ease of application
  - Environmentally friendly
  - Economical
  - Excellence of finish
  - Excellence of performance

Other benefits include:

- The elimination to a large extent of solid waste disposal problems.
- Solvent emissions are virtually eliminated, resulting in much easier compliance with EPA regulations.
- Energy costs are greatly reduced and Volatile Organic Component easily controlled.
- No solvents are required in mixing, cleaning or maintenance.
- Up to 99% of powder overspray can be recovered and reused. The 1% residual can easily be disposed off as a solid.

For these reasons there has been a rapid growth in the coating industry.

Powder coatings are often used as alternatives to liquid paint finishing. In comparisons with traditional liquid finishing, powder coatings offer two significant application benefits:

- they are single coat finishes, with no primer required.
- High film thickness can be achieved with a single coat.

The powder coating application process is also readily automated, enabling high volume industrial application plants to operate economically with a minimum of rejects.

These benefits have enabled powder coatings to take a significant share of the industrial finishing market.
APPLICATIONS

HOME APPLIANCES

In the home appliance industry, powder coatings are well recognized as being a high quality finish for both major and minor applications. In the appliance finishing industry, the advantages of high corrosion resistance with single coat application has resulted in powder coatings being used on a wide variety of electrical appliances, including; air conditioners, clothes dryers, cookers, dishwashers, fans, freezers, microwave ovens, rice cookers, refrigerators, stereo components, television components, video components, washing machines, water coolers. In addition to the major appliances noted powder coatings are also widely used for smaller appliances such as toasters, irons, can openers, juice extractors, food processors, vacuum cleaners and floor polishers.

AUTOMOTIVE COMPONENTS

Although powder coatings are not yet widely used on auto bodies, they are finding growing applications on components for both interior and exterior applications. In most automotive applications, powder coatings are used for auto performance characteristics as most auto producers still prefer the use of liquid coatings for those areas requiring optimum appearance. Current applications in the automotive industry include: air filter housing, alloy road wheels, brake calipers & components, bright trim molding, bumper bars, door handles engine block, siron & alloy, mirror housings, motorcycle frames, oil filter housings, rocker covers, seat frames, steel wheels assemblies, stereo system, components suspension systems, underbody primer, windscreen wipers.

FURNITURE

The furniture industry is a major market for powder coatings. Powder coatings are used extensively on both commercial and domestic furniture for both their performance and for their appearance.

The performance characteristics of powder coatings which make them so suited to the furniture industry include:

- toughness
- hardness
- corrosion resistance

ARCHITECTURAL

Powder coatings have developed a strong position in the architectural industry as a coating for aluminum profile, cladding and other building components.

ELECTRICAL AND ELECTRONIC INDUSTRY

Computer casings, computer components, encapsulation, telecommunications equipments.

METAL PRE-TREATMENT

Metal Pre-treatment prior to powder coating is essential step to ensure proper coating performance. Metal Pre-treatment prior to powder coating is of two types.
a) Mechanical surface Preparation.

b) Chemical surface Preparation.

For powder coating most commonly used surface preparation method is chemical pre-treatment.

**It is essential for an applicator to know the following:**

1. Need for Pre-treatment
2. Surface Preparation
3. De-rusting Processors
4. Activation
5. Conversion coatings for
   a) Mild steel
   b) Galvanised steel
   c) Aluminum
   d) Mazak
6. Trouble Shooting

1. Need for Pre-treatment: The performance of powder coating on a metallic surface mainly depends on Proper Pre-treatment of the substrate.
   Proper pre-treatment is an essential factor because of the following advantages
   (1) Pretreatment process provides a clear, uniform, oil-grease free surface.

   (2) Provides good adhesion of film

   (3) It forms an inert layer which inhibit the corrosion of the paint film

**General Pretreatment Process sequence:**

a) De-greasing Process
b) Water-Rinse
c) De-rusting
d) Water rinse
e) Activation
f) Conversion Coating
g) Water rinse

De-greasing Process: Chemical de-greasing methods used in any particular application is closely related to the nature of the surface being cleaned and the amount and type of contamination.
The various chemical degreasing processes applicable to Mild steel, Galvanised Steel & aluminum substrates, are as follows:

**Solvent Cleaning:**

a) **Solvent Wipe:** Solvent cleaning is the cheapest and best method to remove heavy or sticky oil/grease like substances from any surface. Since all solvents are almost neutral they do not attack the base metal. In this process, the parts to be cleaned are wiped with rag of cotton soaked in a suitable solvent such as Kerosene, Benzene, Naptha etc. The following are the advantages and disadvantages of solvent wipe method.

**Advantages**

a) Cheapest cleaning method available in the industry to remove heavy oils, greases or sticky press compounds.

b) Skilled labours and costly plant installation is not required.

c) Suitable for smallest job coater as well as for OEM industry.

