



# MILITARY PLATING SPECIFICATIONS

Anodize | Cadmium | Chem Film | Copper | Dry Lube | Electroless Nickel | Grinding | Hard Chrome | Liquid Penetrant Inspection  
 Magnetic Particle Inspection | Sulfamate Nickel | Nital Etch | Paint | Passivate | Phosphate | Precision Machining | Precision Shafting

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>BLACK OXIDE COATING</b>	<b>MIL-C-13924</b>		
A uniform black coating for ferrous metals. Mostly a decorative coating. Only very limited corrosion protection under mild corrosion conditions.  Black oxide coatings should normally be given a supplementary treatment (i.e. oil displacement per Mil-C-16173 Grade 3 or protective treatments of Mil-C-16173).	Class 1	No dimensional change.	For moving parts which cannot tolerate the dimensional change of a more corrosion resistant finish.
	Class 2		For decorative applications and can be used to decrease light reflection.
	Class 3		Alkaline oxidizing. For wrought iron, plain carbon, and low alloy steels.
	Class 4		Alkaline chromate. For corrosion resistant steels.

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>BRUSH PLATING</b>			
Brush Plating is a portable surface finishing method used to enhance, repair, and refurbish localized areas on manufactured components. The SFCO Process <sup>®</sup> is the leading portable method of brush plating localized areas without the use of an immersion tank. It is primarily used for enhancing surfaces on OEM components, permanent repairs and salvaging worn or mis-machined parts.			

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>CADMIUM</b>	<b>QQ-P-416</b>		
Bright silvery white. Supplementary treatments for Type II can be golden, iridescent, amber, black, olive drab. Corrosion resistance is very good, especially with Type II finish. Type II shall show no surface corrosion products after 96 hours (20%) salt spray exposure. Parts with hardness greater than Rc-36 shall be stress-relieved before cleaning and plating, and shall be given a 375° F (±25° F) post bake.	Type I		No supplementary treatment.
	Type II		Supplementary chromate treatment.
	Type III		Supplementary phosphate treatment.
	Class 1	.0005" min.	Type II best for corrosion resistance.
Class 2	.0003" min.	Type III is used as a paint base.	
Class 3	.0002" min.	Excellent for plating stainless steels that are to be used in conjunction with aluminum to prevent galvanic corrosion.	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>CHEMICAL FILMS</b>	<b>MIL-C-5541</b>		
Coatings for aluminum. Color can vary from colorless to golden-iridescent-brown. Materials should conform to Mil-C-81706. Coatings shall be continuous, free from powdery areas, breaks, scratches, etc.	Class 1A	No dimensional change.	Class 1A is used as a corrosion preventative film (unpainted) or to improve adhesion of paint finish systems.
	Class 3		Class 3 is used as a corrosion preventative film for electrical and electronic applications, where low-resistance contacts are required.  For minimum protection against corrosion, painted or unpainted. For protection against corrosion where low electrical resistance is required.

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>CHROME</b>	<b>QQ-C-320</b>		
Excellent hardness (68-74 HRC), wear and abrasion resistance. Chrome plating is also heat resistant, has a low coefficient of friction, and can be rendered porous for lubrication purposes.	Type I		Bright finish
	Type II		Satin finish
All coated steel parts having a hardness of 36 HRC or higher must be baked within 4 hours after plating at 375 ±25° F as follows:  Tensile Strength — Time (at Temperature) ksi ————— Hours	Class 1	.00001" min. on all visible surfaces	Corrosion protective plating usually applied over an underplate of QQ-N-290 nickel.
	Class 2	As specified on drawing or .002" minimum.	Engineering plating usually applied directly to the basis metal and finished by grinding to the specified dimensions. Also known as "Industrial" or "Hard" chrome.
Post plate baking is necessary for high strength steels to relieve hydrogen embrittlement.			

