CHAPTER 5

SURFACE PROTECTION

This chapter presents information on the recommended methods to be used for the protection of various type surfaces.

5.1 PAINT

5.1.1 Precautions

a. Health Hazards. Vapors and gases from paints, solvents, and cleaners frequently have a toxic effect on the human system. Every precaution should be taken to prevent excess contamination of the air by vapors. Certain paints and solvents irritate or burn the skin and must be handled with approved gloves. Protective clothing, goggles, respirators, and gloves should be worn depending on conditions encountered. Proper ventilation of the area used for painting is essential for the health of operators.

b. Fire Hazards. The use of paints, varnishes, lacquers, cleaners, solvents, and other surface protective materials containing flammable solvents, readily ignitable at comparatively low temperatures, involves a marked fire hazard. No smoking, flames, or sparks should be permitted in the painting areas. Suitable signs should be posted conspicuously to warn personnel of the dangers.

c. Surface Compatibility. When paint is to be applied to a surface previously painted, or to a non-metallic surface, determination must be made that the paint is compatible with the surface and will adhere properly. To verify, apply paint to a small area and check to see if there is any discoloration or roughness when the paint is dry.

d. Items Not to Paint. Paint should not be applied to any of the following:

- Plastic or plated surfaces
- Insulators
- Gaskets or gasket mating surfaces
- Areas of movement of moving parts
- Identification plates
- Electrodes

- o Antenna and transducer domes
- o Wire handropes (life lines)

5.1.2 Surface Preparation

The durability of the pretreatment and priming coating system depends on both surface preparation and the environmental conditions under which the coating is applied. The best paint available will fail prematurely if applied to a contaminated or improperly prepared surface. The surface also will influence the final appearance of the paint film as surface irregularities may not be hidden by the paint. The principal surface contaminents that are deleterious to the performance and life of painted surfaces include oil, grease, dirt, rust, mill scale, water, and salts such as chlorides and sulfides.

a. Wood. Exterior wood must be clean and dry. Knots and pitch streaks in new wood must be scraped or burned, then coated with shellac as a sealer before the priming coat is applied. If wood has been painted before, remove loose paint with a scraper, wire brush, or sandpaper. Surfaces of interior woodwork and trim should be clean, sanded smooth with the grain, and free of all surface blemishes. Seal with a clear organic wood preservative as specified in MIL-S-1 3518, using the specific type called for exposed or sheltered surfaces.

When completely dry, apply a priming coat which meets federal specification TT-P-636 to new wood. Spot prime all bare spots on old wood. Fill nail holes and cracks with putty after the priming paint has dried.

b. Concrete and Masonry. Concrete and masonry must be cleaned to remove all of the loose dust, dirt, efflorescence and mortar. Moisture in concrete and masonry brings out alkali to the surface where it is harmful to paint. Allow 2 to 6 months for these materials to dry out before painting. Surface preparation can be done by sandblasting or washing the surface with an acid-detergent compound. Using a 10 percent solution of muriatic acid, followed by a clear water rinse, will remove all concrete laitance. Smooth glazed surface should be roughened or weathered to dullness prior to painting.

Priming is done with a standard concrete and masonry primer or conditioner. Portland cement paint is especially suitable for first painting of porous surfaces such as cinder block. Before applying the paint, wet the surface so that the water will not be extracted from the paint by capillarity.

c. Ferrous Surfaces. Ferrous (iron base) surfaces must have all surface contaminants completely removed prior to the application of the surface protective coating or paint. The method used may be either abrasive blast cleaning, wire or fiber brush cleaning, or chemical cleaning which includes emulsion, solvent, vapor, alkaline, acid, pickling, or steam cleaning.

Etch the surface with phosphoric acid metal conditioner and base; military specification MIL-M-10578 or equivalent. Apply a coat of primer which meets Federal Specification TT-P-664. Caution should be exercised when using the primer as it contains zinc chromate, personnel must avoid breathing the mist or getting any on the skin.

d. Galvanized Surfaces. A galvanized surface is one in which an adherent protective coating or zinc and zinc compounds is applied to the surface of iron or steel products. Prior to painting the bright metal gloss of the coating must be removed along with any surface contaminant.

Remove all surface deposits by washing with an approved solvent by the best method available. Etch the galvanized coating by applying a 3 to 5 percent commercial phosphoric acid solution or treatment, MIL-T-12879, type 1 or equivalent. Apply the solution by brushing, spraying, or wiping. Rinse the surface thoroughly with clear running water.

e. Aluminum Surfaces. Aluminum and aluminum-based alloys shall be cleaned of all surface dirt and grease and anodically passivated as described in paragraph 5.2.