**Disadvantages**

a) The process is labour intensive.

b) Since all the solvents are flammable, a great fire risk is associated with the solvent cleaning.

c) Frequent change of cloth and solvent is essential or otherwise it can affect the quality of cleaning.

d) Solvent going into the drainage can cause effluent disposal problem.

**Vapour De-greasing:**

Vapour de-greasing is quite a sophisticated method of cleaning.

In this method, special type of solvent is used which has following advantages.

- Has lower boiling point than water
- Non-toxic to human being.

This process requires a closed system in which the item to be cleaned is exposed to the condensing vapours of solvent. This method effectively removes light oils, greases but cannot remove heavy oils, greases, and sticky press compounds.

**Advantages**

a) Very good method for cleaning light oils, greases.

b) Less risk of fire hazard, minimum pollution as it is a closed system.

c) Since the solvent used is a non-toxic there is no danger for the operating worker.
Disadvantages
a) Require costly plant installation and skilled labour.

b) Frequent removal of oil & grease is required or otherwise they increase the boiling point of solvent.

c) Thin sheets having heavy oil grease or sticky press compounds can not be removed by the process as there is no mechanical action on the parts.

d) Costly process.

Emulsion Cleaning:
Emulsion cleaners are popular as they are based on mild Alkalis and hence suitable to all substrates (Iron, Galvanised steel Mazak etc.) and operate at room temperature. Emulsion cleaners are generally based on either kerosene-emulsifier or turpentine-emulsifier. These cleaners are generally milky in appearance. Emulsion cleaners have a limited cleaning tendency and they leave a very thin film of solvent/emulsifier over the substrate even after water rinsing. Hence, Emulsion Cleaning is always followed by Alkali cleaning. In case of spray process the parts to be cleaned are suspended in a funner wherein they are constantly exposed to the spray solution for 2 to 5 minutes at a pressure of 2-3 kgs/cm² for better results. In dip process, the parts to be cleaned are simply immersed in a bath of the cleaning solution.

This process has following advantages and disadvantages

Advantages
a) Operates at a lower temperature (45-50 ºc) hence consume less energy.

b) Suitable for all the substrates such as Mild steel, Mazak, Aluminium, Galvanised etc.

Disadvantages
a) Limited cleaning ability as it can not remove heavy grease, oil etc.

b) Not suitable for higher temp. As the emulsions are based on solvents which gets separated above 70 ºc from the emulsion phase.

Alkali Cleaning:
Alkali cleaners enjoy superior position in the Pretreatment industry due to following advantages.

• They operate at room temp.

• Bath stability is higher compared to all other degreasing processes, low foaming tendency.

• Simple bath control.

• Costly plant installation is not always required.

• High capacity to absorb oil.

These cleaners are based on strong alkali such as Sodium hydroxide, Sodium silicates, other filters and builders such as soda ash etc, surfactants and additives.

The parts to be cleaned are immersed in this bath at a recommended temperature and time.

Strong alkaline cleaners are avoided in case of Manganese phosphate process as they can cause inferior quality coating.
Strong alkaline cleaners are also not suitable for non-ferrous substrate such as Zinc, aluminum, Brass, Copper, Glass, Galvanised Steel, because all these metals readily get attacked by strong alkalies.

**De-rusting:** Corrosion is common phenomenon for metals. Iron or steel when exposed to humid atmosphere the corrosion process is initiated resulting in rust formation.

Rust is the oxide of iron which is loosely adhered to the substrate and hence it is very dangerous if overcoated by any surface coating. Rust is readily soluble in acids such as Hydrochloric acid, Sulphuric acid, Phosphoric acid and hence it can be removed by acid cleaning.

**De-Rusting Process**

**Advantages**

a) Cheaper process than blast cleaning or flame cleaning.

b) Can be done anywhere, no big plant or sophisticated equipments are required.

c) Remove rust, Mills scale.

d) Makes the surface reactive for the next phosphating stage.

**Disadvantages**

a) If Hydrochloric acid or hot Sulphuric acid is used for derusting it can create a corrosive atmosphere in the plant.

b) Not suitable in case of spray application.

c) Carry over can create problem in next stage (i.e.) in phosphating bath.

De-rusting can be done with the following acids/ acid combinations:

1. **Hydrochloric acid Pickling:** Hydrochloric acid is fuming acid and mostly used for “Pickling”, as it readily dissolves the mill scales formed during the hot rolling operations. Hydrochloric acid pickling is the cheapest de-rusting process. The use of Hydrochloric acid is very limited in the industry due to the corrosive nature of the Hydrochloric acid fumes which can create problem in the coating plant and secondly the carry over of Hydrochloric acid to the next pre-treatment stage (i.e.) either activation or phosphating can damage the bath permanently.

   In case of Pure Hydrochloric acid de-rusting the tank should be of Stainless Steel.

