

## **Unit 7 Painting & Refinishing**

Paint is normally defined as a liquid which, when applied to a surface of an object, forms a thin layer and hardens with time to create a film on that surface. Painting is the application of paint on the surface of an object for the purpose of protecting it from the elements, beautifying its appearance or for marking it with certain designations.

### **OBJECTIVES OF PAINTS:-**

#### **1. Protection**

The automobile is constructed primarily of steel sheet metal. If this steel was left uncovered, the reaction of oxygen and moisture in the air would cause it to rust. Painting serves to prevent the occurrence of rust, therefore protecting the body.

#### **2. Appearance Improvement**

The shape of the body is made up of several types of surfaces and lines, such as elevated surfaces, flat planes, curved surfaces, straight and curved lines, etc. Therefore; another objective of painting is to improve the body appearance by giving it a 3- dimensional color effect.

#### **3. Quality Upgrading**

When comparing two vehicles of identical shape and performance capabilities, the one with the most beautiful paint finish would have been have a higher market value.

Hence, another objective of painting is to upgrade the value of the product

#### **4. Color Designation.**

Still another objective of painting the automobile is to make them easily distinguishable by application of certain colors or markings. Examples are police and fire department vehicles.

## **AUTOMOBILE PAINTS**

Functional Nomenclature	Primary objective	Use and features
Primer	Adhesion and anti-corrosion	Applied directly to panel surface.
Primer-surfacer	Adhesion, anti-corrosion and smoothness	Intermediate between primer and surfacer. Applied to metal surface or over primer.
Surfacer	Smoothness and prevention of top coat absorption	Thick application possible to provide smoothness. Applied over primer.
Putty	Filler	To smooth out rough spots.
Sealer	Prevent absorption of topcoat	Intermediate between surfacer and top coat. Prevents absorption of top coat and helps avoid troubles arising from old (previous) paint.
Top coat	Upgrades external appearance	Gives color, gloss and body to help upgrade merchandising value.

## PAINTING METHODS

Painting Method	Outline	Example of use
Spatula	Wooden, plastic or rubber spatula used to spread thick amounts of high viscosity putty for smoothing rough spots.	Railroad cars
Brush	Pig hair or horse hair brush used. Easy to apply regardless of shape of adherend, location or equipment available. Long established and widely used method.	Building materials
Roller	Used for continuous painting of long and smooth items which allow passage of roller width	Sheet metal

	Roller Brush	Uses hair or synthetic fiber roller. Suitable for flat surfaces such as walls.	Building materials
	Flow Coaler	Paint flows in form of thin curtain onto adherend which moves by on a conveyer.	Building materials
Immersion	Dipping	Adherend dipped into paint bath. Paint reaches all areas of adherend.	
	Electrode-position	Also called ED. Direct current passed through paint and adherend to cause paint film adhesion.	Metal
	Powder coating (dry painting)	Adherend dipped into powdered paint. Paint film formed by heat fusion. Typical types include fluidized bed coating, flame spray coating and electrostatic coating.	
Spray	Air spray	By means of compressed air, paint is sprayed by gun through atomizer nozzle. Provides good paint finish and can be used regardless of adherend shape or material so it is used extensively. This is the most common method for automobile painting.	
	Airless spray	High pressure applied directly to paint to force it from nozzle by high-speed injection to atomize it. Compared with air spray, there is less paint loss through scattering and a thicker layer can be applied.	Building materials
	Electrostatic	Adherend electrically charged with positive (+) current and paint electrically charged with negative (—) current to cause electrical attraction of the paint to the adherend.	Metal

## NEW VEHICLE PAINTING PROCESS

Because a high degree of rust prevention and attractiveness are required of automobile bodies, they go through a comparatively complicated painting process. Basically, there are 4 stages to the painting process; a pre-treatment stage which is known as the 3-coat, rust prevention stage, the undercoat stage, the second-coat stage for the purpose of enhancing appearance and the top-coat stage. For trucks, only two coats are applied during the second-coat stage. In the actual painting process, however, several other stages are employed which make it a much more complicated operation.

