

## **PRETREATMENT FOR POWDER COATING**

- WHAT IS POWDER COATING
- WHAT IS PRETREATMENT
- PRETREATMENT FOR MILD STEEL
- PRETREATMENT FOR ALUMINIUM
- PRETREATMENT FOR GALVANIZED SHEETS
- PRETREATMENT FOR CASTING MATERIAL
- PROBLEMS ENCOUNTERED BECAUSE OF IMPROPER PRETREATMENT.

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## **1. WHAT IS POWDER COATING**

Powder coating is an advanced method of applying a decorative and protective finish to a wide range of materials and products that are used by both industries and consumers. The powder used for the process is a mixture of finely ground particles of pigment and resin, which is sprayed onto a surface to be coated. The charged powder particles adhere to the electrically grounded surfaces until heated and fused into a smooth coating in a curing oven. The result is a uniform, durable, high-quality, and attractive finish.

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## **2. WHAT IS PRETREATMENT FOR POWDER COATING**

Pretreatment means surface preparation.

Here by pretreatment, we mean metal pretreatment as the powder coating is predominantly applied to metals.

Surface preparation includes:

### **Cleaning – mechanical or chemical**

Mechanical cleaning includes methods like scratch brushing and sand blasting. This by abrasive action not only removes the surface impurities but also eliminates scratches and surface irregularities. Cleaning is very good, however, coating must be done immediately because the cleaned surface is in a highly reactive state and corrosion occurs very soon.

Chemical cleaning includes removal of dirt, oil and grease, and the oxidation products present on the surface by means of chemicals. The chemicals may be applied by wiping, spraying or dipping. The nature of chemicals used depends upon the base metal and will be discussed later in detail.

### **Application of conversion coating.**

Conversion coating. – These are applied for three purposes: 1) provide temporary in process corrosion protection before application of powder coating. 2) promote good adhesion of the powder coating to the substrate. 3) impart under paint corrosion & thereby improve the life of the powder coating. The type of the conversion coating used also depends upon the base metal and will be discussed later.

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### **3. PRETREATMENT FOR MILD STEEL**

**TENDENCY OF MATERIAL :-** picking up rust when exposed to atmosphere bare.

**NEED OF CLEANING - Presence of oil, grease, rust and black scale on the surface.**

Mild Steel material is known for its tendency of going under rapid oxidation when exposed to atmosphere bare. The result of oxidation is the formation of oxide layer on the surface which we commonly call as 'RUST'.

To avoid this oxidation or rusting, the mild steel material is not allowed to get directly exposed to atmosphere. For this, we generally find rust preventive oil on the surface of mild steel material. The oil does not allow the material to come in direct contact with air and thus delays oxidation. However, this doesn't entirely eliminates the problem of rusting and it only delays the process of rust formation.

Some mild steel materials are hardened for strengthening and similarly some are welded during fabrication. Both these processes leave black scale on the surface.

In short, mild steel parts generally have rust and/or grease-oil and/or black scale on the surface. All these cause severe problems of bonding if not removed before application of paint.

**NEED OF CONVERSION COATING – The bare metal being extremely susceptible to atmospheric corrosion should be applied with conversion coating**

Before painting, once the rust, oil and scale are cleaned, the bare metal is again exposed for oxidation. To avoid this, the material has to be coated with some type of conversion coating which prevents further oxidation before applying paint and also gives adhesion for paint.

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## **PRECLEANING OF MILD STEEL**

### **DEGREASING - Removal of oil and grease from the surface.**

This can be done by

#### ***Solvent Based Degreasing:-***

Petroleum based solvents have excellent degreasing abilities but are not commonly used because they are highly inflammable.

#### ***Alkaline degreasing powders :-***

This is generally a blend of alkalies and surfactants. This is advised to be used under hot conditions. However, alkaline powders are also used under cold conditions as knock out degreasing stage.

#### ***Acidic Degreasing :-***

These are solvent based liquids which are acidic in nature. They remove rust as well as grease under cold conditions. The bath of these chemicals is however, much expensive as their concentration is much higher than alkaline degreasing.

### **DERUSTING – Removal of rust and light scale from the surface.**

These are necessarily acidic chemicals unlike degreasing, which may be alkaline in nature. The chemical is generally a blend of mineral acids like phosphoric acid, sulfuric acid and hydrochloric acid with added inhibitors. Higher acidity will result in faster removal of rust. However, this will affect the life of the coating applied later.

Phosphoric acid based derusting chemicals are most suggested for pretreatment of mild steel before applying paint.

### **DESCALING – Removal of heavy scale and heavy rust from the surface.**

These are strong mineral acid based chemicals with added inhibitors.