2. **Sulphuric Acid:** Sulphuric Acid is a strongest acid and it is most suitable for the heavily rusted components. Sulphuric Acid at an elevated temp.(50-60ºc) gives outstanding results in a short time. The use of hot process is limited in the industry due to the corrosive nature of Sulphuric acid fumes. The use of inhibitor is must in hot process to avoid the excess arrack of acid on the base metal. Carry over of Sulphuric Acid bath in phosphating bath can permanently damage the phosphating bath. For Sulphuric Acid based derusting the tank should be of either stainless steel or Mild steel with lead lining.

3. **Phosphoric Acid:** Phosphoric acid based de-rusting process is more popular in the finishing industry due to its following advantages.
a) It gives a uniform & fine de-rustng pattern which ultimately gives less coarser coating in phosphating.

b) It has less pitting tendency than Hydrochloric acid & sulphuric acid based derusting.

c) It does not emit any corrosive hazardous fumes.

d) Carry over of bath solution does not create much problem.

Phosphoric acid based de-rusting is costly as compared with Hydrochloric acid or Sulphuric acid. For Phosphoric acid based de-rusting, the bath should be of Stainless steel.

Activation Process: This process provides fine active crystal centres on the surface of the metal which ultimately results into tine phosphate coating layer in phosphating stage. This process helps to attain a uniform phosphate coating. There are two types of activation processes:

a) Acidic Activation

b) Basic Activation

a) Acidic Activation: This is a cheaper process. Here bath testing and control is not required. Bath can be prepared in hard water. The process results into coarser bigger crystalline coating. Not suitable for non ferrous substrates such as Aluminium.

b) Basic Activation: This process is based on titanium based compounds which are most suitable for Ferrous & non Ferrous substrate. It gives more compact, uniform fine crystalline coating having better corrosion resistance. Disadvantages are 1) The bath is unstable (Titanium forms colloids in aqueous solutions) 2) Bath cannot be prepared in hard water.

Conversion Coatings: Phosphating is universal method of metal Pre-treatment. Phosphating consist of the deposition on the metal surface of insoluble metal phosphates which are actually chemically bonded to the substrate. Since this is a chemical reaction, it gives good adhesion for paint film. Phosphating can be either crystalline or amorphous. This process provides the following:

a) A clean, grease/oil free surface.

b) A corrosion inhibitive base for powder coating.

c) A non-conductive bond between base metal and powder coating.

d) A chemically inert surface which prevent the reaction between the base metal and powder/paint ingredients.

Phosphating process is divided into 2 types,

a) Zinc Phosphating (sub-divided into Mono, Di, Tri Cationic Process).

b) Iron Phosphating

a) Zinc Phosphating: Zinc phosphating process is widely in the automobile, hardware, home appliance industry. Zinc Phosphating bath solution contain a saturated solution of phosphoric acid along with Zinc phosphate. On immersion of an article in such a bath the iron gets attacked by the acid component of the bath, by lowering its concentration at
the metal surface. After certain time (within 2 min. Maximum) the phosphate crystalises on the metal surface. Since
this is a chemical reaction between the metal and the phosphating solution, it stops after the formation of crystalline
phosphate layer. It is not advisable to keep the parts/ components in the phosphating bath for more than 10 minutes
because the bath pH is acidic (between 4.8 to 5.5, depending on the bath concentration) and at this pH the coating
formed gets dissolved slowly thereby leaving the bare metal, which is again attacked by the phosphating solution
forming fresh crystalline layer of phosphating. This process may go on till the end of the metal and it unnecessarily
increases the chemical consumption.

Zinc phosphating is sub-divided into 3 types:

**Mono-cationic:** Cations are positively charged ions. Zinc is the basic cation in all crystalline phosphating processes. Mono-cationic processes are comparatively cheaper than di & tri cationic processes. The bath solution contains only zinc as a cation. These processes find a very limited use in the industry as they have a limited corrosion resistance.

**Di-cationic Process:** In this type the bath solution consist of zinc and Nickel as cations. Zinc imparts adhesion and Nickel contributes to the corrosion resistance. Hence coating formed in this type is more durable and withstand drastic corrosive atmosphere than Mono-cationic.

**Tri-cationic Process:** In this type, the bath solution consists of zinc, nickel and manganese as cations. Manganese improves wear resistance of the phosphate coating. Hence coatings formed in this type are more superior with respect to adhesion, corrosion resistance and wear resistance.

Today tri-cationic process is more popular in the metal pre-treatment industry because
(1) It gives superior quality coating along with better corrosion and wear resistance.
(2) Generates lesser amount of Soft Sludge as compared with mono or Di Processes.

This process is mostly acceptable by automobile industry (most used prior to Electro-deposition process) Home & consumer appliance industry etc. Suitable for Mazak and Aluminium.