## **1. Degreasing and Chemical Treatment Stage.**

In this stage, dirt and grease are completely removed from the body panels and a zinc phosphate film is formed to help prevent rust and assist adhesion of the undercoat. There are two methods of doing this ; by spraying a chemical onto the panels or dipping the body into the chemical. However, in respect to anti-corrosion performance (described below), new companies almost exclusively uses the full dip method.

### **Features of Full Dip Method:**

- With complete immersion, sufficient treatment can be applied even to the areas of the body, where corrosion easily occurs such as the inner-side of the doors and rocker panel.
- As can be seen in the photos below, the finished phosphate film of the full dip method is made up of minute crystals which provide a better anti- corrosion performance.
- There is no bothersome clogging of the spray nozzle which results in better quality and reliability.

## **2. Electrodeposits Painting Stage.**

This is the stage in which the body is completely dipped into ED paint so that the paint is applied evenly not only on the panel surfaces but also to every joint and closed section. From the standpoint of corrosion prevention, this is a very important stage. As the paint applied at this stage forms the bottom most layer of the finished paint film, it is also called the undercoat or undercoat film. After the chemical treatment stage, the body is immediately dipped into the ED tank where where 200-300V of direct current charge is applied. Then, after removal of sags and shower, it is dried at 150-170°C (302-338T) for 25-30 minutes. The thickness of film at this stage is 15-20 $\mu$  for regular panel surfaces and 10  $\mu$  for the rocker panel.

There are two methods of ED painting; the anionic method in which the body is given positive electrical charge and the cationic method in which the body is given a negative charge now-a-days the cationic method is used almost exclusively because it provides a better anti-corrosion performance.

As mentioned above, with anionic method, a positive charge is applied to the body and negative charge to the paint. A problem of this method is that the zinc phosphate applied in the previous pre-treatment stage and the steel is attracted by the negative charge and dissolves into the paint, thereby lowering the anti-corrosion performance.

With the cationic method, the body is given a negative charge and the paint a positive charge so that there is no dissolving of the pre-treatment film, assuring a better anti-corrosion effect

After exiting from the dryer and while still suspended on a hanger, the underbody is given as undercoat by airless spray in-order to reduce road noise and vibration. Then the body

is placed on a dolly and is transported to a floor conveyer where it proceeds to the color indication stage. The color indication stage is where, for the first time, the exterior panel paint specifications vary in accordance with the vehicle chassis, model and destination.

#### Indicated items

Outer panel color, inner panel color, instrument panel color, 2-tone specification, design black, area anti-corrosion treatment, tape stripe, etc. Thereafter, the body passes through the following-listed stages while advancing to the 2nd-coat stage.

### 3. Second Coat Painting Stage.

Here any roughness of the base metal ED paint film is corrected and a 2nd coat is applied to upgrade the quality of the top coat. Also, at this stage, the engine compartment and inner trunk are painted, the instrument panel is given a dull coat and the door frames are given a semi-gloss coating. An example of a second coat line is shown below.

For the purpose of maintaining consistent quality, the film thickness applied at this stage is  $30\mu$ . After drying at  $140^{\circ}\text{C}$  ( $284^{\circ}\text{F}$ ) for 30 minutes, the body is inspected and an Undercoat is applied to the inner wheel housing before proceeding to the the wet sanding Stage.

During wet sanding, the 2nd coat finish is smoothed out and rubbed down with water to improve adhesion of the top coat an automatic wet sander and rotary air sander are used along with manual sanding. To remove polishing residue, the body is then washed and blow dried at about  $110-120^{\circ}\text{C}$  ( $230-248^{\circ}\text{F}$ ) to completely dry off any water.

### 4. Top Coat Painting Stage.

This is a particularly important stage during which the body surface is given its final appearance finish. For this reason, special attention is given to the paint Film texture, adhesion of dust particles, etc.