160-180	3
181-220	8
221 and above	12

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>CHROMIC ANODIZED</b>	<b>MIL-A-8625</b>		
Color will vary from light gray to dark gray depending on alloy. Not as readily died as sulfuric anodize.	Type I	.00002-.0003"	Conventional chromic acid anodize.
	Type IB	.00002-.0003"	Low voltage (20-24 V) chromic anodize.
Minimum weight for Type I or IB coatings: Class 1: 200 milligrams/sq. ft. Class 2: 500 milligrams/sq. ft.	Type IC	.00002-.0003"	Non-dyed. Natural color, including dichromate sealing.
	Class 1		Dyed to specified color.
Because of thinness, will scratch easily. Intended to provide corrosion protection or serve as a base for paint systems.	Class 2		Shall not be applied to aluminum alloys with over 5.0% copper, 7.0% silicon, or over 7.5% total alloying constituents.
	Class 2		Heat treatable alloys shall be in a temper obtained by heat treatment, such as -T4 or -T6, prior to anodizing.

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>COPPER</b>	<b>MIL-C-14550</b>		
Copper in color and matte to a very shiny finish. Good corrosion resistance when used as undercoat. A number of copper processes are available, each designed for a specific purpose. Brightness (to eliminate the need for buffing); High speed (for electro-forming); fine grain (to prevent casehardening); etc. Parts with hardness greater than Rc-36 shall be stress-relieved before cleaning and plating, and shall be given a 375° F ±25° F post bake.	Unless otherwise specified.		
	Class 0	.001-.005" min.	For heat treatment stop-off.
	Class 1	.001" min.	Supplementary chromate treatment.
	Class 2	.0005" min.	For carburizing and decarburizing shield, also plated through printed circuit boards.
	Class 3	.0002" min.	As an undercoat for nickel and other platings.
Class 4	.0001" min.	To prevent basis metal migration into tin (prevents poisoning solderability).	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>ELECTROLESS NICKEL</b>	<b>MIL-C-26074</b>		
Coating consists of nickel-phosphorus alloy. Similar to stainless steel in color. Plates uniformly in recesses and cavities without build up on edges. Corrosion resistance is good for coatings over .001" thick. Coating facilitates soldering and brazing. Used when hard, uniform coatings are required, such as salvaging mis-machined parts, or plating to size on irregular shaped parts. Steel parts with hardness of 40 HRC or higher shall be given a stress relief heat treatment prior to plating and a hydrogen embrittlement relief bake after plating. Hydrogen embrittlement and Class 2 hardness bakes must begin within 4 hours after plating.	Grade A	.0010" min.	Unless otherwise specified, minimum thickness on aluminum alloys.
	Grade B	.0005" min.	Unless otherwise specified, minimum thickness on copper, nickel, cobalt, titanium, or beryllium alloys.
	Grade C	.0015" min.	Unless otherwise specified, minimum thickness on iron based alloys.
	Class 1		As plated, no subsequent heat treatment. Heat treated to obtain required hardness.
	Class 2		Minimum Class 2 hardness is 800 Knoop.
Class 3		Nonheat-treatable aluminum alloys are baked 375° F to improve adhesion.	
Class 4		Heat-treatable aluminum alloys are baked at 275° F to improve adhesion.	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>HARD ANODIZED</b>	<b>MIL-A-8625</b>		
Color will vary from light tan to black depending on alloy and thickness. Can be dyed in darker colors depending on thickness. Coating PENETRATES base metal as much as builds up on the surface. The term THICKNESS includes both buildup and the penetration. Provides very hard ceramic type coating. Abrasion resistance will vary with alloy and thickness of coating. Good dielectric properties. Corrosion resistance is good, but recommend seal hard anodize in 5% dichromate solution where increased corrosion resistance is required. Where extreme abrasion resistance is required do not seal as some softening is encountered.	Type III	Unless otherwise specified.	Most aluminum alloys depending on process used. Where maximum service ability or special properties are required, consult metal finisher for best alloy choice. Thick coatings (over .004") will tend to break down sharp edges. Typical applications: hydraulic cylinders, wear surfaces, actuating cams, etc. Can be used as an electrical insulation coating. "Flash" hard anodize may be used instead of conventional anodize for corrosion resistance and may be more economical in conjunction with other hard anodize areas.
	Class 1	.0020"	Non-dyed
	Class 2	±.0004"	Dyed