**b) Iron Phosphating:** Iron phosphating is of limited use in the pre-treatment industry although this has got its own segment. Iron phosphating do not contain any zinc like cation. They are based on sodium or dihydrogen phosphate as major ingredient along with accelerators such as molybdate. The coating formed is non-crystalline (amorphous) and having dark bluish colour. The major advantage of Iron phosphating is (due to its non-crystalline nature) iron phosphated parts can be welded prior to powder coating. Iron phosphated parts when powder coated give outstanding mechanical properties.

Conversion coating for Aluminium: Aluminium can be pretreated by the following ways.
(1) Phosphating (Tri-cationic Zinc)
(2) Chromatising (Green, Yellow or colourless)

**Phosphating:** Aluminium parts can be phosphated like mild steel. For Aluminium mild degreasing chemicals should be used. Heavy, strong degreasing chemicals can cause excessive etching to the base metal. Derusting process should be avoided in phosphating sequence, which should be replaced by desmutting process (parts to be dipped in 10% Caustic Solution for 1 to 2 minutes). Phosphating process is not popular in Aluminium pre-treatment because Aluminium ions beyond a limit can cause poisoning to the phosphating bath.
**CHROMATISING:**

a) **Green Chromium Phosphate**: This is a general process for the pretreatment of Aluminium. This bath contains mixtures of phosphoric acids, chromic acids, and additives. This process is more popular in the food industry as it is non-toxic. This process forms an excellent substrate for powder coatings. The coating formed is dark green in colour weighing 0.5-1.5 gm/m². It gives limited corrosion resistance.

b) **Yellow chromium chromate**: This process is more popular in the powder coating industry. The bath contains a mixture of chromic acid along with accelerators. This process gives a dark yellow coloured (process applicable to OEMs) coating, which has high corrosion resistance. Since this process is based on hexavalent chromium, it suffers from disadvantages such as effluent problems, etc.

c) **Colourless coating**: This process is a modified process originated from process b) and used for certain applications (lacquer coat/clear coat applications) where it is desired to retain the original metallic Aluminium appearance. The coating formed is having limited protective value. This process is not popular in the industry.
## A troubleshooting guide to iron phosphating

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<td>pH not in range</td>
<td>Adjust pH (down with acid, up with Caustic)</td>
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<td></td>
<td>See “Poor Cleaning”</td>
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<tr>
<td>Poor Cleaning in De-greasing stage</td>
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<td>See “Poor Cleaning”</td>
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<tr>
<td></td>
<td>Contamination rinses.</td>
<td>Check rinse tanks.</td>
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<tr>
<td></td>
<td>Poor exposure</td>
<td>Check racking.</td>
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<td></td>
<td></td>
<td>Better placement of nozzles.</td>
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<tr>
<td></td>
<td></td>
<td>Use fog nozzles.</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td>Lower concentration.</td>
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<td></td>
<td>Poor cleaning in de-greasing stage.</td>
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<tr>
<td></td>
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<td></td>
<td>Bad Steel.</td>
<td>Check raw material for excessive oil.</td>
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# A trouble shooting guide for Zinc phosphating

## Problem

### Coating weight too low

**Cause**
- Phosphate or Accelerator concentration too low.
- Phosphate bath temperature too low.
- Process time too low.

**Remedy**
- Increase Concentration.
- Increase phosphate bath temperature.
- Lengthen time phosphating stage.

### Coating weight too high

**Cause**
- Phosphate or Accelerator concentration too high.
- Process time too long.

**Remedy**
- Decrease concentration
- Shorten time.

### Powder on Coating

**Cause**
- Poor rinses.
- Excessive sludge.
- Accelerator concentration too high.
- Higher bath temperature.

**Remedy**
- Keep rinse overflowing.
- D-sldge tank.
- Allow concentration to drop.
- Lower the temperature of the bath.

### Spotty Coating

**Cause**
- Poor cleaning.
- Low concentration of Phosphatizer or Accelerator.
- Poor solution coverage
- Resistant Metal.

**Remedy**
- Check cleaning tank.
- Increase concentration.
- Check racking and nozzles.
- Add Jernstedt salts to rinse or clean tank.

### Rusting

**Cause**
- Coating weight too low.
- Final dry-off too slow.
- Dry-off between stages.
- Higher free acid pointage in phosphating bath

**Remedy**
- See “Trouble-Coating Weight too Low”
- Increase temperature in the final rinse use air blowoff.
- Better placement of nozzles
- Use fog nozzles
- Run at lower temperatures.
- Reduce the free acid pointage.