The aluminum surface will be pretreated with a wash primer coating which meets military specification MIL-P-15328. The purpose of the wash primer is to increase the adhesion of the primer system itself. It is not intended as a permanent protective primer in itself although some protection is afforded for a short period of time. To ensure good results, the pretreatment should be coated with primer as soon as possible.

The pretreatment coating is sufficiently dry in 15-30 minutes for the primer coat to be applied. Apply one coat of zinc-chromate primer which meets the requirements of MIL-P-8585.

f. Magnesium Surfaces. Magnesium surfaces can be protected by the sealed chrome-pickle treatment is used for long-time protection of all alloys that do not require close dimensional tolerances. The dichromate treatment is used for all alloys (except magnesium-manganese and magnesium-cerium) including work which requires close dimensional tolerances.

(1) Sealed Chrome-Pickle Treatment. After surface has been cleaned, immerse item for 1/2 to 2 minutes in a solution containing 1.5 pounds sodium dichromate, 1.5 pints concentrated nitric acid (specific gravity 1.42), and water to make a 1-gallon solution. The solution temperature should be 70° - 90°F.

Drain item for 30 seconds and rinse in cold running water.

Prepare a 1-gallon solution containing 1 to 1.5 pounds sodium dichromate, 1/3 ounce calcium or magnesium fluoride, and water. The solution must be boiling. Immerse item for 30 minutes.

Rinse item in cold running water, dry with heat or forced air.

(2) Dichromate Treatment. Immerse clean item for five minutes in a 1-gallon solution of 6-2/3 ounces of sodium-, potassium-, or ammonium-acid fluoride and water. Maintain temperature of solution between 70° and 90°F.

Rinse item in cold running water.

Prepare a 1-gallon solution containing 1 to 1-1/5 pounds sodium dichromate, 1/3 ounce calcium or magnesium fluoride and water. Immerse the item in the boiling solution for 30 minutes.

Rinse item in cold running water and dry with heat or forced air.

(3) The magnesium surface should then be treated with a wash primer coating, MIL-P-15328 and the primer coating, MIL-P-8585.

g. Nonferrous Surfaces. Nonferrous surfaces such as brass, copper, and stainless steel shall be cleaned of all surface contaminants and etched with a phosphoric-acid base metal conditioner which meets specification MIL-M 10578. A primer coating is then applied which meets Federal Specification TT-P-664.

5.1.3 Colors and Materials

a. Colors. Federal Standard No. 595 presents in convenient form a collection of standard colors currently used by the various departments of the government. These standard colors, identified by five digit numbers, are defined by fundamental colorimetric data and are reproduced in the standard in the form of individual color chips.

There are 358 distinct colors classified in three main groups, depending upon the specular gloss; they are designated as gloss, semi-gloss, and lusterless. Within each gloss group, the colors are further arranged in eight arbitrarily selected color classification groups, and within the latter groups in the order of approximate increasing diffuse reflectance.

b. Materials. Paint is a mixture of pigment, drying oil, drier, and thinner. The pigment imparts color; the oil continuity; together they create opacity. The drier shortens the drying time. Thinner is used to adjust the consistency. Finish paint falls into two main categories: enamel and lacquer.

(1) Enamel. Enamel is widely used and forms a relatively smooth, hard coating, which may range from highly glossy to dead flat. It may be applied by either brush, spray, or roller. Enamels take considerable time to dry, which permits brush marks to flow out and leave a smooth surface. However, care must be taken to obtain a dust-free finish. To speed up the drying period, the items, where possible, are baked in an oven for about 45 minutes at 250°F.

WARNING

Lacquer is highly flammable, and proper ventilation is required.

(2) Lacquer. Lacquer is a synthetic paint widely used in finishing and refinishing. It is applied by spray only and is very fast drying. Since it is fast drying, it is easy to build up heavy coats by making successive passes over the surface. Another advantage to lacquer is that its fast-drying quality results in a relatively dust-free surface.

5.1.4 Paint Removal by Blasting

Paint and all surface contaminants can be removed by the use of abrasives applied in several methods. The various methods are:

a. Dry Sandblasting. This method produces a great deal of dust and is a health hazard; air-fed respirators must be worn at all times by the operator to minimize the danger of silicosis. All vents, cracks, and other openings must be sealed to prevent the abrasive dust from entering mechanisms with moving parts.

b. Wet Sandblasting. This method reduces the dust and the health hazard by incorporating the sand into a water slurry. In order to prevent rusting of freshly blasted surfaces, a rust inhibitor must be added to the solution when blasting ferrous materials.

c. Grit-or Shot-Blasting. This method shall be used only in unusual circumstances (unless suitable reclaiming equipment is available) because of the high cost of the abrasives. This method shall be avoided on other than steel or cast-iron surfaces.