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>LUBRICANT SOLID FILM</b>	<b>MIL-C-46010</b>		
Used to reduce wear and prevent galling, corrosion, and seizure of metals. May be applied on steel, aluminum, stainless steel, copper, or titanium alloys, as well as on chromium or nickel plating. After heat curing, the solid film is corrosion inhibiting and highly resistant to conventional fluid lubricants.	Type I	.0002-.0005"	Do not use on materials adversely affected by exposure to the cure temperature for 1 hour.
	Type II	.0002-.0005"	Generally used for sliding motion applications where conventional lubricants are difficult to apply or retain, or may be easily contaminated.
		Unless otherwise specified.	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>NICKEL</b>	<b>QQ-N-290</b>		
There is a nickel finish for almost any need. Nickel can be deposited soft or hard – dull or bright, depending on process used and conditions employed in plating. Thus, hardness can range from 150-500 Vickers. Can be similar to stainless steel in color, or can be a dull gray or light gray (almost white) color. Corrosion resistance is a function of thickness. Has a low coefficient of thermal expansion – is magnetic. All steel parts having a hardness of Rc-40 or greater require a post bake at 375° F ±25° F for 3 hours.	Class 1		NOTE: All steel parts having a tensile strength of 220,000 or greater shall not be nickel plated without specific approval of procuring agency.
	Grade A	.0016" thick min.	
	Grade B	.0012" thick min.	
	Grade C	.0010" thick min.	Corrosion protection plating.
	Grade D	.0008" thick min.	
	Grade E	.0006" thick min.	
	Grade F	.0004" thick min.	
Grade G	.0002" thick min.		
Class 2	Nickel plated to specified thickness or after plating dim.		For engineering applications. Type of nickel (process) should be called out. For salvage and where good hardness and corrosion required.

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>OLIVE DRAB</b>	<b>MIL-STD-171</b>		
Provides a uniform olive-green finish. Has "self-healing" properties which help protect areas damaged by abrasion or scratching. Offers excellent corrosion protection. Commonly used in military and automotive applications.	Type II		
	Type VI		

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>PASSIVATE</b>	<b>QQ-P-35 (AMS-QQ-P-35 / ASTM A-967)</b>		
A process designed to remove foreign metals from the surface of stainless and corrosion resistant steels and to promote the natural tendency of the surface to oxide. Does not change the appearance of the base metal. Process cleans and purifies the surface and improves corrosion resistance.	No dimensional change.		
	Type II		Medium temperature nitric acid and sodium dichromate solution.
	Type VI		Low temperature nitric acid solution.
	Type VII		Medium temperature nitric acid solution.
	Type VIII		Medium temperature, high concentration nitric acid solution.