### Streaking

**Cause**
- Poor cleaning
- Poor rising
- Dry-off between stages.

**Remedy**
- Check cleaning stage.
- Keep overflowing.
- Better arrangement of nozzles.
- Use fog nozzel.
- Run at lower temperatures.
**A trouble shooting guide for chromate process**

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<th>REMEDY</th>
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<td>Bath pickles Metal and creates</td>
<td>Accelerator level too high</td>
<td>Reduce accelerator level by processing the aluminium or auto-draining* and adjusting the bath.</td>
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<tr>
<td>Dusty Coating.</td>
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<td>Aluminium concentration too high in bath.</td>
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<tr>
<td></td>
<td>Accelerator too low.</td>
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<tr>
<td></td>
<td>Concentration too low.</td>
<td>Add accelerator.</td>
</tr>
<tr>
<td></td>
<td>Total acid too high in relation to chromium concentration.</td>
<td>Add make-up chemical</td>
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<tr>
<td></td>
<td></td>
<td>Autodrain* bath and adjust.</td>
</tr>
<tr>
<td>No coating</td>
<td>Total absence of accelerator in bath</td>
<td>Add accelerator</td>
</tr>
<tr>
<td>Sludge Plugging in Nozzles</td>
<td>Aluminium concentration in bath too high.</td>
<td>Autodrain* bath and adjust</td>
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<tr>
<td></td>
<td>Alkaline salts dragged into bath</td>
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Trouble Shooting Guide for Powder Coating

INTRODUCTION

There are a wide variety of powder coating materials available; each with its own characteristics. Fluidised bed or electrostatic application can be used. Application reclaim and auxiliary equipment vary from supplier to supplier. However, there are operation problems common to all. This chapter will provide a systematic check list to follow when a problem arises.

Many of these problems can be avoided with good procedure and supervision. Close attention to a few critical areas will eliminate potential operation problems with a powder finishing system. Careful attention should be given to having a clean, dry, compressed air supply, clean sieved reclaim powder, good ground to parts and equipment, humidity controlled spray booth air, and regular inspection and replacement of wear parts. The powder coating equipment should be installed and operated as recommended by the equipment supplier’s manual. Follow the recommendations on your powder coating material data sheets. Have a good regular preventive maintenance program and good housekeeping practices.

Following are some trouble-shooting procedures that may be of value in correcting difficulties that may arise with powder coating operations.
POWDER SUPPLY PROBLEMS:

1) Fluidized Bed Operation

Trouble

1. Dusting—powder blowing Out of hopper

2. No air-precooling through powder surface

3. Rat holing—air blowing large jet holes through powder surface

Possible Causes

1. Air pressure too high
2. Powder too fine

1. Insufficient air pressure

2. Plugged Membrane

3. Obstructed membrane

4. Compacted powder

Stratification—powder separating into layers of fine and coarse particles.

1. Powder level too low
2. Packed or moist powder.

3. Obstructed membrane

4. Plugged or broken membrane

1. Powder level too high
2. Powder too fine.
Possible Solutions

1. Adjust air regulator to lower pressure to fluid bed.
2a. Too much reclaim added to virgin powder
2b. Virgin powder pulverised too fine by manufacturer.
1a. Check air supply, increase air regulator pressure
1b. Check air line size to equipment.
2. Check membrane for plugged pores dirty air supply.
3. Check bottom of bed for plastic, cardboard or other large obstructions.
4. Manually loosen powder and fluidize well with clean, dry air.
1. Add powder until hopper is 2/3 full when fluidized.
2a. Manually loosen powder and fluidize well with clean, dry air.
2b. Check compressed air and booth air for high humidity.
3. Check bottom of bed for plastics, cardboard or other large obstructions.
4. Check membrane for plugged pores from dirty air supply, cracks or holes.
1. Remove powder until 2/3 full when fluidized.
2a. Too much reclaim added to virgin powder.
2b. Virgin powder pulverized too fine by manufacturer.

POWDER SUPPLY PROBLEMS:
2) Hoses and pumps: Venturi operation Trouble
1. Plugged from impact fusion hard build-up
2. Insufficient powder feed.
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<thead>
<tr>
<th>Possible Causes</th>
<th>Possible solutions</th>
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<td>1. Clean or replace parts</td>
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<td>3. Moisture in air supply</td>
<td>3. Check air supply for clean, dry air</td>
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<td>5. Worn venturie and wear parts</td>
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<td>6. Powder too fine</td>
<td>6a. Too much reclaim added to virgin powder</td>
</tr>
<tr>
<td></td>
<td>6b. Virgin powder type pulverized too fine by manufacturer</td>
</tr>
<tr>
<td>7. Powder type of formula</td>
<td>7. Some resin types tend to have more impact fusion. Check with your powder supplier</td>
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<tr>
<td>1. Powder not fluidizing</td>
<td>1. See fluidized bed section.</td>
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<tr>
<td>2. Obstruction from contamination powder supply</td>
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<td>3. Kinked or flattened hoses</td>
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<td></td>
<td>3b. Avoid sharp bends. Use hose saddles for reciprocators.</td>
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<td></td>
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<tr>
<td>5. Low air pressure</td>
<td>5. Check air supply. Adjust all setting to pumps and guns.</td>
</tr>
</tbody>
</table>