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## **CONVERSION COATING FOR MILD STEEL**

The most common types of conversion coating include :

- **Zinc phosphate coating**
- **Iron phosphate coating**

Zinc phosphate coating is crystalline heavy coating gray in colour. While iron phosphate coating is amorphous conversion coating that ranges in color from iridescent blue to gray.

Iron phosphate coating gives minimum sludge formation and hence smoother finish than zinc phosphate. Apart from this the bonding characteristics are also good. Iron phosphate processes are much easier to operate than zinc phosphate processes and require fewer process stages (zinc phosphate coating requires a predip in activation chemical prior to phosphating to have micro crystalline grain structure), but iron phosphates do not provide the degree of corrosion protection imparted by zinc phosphates.

Iron phosphate systems are therefore used for a range of products requiring a durable finish that are not exposed to severely corrosive environments.

Zinc phosphating processes have been developed to provide exceptional painted part durability in corrosive requirements. Typical industries using zinc phosphate processes include automotive, appliance and truck and bus.

## **POST-TREATMENT**

After a metal surface receives a conversion coating, the surface is water rinsed to remove unreacted conversion coating chemicals and a post-treatment is applied. The post-treatment can provide a two- to ten-fold increase in corrosion resistance and humidity resistance when compared to conversion coatings without final rinses. Post-treatments are generally based on chromic acid.

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**SEQUENTIAL PROCESS FOR PRETREATMENT OF M.S.**

**Seven (or eight) stage treatment for zinc/iron phosphate include following stages:**

- 1. Degreasing**
- 2. Water rinse**
- 3. Derusting**
- 4. Water rinse**
- 5. Activation : This gives more compact and uniform coating of zinc phosphate. This step can be omitted for iron phosphate process.**
- 6. Phosphating : This forms coating of zinc phosphate (4 to 6 microns) OR iron phosphate (1 to 1.5 microns) on the clean surface of M.S.**
- 7. Water rinse**
- 8. Passivation : This will seal the pores of phosphating.**
- 9. Drying.**

**CLEANER-COATER SYSTEM-3 IN 1 CHEMICAL.**

Cleaner-coater system for mild steel is a much simplified treatment than 8 tank process. This is done in a single tank with 3 in 1 chemical. In this system, all three processes of degreasing, derusting and iron phosphating are done with single chemical, thus making the process time effective. However, its corrosion resistance and bonding properties are not as good as that of 8 tank process.)

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#### **4. PRETREATMENT FOR ALUMINIUM**

**TENDENCY OF MATERIAL:-** Aluminium is known for its tendency of undergoing natural oxidation forming a thin layer of aluminium oxide on the surface.

#### **NEED OF CLEANING – PRESENCE OF OIL AND/OR LAYER OF ALUMINIUM OXIDE ON IT'S SURFACE.**

Aluminium has a tendency to undergo natural oxidation forming a thin layer of aluminium oxide on the surface. Apart from this, commonly known process of anodizing also leaves layer of aluminium oxide under the influence of electric current. This is not a good base to apply powder or any other coating. Hence, it must be removed before powder coating.

Apart from this, there may be oil on the surface which may have come during fabrication process. This must be removed to have proper bonding of powder coating.

#### **NEED OF CONVERSION COATING - TO PREVENT FURTHER OXIDATION OF CLEANED ALUMINIUM SURFACE.**

#### **PRECLEANING OF ALUMINIUM**

**This include :**

**Alkaline Cleaning & Acidic Cleaning**

**Strong alkaline cleaners**

**Mild alkaline cleaners**

The aluminium material is very sensitive to alkaline attack. There for alkaline cleaners are milder for aluminium than for mild steel. However, if there is anodizing layer on aluminium, caustic soda based strong alkaline cleaner has to be used. However, this leaves black smut on the surface. To remove this aluminium is deeped in weak bath nitric acid.

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### **Acidic Cleaning**

These are based on phosphoric acid. They are capable of removing anodizing layer without formation of black smut and hence reduces additional step of rinsing in nitric acid.

### **CONVERSION COATING FOR ALUMINIUM**

**This include :**

- **Chromium Phosphate coating – Green in colour**
- **Chromate coating – Yellow in colour**

### **SEQUENTIAL PROCESS FOR PRETREATMENT OF ALUMINIUM**

**Six stage treatment for aluminium include following stages:**

- 1. Alkaline Degreasing**
- 2. Water Rinse**
- 3. Nitric acid**
- 4. Water Rinse**
- 5. Chromating**
- 6. Water Rinse**

**Alternatively, four stage treatment for aluminium is as follows.**

- 1. Acidic Degreasing**
- 2. Water rinse**
- 3. Chromating**
- 4. Water Rinse**

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**CLEANER-COATER SYSTEM-3 IN 1 CHEMICAL.**

Cleaner-coater system for aluminium is a much simplified treatment than 6 tank process. This is done in a single tank with 3 in 1 chemical. In this system, all three processes of degreasing, oxide layer removal and aluminium phosphating are done with single chemical, thus making the process time effective. However, its corrosion resistance and bonding properties are much inferior than conventional chromating process.

