Sheet metal finishes

By using chemical reactions, metal parts can be coated to control corrosion, improve appearance, and enhance durability. The following table is a quick comparison of some common plating applications.

Quick comparison of plating types:

	Applied On	Purpose	Specification
Anodize	Aluminum	Durable decorative coating. Nonconductive. Available in many colors. Thickness build up: .00005" - .0010"	MIL-A-8625 TYPE II CLASS 1 (NON-DYED 600mg/sf) OR CLASS 2 (DYED 2500mg/sf)
Black Oxide	Steel (ferrous metals)	Thin decorative coating. Very little corrosion protection. Good on moving parts. Should be oiled.	MIL-C-13924 CLASS 1 (ALKALINE OXIDIZING) for plain steel. OTHER CLASSES ARE AVAILABLE.
Chromate	Aluminum (non ferrous)	AKA Chem Film, Iridite, Alodine, etc. Corrosion control or paint primer. Conductive. Easily scratched. Normally yellow. Specify CLEAR if needed.	MIL-C-5541 CLASS 1A (MAX PROTECTION) OR CLASS 3 (MAX CONDUCTIVITY)
Chrome	Copper over Steel	Hard, durable, decorative finish. Low coefficient of friction. Pretty, but pricey.	QQ-C-320 TYPE I (BRIGHT) OR TYPE II (SATIN) CLASS 1 (DECORATIVE). OTHER CLASSES AVAILABLE.
Copper	Ferrous or nonferrous	Used for undercoating, to eliminate buffing, to lubricate, to prevent case hardening, to enable tinning, etc.	MIL-C-14550 CLASS 0,1,2,3, or 4 (APPLICATION DICTATES WHICH CLASS TO USE)
Gold	nonferrous	Conductive decorative corrosion resistance. Really pricey.	MIL-G-45204 TYPE I, II, OR III CLASS 00 THRU 6 (APPLICATION DICTATES WHICH TYPE AND CLASS TO USE)
Electroless Nickel	nonferrous or Copper over steel	Decorative, durable, moderate corrosion protection. Electroless can cover into tight corners.	MIL-C-26074 GRADE A OR B CLASS 1,2, OR 3
Nickel	nonferrous or Copper over steel	Hard, durable, corrosion protection.	QQ-N-290 CLASS 1 GRADE A-G
Passivate	Stainless Steel	Removes iron from surface to reduce rusting.	QQ-P-35
Silver	nonferrous or over copper flash	Decorative, conductive, corrosion resistance, lubricity.	QQ-S-365 TYPE I (MATTE) TYPE II (SEMI-BRIGHT) OR TYPE III (BRIGHT) GRADE A (WITH CHROMATE)
Tin	nonferrous or over copper flash	Improves solderability & conductivity.	MIL-T-10727 TYPE I (ELECTRODEPOSITED) OR TYPE II (HOT DIP)
Zinc	Steel	Corrosion control or paint primer. Electro-deposited, does not cover well on inside corners and closed hems. TYPE I (NO CHROMATE). TYPE II (YELLOW CHROMATE). TYPE III (CLEAR CHROMATE).	ASTM B633 TYPE II CLASS SC1 (THIN) UP TO CLASS SC4 (THICK)

Properly applied, paint is an excellent finish when considering cost, corrosion control, and appearance. To minimize air borne pollutants, "powder coat" paints are becoming widely used. Solvent based paints use a liquid to suspend the paint solids during application. The carrier solvent evaporates, leaving the paint film behind. Powder coat paints, on the other hand, take advantage of static electricity to cause the fine, dry powder of paint solids to cling to the part being coated. Heat is used to liquify the power to form a film. As the part cools, the paint returns to a solid.
Several brands of powder coat are available (Morton, Tiger Drylac, Spraylat, HB Fuller, Cardinal, O'brien to name a few).
The following comparison of materials is taken from an O'brien catalog.
The ranking system: 1=NOT RECOMMENDED, 2=FAIR, 3=GOOD, 4=VERY GOOD, 5=EXCELLENT.
Quick comparison of powder coat materials:

	Epoxy	Hybrid	Aromatic Urethane	Aliphatic Urethane	TGIC Polyester
Hardness	5	4	3	3	4
Flexibility	5	5	5	5	5
Overbake Stability	2	3	2	5	5
Exterior Durability	1	1	1	5	5
Corrosion Protection	5	4	3	3	4
Chemical & Solvent Resistance	5	3	3	3	3
Ease of Application	4	5	4	4	5

When the part cannot be heated as required in the powder coating process, water based paints may be an option. A wide variety of films are available, but generally lack the abrasion resistance and toughness of powder coatings.
Traditional petroleum solvents are still in use, but require extensive air filtration equipment to prevent VOC (Volatile Organic Compound) pollution of the atmosphere.

Screen Printing

Sometimes called "silk screening", this process is used to paint lettering and graphics on the panels, chassis, covers, and brackets.
The operator, using a wiping paddle, presses the ink through a fine screen mesh to apply it to the work piece. The screen mesh is stretched tightly around a frame, which is raised and lowered to align with the work piece.
To prepare the screen mesh (so the ink only goes where it should) it is completely sealed with a photo-resist. A high contrast master art film layout is used to expose the photo-resist, which is then removed by rinsing. Most of the screen mesh remains sealed after exposure. Only the desired lettering, lines, and graphics are open to pass the ink to the work piece.
The screen mesh, typically a high quality stainless steel cloth, can be reused many times for various projects by rinsing to remove all of the photo-resist. The art film master is kept on-file for preparing the screen frame for the next batch of parts.
The Pantone Color Chart is an excellent reference for specifying shades & hues. Each color of ink must be applied separately and requires its own art film master and screen mesh setup.
The preparation of the art film (produced with a Line-o-type film printer) can take advantage of a variety of CAD and Graphics software. A camera can be used to "shoot" a cut & paste layout. We can also design an art layout from just a concept sketch or outline.
The inks used are generally epoxy based and will adhere to virtually any clean, dry surface (anodize, chromate, zinc, paint, plastic, etc.). Rough surfaces (highly textured paint) can make it very difficult to apply fine detail.