3) Electrostatic coating operation

**Trouble**

1. Poor charging inadequate powder build or wrap on part.
### Possible Causes

1. High voltage source not providing enough KV at charging electrode or grid.

2. Poor ground.

3. Powder delivery (feed) is too high.

4. Excessive moisture in powder booth air.

5. Powder too fine.

6. Powder type or formula.


### Possible Solutions

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High voltage source not providing enough KV at charging electrode or grid.</td>
<td>1a. Check high voltage source is on. Systematically check electrical continuity from voltage source to electrode (grid) including cable, resistors and fuses.</td>
</tr>
<tr>
<td></td>
<td>1b. Replace missing or broken electrode (grid) insulated by powder build or impact fusion.</td>
</tr>
<tr>
<td></td>
<td>1c. Clean electrode (grid) insulated by powder build or impact fusion.</td>
</tr>
<tr>
<td>2. Poor ground.</td>
<td>2. Check ground from conveyor rail (or rub bar when used) through hanger to part. All contact areas must be free from heavy grease and other insulating material</td>
</tr>
<tr>
<td>3. Powder delivery (feed) is too high</td>
<td>3. Turn down powder feed until all material passing through charging corona (field) is adequately charged.</td>
</tr>
<tr>
<td>4. Excessive moisture in powder booth air.</td>
<td>4. Moisture in humid air will tend to dissipate humidity in the powder spray area.</td>
</tr>
<tr>
<td>5. Powder too fine.</td>
<td>5a. Too much reclaim added to virgin powder.</td>
</tr>
<tr>
<td></td>
<td>5b. Virgin powder pulverized too fine by manufacturer.</td>
</tr>
<tr>
<td>6. Powder type or formula</td>
<td>6. Some resin type charge better than others and some formulas are designed for thin firm applications. Check with your powder supplier.</td>
</tr>
<tr>
<td>7. Powder delivery air too high. Powder blowing by part.</td>
<td>7. Turn down air setting or move gun position further away from part.</td>
</tr>
</tbody>
</table>
4. Powder picks up charge through powder hoses. Reverse charging usually through reclaim system.

**Possible Causes**

1. Powder delivery too high

2. Poor ground.

3. Powder spray pattern too wide

4. Voltage too high.

5. Powder delivery velocity too high

6. Poor gun placement

7. Powder too fine

1. Voltage too high.

2. Gun positioned too close to part.

3. Poor ground

4. Powder too fine.

1. Powder booth air too dry
Possible Solutions

1a. Turn up powder delivery air setting.
1b. Use barrel extension.

2. Check ground.
   See page 16
2. Poor ground.
   - solution.

3. Select smaller deflector or use suitable slotted barrel and cover. (consult your equipment supplier).

4. Turn voltage setting down so powder builds on part edges and leading surfaces do not repel powder from corner.

5. Turn air setting down so powder/air stream does not blow powder out of corners.

6. Adjust gun position so powder cloud has direct path to recess area.

7a. Too much reclaim added to virgin powder.
7b. Virgin powder pulverised too fine by manufacturer.

1. Turn down voltage setting.
2. Change gun placement away from part.
3. Check ground
   See page 16
3. Poor ground.
   - solution.
4a. Too much reclaim added to virgin powder.
4b. Virgin powder pulverised too fine by manufacturer.

1. Adjust powder spray area humidity.

Possible Causes

1. Insufficient air pressure volume

Trouble

5. Powder feed spurting or slugging interrupted powder feed.

2. Hoses kinked, flattened or too long.

3. Hoses, pump venturies or guns clogged with powder.

6. Poor spray pattern – not a symmetrical powder cloud (not applicable when using special deflectors for desired effect.)

4. Hoses, venturies or gun blocked with powder

Continued
### Possible Solutions

1. Check air supply. Air supply piping to equipment is large enough. Enough air volume must be provided so that when other equipment such as reverse air cleaning in reclaim housing pulses, air pressure to powder feed does not drop.
2. Check powder feed hoses.

3a. Clean hoses, venturis and guns.
3b. Check air supply for moisture that causes powder compaction.
3c. Check spray booth air humidity.
3d. Check powder supply for contamination. Check reclaim sieve.

1. Replace worn feed tubes, orifices deflectors and covers.
2. Clean gun parts as needed.
3. Check air supply, Increase air for powder feed.
4. Clean hoses, venturis and guns.

### POWDER SUPPLY PROBLEMS:

#### 4) Collection and reclamation operation

**Trouble**

1. Contamination in reclaim powder.

#### Possible Causes

1. Reclaim in-line sieve torn, missing or inoperable.
2. Powder or dirt falling in spray booth from conveyor or hangers.
3. Contamination from parts entering spray booth
4. Contamination from plant air circulated through spray booth.