5.1.5 Reference Source for Paint Materials

Group 80 of the Federal Supply Catalog provides an excellent reference for information on paints and associated materials.

The catalog contains an alphabetical listing of paint materials by item and table number together with a cross reference to the federal specification and stock number. It also lists the manufacturers' names, code numbers, and the commercial number of the item.

5.2 ANODIZING

Aluminum and magnesium are protected by an electrolytic-anodizing treatment which produces a thin, inert, hard, durable oxide surface that has excellent abrasion and corrosion resistance. Since anodic films have high dielectric strength (good insulating properties), anodizing shall not be used on surfaces that require electrical grounding.

5.2.1 Aluminum

a. Dichromate Seal. An electrolytically-formed finish obtained through the use of a chromic-acid solution that contains provisions for a dichromate seal. It is used to provide protection where further organic finishes are required.

NOTE

This finish shall not be used on aluminum alloys that contain more than 5 percent copper or on assemblies which contain metals other than aluminum. Other materials would be seriously attacked by the electrolyte.

The method of applying a dichromate seal is as follows:

(1) Clean surface of all foreign matter. Place in an anodizing tank with a solution consisting of 3 percent (by weight) chromic-acid concentration at a temperature of 32.2°C (90°F).

(2) Apply a low positive voltage. During the first 15 minutes raise the voltage to a maximum of 40 volts in such a manner that the current density does not exceed 5 amperes per square foot.

(3) Maintain voltage at 40 volts for 35 minutes. Then raise voltage to 50 volts over a period of five minutes. Allow voltage to remain at 50 volts for five minutes.

(4) Reduce voltage and remove part from solution. Immerse part in a 5 percent solution of sodium or potassium dichromate at a temperature of 97.8° to 100°C (208° to 212° F) for a period of 15 to 20 minutes.

(5) Remove part from chromic-acid solution, rinse in running water and dry thoroughly.

b. Hot Water Seal. This is an electrolytically-formed finish obtained through the use of a sulfuric-acid solution, followed by a hot-water seal. It is used to provide corrosion protection where no further finishes are required.

This finish is not to be used for assembled parts of spot-welded or riveted construction, or for other assemblies which are subject to stress and which contain joints or recesses. It should not also be used on assemblies that include aluminum alloys. Apply the hot water seal as follows:

(1) Clean surface of grease, oil, or foreign matter.

(2) Anodize in a solution of 15 percent (by weight) sulfuric-acid concentration; maintain a current density of 12 amperes per square foot and a temperature of 21.1°C (70°F) for approximately 30 minutes.

(3) Remove part from sulfuric-acid concentration and immerse in a bath of clean water, maintained at a temperature from 97.8° to 100°C (208° to 212°F) for a period from 15 to 20 minutes.

(4) Remove part from water bath and dry thoroughly.

5.2.2 Magnesium

The magnesium caustic anodizing treatment is used for long time protection of all magnesium alloys that do not require close dimensional tolerances. The method is as follows:

a. Suspend clean item for 3 to 5 minutes in a steel or magnesium tank containing a gallon solution made from 32 ounces of sodium hydroxide, 0.55 pint of ethylene or diethylene glycol, 1/3 ounce of sodium oxalate, and water. The temperature of the solution should be between 73.9° and 79.5°C (165° and 175°F).

b. Connect to power as follows:

AC - Apply current, 10-20 amperes per square foot, at 6 to 24 volts.

DC - Make item the anode; apply 6 volts.

c. Anodize for 15 to 25 minutes, then turn current off and leave part in the bath for 2 minutes to stabilize coating.

d. Rinse item in cold running water.

e. Immerse part in a steel or magnesium tank containing a 1-gallon solution consisting of 6-2/3 ounces sodium-acid fluoride, 6-2/3 ounces sodium dichromate, and water.

f. Rinse item in running water and dry with heated air.

5.3 CHROMATE FILM TREATMENT

Chemical coatings, usually referred to as chromate conversion coatings, result from the treatment of aluminum and aluminum alloy parts nonelectrolytically with an aqueous solution of chemicals to produce a suitable protective film on the metal surface. Military specifications MIL-C-5541 and MIL-C-81706 apply to chemical coatings.

Two types of coating may be applied depending on the specific application of the item. A class 1A coating is applied where maximum protection from corrosion is required and supplementary paint systems may or may not be necessary or specified. A class 3 coating is applied where protection against corrosion is required and low electrical resistance is necessary. Unless otherwise specified, surfaces with class 3 coating will not be painted.