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>PHOSPHATE COATING – LIGHT</b>	<b>TT-C-490</b>		
Specification covers cleaning methods and pretreatment processes.	Cleaning Methods:		Light coating for use as a paint base.
	Method I		Mechanical or abrasive cleaning
Type I – Intended as a general all purpose pretreatment prior to painting.	Method II		Solvent cleaning
	Method III		Hot alkaline
Type II – Intended primarily for use where metal parts are to be formed after painting.	Method IV		Emulsion
	Method V		Alkaline derusting
Type III – Intended for use where size and shape preclude using Type I and Type II, metal components are assembled prior to treatment.	Method IV		Phosphoric acid
	Coatings:		
Type I		Zinc phosphate	
Type II		Iron phosphate	
Type III		Organic pre-treatment coating (wash primer)	
Type IV		Non-aqueous iron phosphate	
Type V		Zinc Phosphate (Heavy)	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>PHOSPHATE COATING – HEAVY</b>	<b>DOD-P-16232</b>		
A coating for medium and low alloy steels. Gray to black in color. Type M is more resistant than Type Z to alkaline environments. Type M can be used up to 250° F. Provides moderate corrosion resistant and prevents wear.	Type M	.0002-.0004"	Heavy coating for corrosion and wear resistance.
	Type Z	.0002-.0006"	Manganese phosphate base coating (16 grams/sq. meter, minimum).
Type Z can be used up to 200° F to prevent galling in extrusion and deep drawing. Class 2 is good for corrosion resistance.	Class 1		Zinc phosphate base coating (11 grams/sq. meter, minimum).
	Class 2		Supplementary preservative treatment or coating, as specified.
Class 3		Supplementary treatment conforming to MIL-L-3150 or MIL-C-16173.	
Class 4		No supplementary treatment.	
Class 4		Chemically converted (may be dyed to color as specified). With no supplementary coating or supplementary coating as specified.	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>SILVER</b>	<b>QQ-S-365</b>		
White matte to very bright in appearance. Good corrosion resistance, depending on base metal. Will tarnish easily. Hardness varies from about 90 Brinell to about 135 Brinell depending on process and plating conditions. Solderability is excellent, but decreases with age. Best electrical conductor. Has excellent lubricity and smear characteristics for anti-galling uses on static seals, bushings, etc.	.0005" min. unless otherwise specified.		
	Type I		Matte
	Type II		Semi-bright
	Type III		Bright
	Class A		Chromate post-treatment to improve tarnish resistance.
Class B		No chromate treatment.	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>SULFAMATE NICKEL</b>	<b>MIL-P-27418</b>		
The plating conforming to this specification is intended to facilitate the formation of a seal between two metallic surfaces.	0.0020" ±0.0003"		The nickel plating shall have a columnar crystalline structure before annealing.
	PLATING HARDNESS. Not to exceed 150 Knoop hardness (500 gm. load) after annealing.		

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>SULFURIC ANODIZE</b>	<b>MIL-A-8625</b>		
Color will vary with alloy. Aluminum with low alloying elements will show practically no color change. Can be dyed almost any color or shade. Sealing is required and gives good corrosion resistance. Minimum coating weight for Type II:  Class 1: 600 milligrams/sq. ft.  Class 2: 2500 milligrams/sq. ft.	Type II	.0005" min.	All aluminum alloys, but do not use on assemblies or parts where sulfuric acid solution may become entrapped. Non-dyed, natural color.
	Type IB		
	Class 1		This includes the characteristic color imparted by dichromate sealing.
Class 2		Dyed to specified color.	

PROCESS	MIL. SPEC.	THICKNESS	COMMENTS
<b>ZINC NICKEL</b>	<b>AMS-2417 BAC-5637</b>		
Dull matte gray or green iridescent. Type II acid or alkaline process. Excellent alternative for cadmium plate requirements. Meets and exceeds 96 hours salt spray test.	.0005" min. .0003" min. .0002" min.		No supplementary treatment or supplementary chromate treatment.

## IN-HOUSE CAPABILITIES

### Metal Finishing & Enhancements

- Flap Peen
- Glass Bead
- Shot Peen

### Grinding

- Centerless Grinding
- CNC Grinding
- Jig Grinding
- Surface and Low Stress Grinding

### Non-Destructive Testing Services

- Fluorescent Penetrant Inspection
- Magnetic Particle Inspection
- Nital Etch

### Certifications & Approvals

- AS9100D, AS9110C w/ ISO9001:2015
- DDTC Registered
- FAA / EASA Certified
- ROHS Compliant
- NADCAP
  - Chemical Processing
  - Conventional Machining
  - Surface / Low Stress Grinding
  - Non Destructive Testing
  - Surface Enhancement
  - Shot Peen / Flap Peen

### OEM Approvals (list non-exhaustive)