#### 1. Bag or cartridge filters blinding

2. Spray booth dusting inadequate air flow through spray booth
3. Too large of open area in spray booth housing.
4. Powder delivery (feed) too high
### Possible Solutions

1. Replace sieve or repair as necessary
2. Clean conveyor regularly (or continuously) before entering powder spray booth. Strip hangers as needed.
3. Check cleaning pre-treatment equipment and ensure proper part drainage before spray booth.
4. Isolate spray booth area. Preferably enclose in a room filtered, humidity controlled air.

#### 1a. Clean or replace bags or cartridge filters
#### 1b. Check spray booth air humidity.
#### 1c. Check reverse air cleaning.

#### 2. Check filter bags or cartridges for powder leakage, repair or replace as needed.

#### 3. Reduce open area. Increased opening reduces booth air velocity.

#### 4. Reduce the number of spraying or the amount of powder to each gun.

### CURED FINISH PROBLEMS
5) Coating finish-cured physical properties

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Poor adhesion</td>
<td>2. Poor cleaning or pre-treatment</td>
</tr>
<tr>
<td>3. Poor corrosion resistance</td>
<td>3. Film thickness too high</td>
</tr>
<tr>
<td>4. Poor chemical resistance</td>
<td>4. Change in substrate thickness or type</td>
</tr>
<tr>
<td>5. Poor pencil hardness/ poor abrasion resistance</td>
<td>5. Powder resin type or formula</td>
</tr>
</tbody>
</table>

1. Poor cleaning or pre-treatment
2. Under-cured

1. Under cured.
2. Powder resin type or formula
Possible Solutions

1a. Increase oven temperature
1b. Increase dwell time in oven.
2. Check pre-treatment equipment and chemicals
3. Reduce film thickness by adjusting application equipment.
4. Check substrate with supplier.
5. Check with powder manufacturer.

CURED FINISH PHYSICAL PROBLEMS

Trouble

1. Poor surface flow—too much orange peel.
2. Gloss too low— for high gloss powder
3. Gloss too high— for a Matt type powder
4. Contamination in powder.
5. Inconsistent film thickness

Possible Causes

1. Film thickness too thin
2. Heat-up rate too slow
3. Powder resin type or formula.
4. Incompatible powder contamination
5. Micro-pinholing from gassing.
6. Over cured film.
7. Powder formula
8. See reclaim system: contamination No. 1 through No. 4
9. Virgin powder contaminated
10. Guns positioned wrong.
11. Reciprocators not matched to line speed.
13. Defective spray equipment
Possible Solutions

1. Increase film thickness by adjusting application equipment.
   2a. Increase oven temperature.
   2b. Modify oven baffling to increase heat rate.

3. Check with powder manufacturer.

1. Clean application equipment before changing powders.
   2a. Check substrate for porosity.
   2b. Check substrate for moisture.
   2c. Check powder for moisture from reclaim or compressed air.
   2d. Check film thickness, coating too thick.

3. Check oven temperature

4. Check with powder manufacturer

1. Increase temperature of oven.
   2b. Increase dwell time in oven

2. Check with powder manufacturer.

2. Check with powder manufacturer

1. Check and reposition guns so that spray patterns overlap slightly
   2a. Adjust line speed : Adjust reciprocator stroke.

3. Consult your equipment supplier.

4. Go through application section check list.

CURED FINISH PHYSICAL PROBLEMS Continued

Trouble


7. Pinholing and gassing through coating surface.

8. Pull-way or tearing coating film shrinks leaving bare substrate.

Possible Causes

1. Improper oven

2. Bake time too long.

3. Oven temperature too high

4. Variation in film thickness

5. Powder formula.

1. See coating appearance section, low gloss, No.2 and No.3.

1. Uncharged powder.

2. Poor cleaning, metal preparation or dry off..
Possible Solutions

1. Check exhaust vent fan(s)
2. Adjust line speed
3. Lower oven temperature.
4. See coating appearance page 21, point 5 inconsistent film thickness causes point 1 to 4
5. Check with powder manufacturer.

POWDER APPLICATION PROBLEMS

6) Output of powder insufficient to coat parts.

Possible Reasons

1. Poor fluidizing properties in the powder hopper.
2. Blockage in venturies and hoses.
3. Pressure of fluidizing air too low.
4. Fluidizing membrane is blocked
5. Humidity of compressed air too high
6. Humidity of the powder too high
7. Free-flowing properties of the powder are bad.

Possible Causes

1. Fusing of the powder in the venturi
2. Fusing of the powder in the hoses.
3. Fusing of the powder in the hoses
4. Bad free flowing properties of powder.
5. Check pre-treatment process, dry off oven and part drainage.
Possible Solutions

1. Adjust (increase) pressure of fluidizing air.
2. Clean or replace the fluidizing membrane: see instructions of equipment supplier.
3. Install an air dryer with a corresponding oil micro filter or another suitable drying system.
4. Check storage facilities. Powder shall be stocked at room temperature (30°C) in closed packing (Maximum humidity 60%).
5. Contact your powder supplier.