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## **5. PRETREATMENT FOR GALVANIZED SHEETS**

**TENDENCY OF MATERIAL :-** Like aluminium, galvanized material has tendency to undergo natural corrosion forming a thin layer of zinc oxide or zinc carbonate on the surface which we commonly call as white rust.

### **NEED OF CLEANING – PRESENCE OF OIL AND/OR LAYER OF WHITE RUST ON IT'S SURFACE**

Galvanized material generally has white rust on the surface. This is not a good base to apply powder or any other coating. Hence, it must be removed before powder coating. Apart from this, there may be oil on the surface which may have come during fabrication process. This must be removed to have proper bonding of powder coating.

### **NEED OF CONVERSION COATING :- TO PREVENT FURTHER OXIDATION OF CLEANED GALVANIZED SURFACE.**

## **PRECLEANING OF GALVANIZED SHEETS**

**This include :**

### **Alkaline Cleaning & Acidic Cleaning**

#### **Alkaline Cleaning**

These are capable of removing only oil. They can not remove white rust.

#### **Acidic Cleaning**

These are based on phosphoric acid. They are capable of removing white rust in addition to grease and oil.

## **CONVERSION COATING FOR ALUMINIUM**

**This include :**

- **Zinc Phosphate coating**
- **Chromate coating**

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**SEQUENTIAL PROCESS FOR PRETREATMENT OF GALVANIZED SHEETS**

**Eight stage treatment for galvanized sheets include following stages:**

- 1. Alkaline Degreasing**
- 2. Water rinse**
- 3. Acidic Degreasing**
- 4. Water rinse**
- 5. Alkaline Activation**
- 6. Zinc Phosphating**
- 7. Water Rinse**
- 8. Passivation**

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## **6. PRETREATMENT FOR DIE CASTING MATERIAL**

**TENDENCY OF MATERIAL :-** Like galvanized sheets, die casting material has tendency to undergo natural corrosion forming a thin layer of zinc oxide or zinc carbonate on the surface which we commonly call as white rust. This material is porous, hence must be properly dried after pretreatment.

**NEED OF CLEANING – PRESENCE OF OIL AND/OR LAYER OF WHITE RUST ON IT'S SURFACE**

**NEED OF CONVERSION COATING :- TO PREVENT FURTHER OXIDATION OF CLEANED SURFACE OF DIECASTING MATERIAL**

### **PRECLEANING OF DIE CASTING MATERIAL**

#### **Mild alkaline cleaners**

Like aluminium, this material is very sensitive to alkaline attack. There for alkaline cleaners are milder for this material. Strong alkaline cleaners are not used because they over etch the material leaving black smut which can not be removed even in nitric acid completely. This also leaves powdery layer on the material which is not good for the bonding of powder coating.

#### **Acidic Cleaning**

These are based on phosphoric acid. They are capable of removing white rust along with oil without formation of black smut if proper timing is given.

### **CONVERSION COATING FOR DIE CASTING MATERIAL**

**Chromate coating – Golden Yellow in colour**

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**SEQUENTIAL PROCESS FOR PRETREATMENT OF DIE CASTING  
MATERIAL**

**Alternatively, four stage treatment for aluminium is as follows.**

- 1. Acidic Degreasing / Alkaline Degreasing**
- 2. Water rinse**
- 3. Chromating**
- 4. Water Rinse**

## **7. PROBLEMS BECAUSE OF IMPROPER PRETREATMENT**

Pretreatment is the base for powder coating. It is said that you can not make a good coating work with poor pretreatment. Hence utmost care should be taken to ensure proper pretreatment is applied before powder coating.

Proper pretreatment means application of the right process and proper maintenance of the chemicals.

### **PROBLEMS BECAUSE OF IMPROPER CLEANING :-**

1. Appearance of oily patches.
2. Appearance of pin holes.
3. Appearance of rusty surface beneath powder coating film.

### **PROBLEMS BECAUSE OF IMPROPER CONVERSION COATING :-**

1. Reduced resistance to weather.
2. Reduced mechanical resistance.
3. Poor finish of the powder coating film.

### **PROBLEMS BECAUSE OF IMPROPER DRYING :-**

1. Appearance of pin holes.
2. Poor bonding of the powder coating film.

These problems can be avoided by the choice of right process – right chemicals and proper maintenance of the chemicals.

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