The illustration below shows the construction of a top-coat paint line. Top coat painting is performed in 2 or 3 steps to prevent occurrence of sags or other defects which could arise if painting was done continuously.

- A. **Preparation Room.** To completely remove any dust on the body surface, the varnish is wiped. Also, here the color is decided, any necessary jigs installed, etc. to prepare the body for top coat painting.
- B. **Touch-up Stage.** Although the body is almost completely painted by automatic paint spraying equipment, there are some areas, such as the inside, where the paint will not reach. These areas are hand spray painted to insure a quality overall finish.
- C. **Automatic Spray Painting Stage.** After one body is completely painted, the spray

gun is automatically cleaned with solvent. Then, the paint change equipment automatically selects the designated paint color for the next vehicle while the automatic painter, by means of a photo electric cell, automatically sets the paint gun location according to the vehicle chassis and model. As the body approaches the automatic painter, the photo electric cell sends a signal to the computer which, in turn directs the operation of the automatic painter.

- D. **Setting Room.** A freshly painted body cannot be immediately sent to the drying oven because the large amount of solvent in the paint would suddenly evaporate, leaving pin holes in the paint film. Therefore, the body is first placed in a setting room for 7-10 minutes to slowly reduce the amount of solvent.
- E. **Drying Oven.** As shown below, for drying of the top coat, combined use is made of a dark infra-red, indirect heating system and a convection current, direct heat system. The first portion of the drying is done by the dark infra-red system so as to prevent adhesion of dust. Then when the paint has dried to the point where dust would not adhere, the body is completely dried in a convection current oven. Total drying times takes 25-70 minutes at 140°C (284°F).

After drying of the top coat, the body is next placed in a well-lit room lined with fluorescent lights on all sides so that every part of the body can be inspected for color gloss, film texture, transparency, sag, seeds, etc. The light intensity is 1,200-2,000 LX (lux), which is about ten times that of an office or conference room.

Defects such as seeds, sagging, orange peel, etc. are corrected here with sandpaper, compound, etc. However, if extensive defects which cannot be corrected in this manner are found, the body is sent back to stage (15) for wet sanding after which it is given another top coat. If there are partial defects, the body is pulled from the line for spot repair.

The bodies which meet inspection standards are then given an application of black out paint around the radiator support. The paint used is an air-drying type and is applied by the air spray method. The bodies which have been designated for two-tone paint applications are returned to the wet sanding stage and then on to the top coat again for a two-tone finish.

## 5. Special Painting:

- A. **Stripe Painting Stage** As shown in the illustration, if the body is to be given a paint stripe, a guide is first installed to the body and then a roller gun set on the guide. As the roller gun moves along the top of the guide, a paint stripe is painted.
- B. **Rocker Black Painting** Here a semi-gloss or flat enamel coat is applied to the rocker panel. After first masking off the surrounding area to prevent over spraying paint onto them, the rocker panel is band sprayed with a 2-component urethane paint which has good adhesion qualities. If there are any other panels, such as the back

panel, which require blacking, it is also done here.

**C. Drying of special Paint** Because the paint used for special painting is a self-reaction, 2-component urethane type paint, it essentially will dry by itself in about 48 hours. However, this amount of time would disrupt the assembly line operations so the special paint is force dried by infrared light, as shown in the illustration, for about 10 minutes at 60-80°C(140-176°F).

## **6. Final Confirmation Inspection.**

This inspection is primarily conducted to check the paint specifications (outer and inner panel colors, rocker black, etc.) and if specifications standards are met, the body is then sent to the assembly line.

## **7. Touch-up Painting Stage.**

Although the body is given an inspection after application of the top coat, it is possible that the paint finish can become damaged or panels dented while on the assembly line. Therefore, another inspection is held at the end of the line, and if any defects are found, the body is sent back to the touch-up stage for block or spot repair, using the same type of paint originally applied.