POWDER APPLICATION PROBLEMS
Continued

Possible Causes

1. Fusing in the gun or gun outlet.
2. Blockage caused by contamination of the powder with dust of other coarse materials.

Possible Reasons

1. Clean or replace the hoses (see instruction of the equipment supplier) if necessary reduce pressure of powder of transport air.
2. Clean the hose by bending and breaking up the fused powder if necessary replace it.
3. Install an air dryer with a corresponding oil micro filter or an air dryer with a corresponding oil micro filter or another.
4. Contact your powder supplier.

Possible Reasons


Possible Causes

1. Fusing in the gun or gun outlet.
2. Blockage caused by contamination of the powder with dust of other coarse materials.
### Solutions

1. Clean the gun according to the instructions of your equipment supplier. When blocking occurs frequently, check humidity of compressed air and the freeflowing properties of the powder.

2. Clean the gun according to the instructions of the equipment supplier and determine the reason of this contamination. (Check powder pumps for possible impact fusion. Impact fusion particles which break off in the pump could be transported to the spray gun and result in blockage.)

### POWDER APPLICATION PROBLEMS

#### 7) Poor or insufficient coverage

<table>
<thead>
<tr>
<th>Possible Reasons</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Insufficient wraparound</td>
<td>1. Poor electrostatic charging of the powder.</td>
</tr>
<tr>
<td>2. Poor penetration into corners, flanges, slots, etc</td>
<td>2. Insufficient ground contact.</td>
</tr>
<tr>
<td></td>
<td>3. Output of powder too low</td>
</tr>
<tr>
<td></td>
<td>4. Using an unsuitable powder supplier.</td>
</tr>
<tr>
<td></td>
<td>1. Output of powder too low</td>
</tr>
<tr>
<td></td>
<td>2. Insufficient ground contact.</td>
</tr>
<tr>
<td></td>
<td>3. Powder cloud too wide</td>
</tr>
</tbody>
</table>
Solutions

1a. Adjust level of electrostatic kilovoltage (Increase). If not possible, check equipment and guns according to instructions of the equipment supplier.
1b. Check for broken electrodes on the spray gun. If found, replace electrodes.
1c. Check for possible frictional transport through powder hose. If evident, consult powder supplier for hose material recommendation.
2. Check the ground contacts using a measuring device. Correct and insure sufficient earth to ground control.
3. Turn up powder delivery air setting.
4. Contact your powder type.

Possible Reasons

3. Poor adherence of powder to part, powder falls from part easily.

Possible Causes

1. Poor electrostatic charging of the powder.
2. Powder output too high or the pressure for the transport air too high, which blows the powder from the object.
3. Unsuitable particle size distribution of the powder or unsuitable powder type for the objects.

POWDER APPLICATION PROBLEMS
Continued

1. Turn up powder delivery air setting.
2. Check the ground contact and if necessary use a suitable measuring instrument.
3. Narrow powder cloud. If necessary install a more suitable deflector or adjust air for cone adjustment.
Possible Solutions

1a. Adjust level of electrostatic kilo-voltage. (Increase voltage if not possible, check equipment and guns according to instructions of equipment supplier.)
1b. See “Insufficient Wrap around” problem 1b, page 25.
2. Reduce powder output and/or reduce pressure of the transport air.
3. Contact your powder supplier.

Possible Causes

1. Contamination with other powder (based on other raw materials).

CURED FINISH APPEARANCE PROBLEMS
8) Coating finish-cured films appearances.

Possible Reasons

1. Dust, precured or other coarse material.

Possible Causes

1a. Dust or other coarse parts on the metal surface.
1b. Dust or other coarse parts in powder.

2. Matting or powder surface.
3. Orange-peel.
4. Cratering

Possible Causes

1. Warming-up of the coated material is too slow or too fast.
2. Powder type too fast or too coarse particle size distribution.
3. Moisture contamination.
1. Contamination with other powder (based on other raw materials.)
3. Contamination with incompatible materials from the spraying areas e.g. silicones
Possible Solutions

1a. Check pre-treatment. High sludge level in phosphate bath.
1b. Check powder and locate the cause of this contamination; if necessary clean up the installation and use fresh or sieved powder.

1. Clean up the installation, if necessary contact your powder supplier.
2. Check curing-cycle and curing oven; if necessary contact your powder supplier.
3. Contact your powder supplier.
4. Replace the powder.

Possible Causes

1. Humidity of the powder too high
2. Air entrapment with casting.

Possible Reasons

5. Pinholing

Possible Reasons

2. Air entrapment with casting.
3. Gas entrapment and escaping due to chemical reaction.
Possible Solutions

1. Check storage facilities. Powder shall be stocked at room temperature in closed packing (maximum humidity 75%)

2. Preheat objects over 320 F (160ºC) and cool down before applications (only galvanized), or contact your powder supplier, who can advise you a special developed powder.

3. Keep coating thickness below 100 microns; if necessary contact your powder supplier.