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REVISION

# MILITARY PLATING SPECIFICATIONS

## The Best Customer Is An Educated Customer

### IMPORTANT HINTS TO REMEMBER BEFORE AND DURING DESIGN OF PRODUCT

- Electroplating** has irregular plating distribution, be sure to make allowances for edge and corner buildup.
  - Steel rod .0020 O.D. .001 thk. Electroplating will not plate all the way into blind holes, and will not cover uniformly thru, or threaded thru holes in excess of 1/8 inch depth and .100 diameter as illustrated. As hole becomes larger, coverage will increase.
- Electroless Plating** plates uniformly within .00020 of an inch or less on all surfaces it comes in contact with. It will not plate in blind areas or blind holes unless constant turnover of solution is maintained. eg.
  - Steel tubing .500 O.D. - .250 I.D. .001 thk. Electroless Nickel Plating After plating: .502 O.D. - .248 I.D.
- Make allowances on all diameter to increase outside diameter by twice the plating thickness and to decrease the inside diameter by twice the plating thickness. Also make allowances to decrease threaded pitch diameters by 4 times the plating thickness. Please ask for our precise illustration on tapped holes.
- Hardcoating** builds up 50% into alloy (penetration) and 50% out on surfaces. eg. .002 thk hardcoating.
  - 6061 Al 1" O.D. - .750 I.D. After Anodize: 1" O.D. - 1.002 I.D. .750 I.D. - .748. Notice you have decreased I.D. and increased O.D. by .002.

## IMPORTANT PLEASE READ ABOVE

Please allow us to assist your company prior to new product design and let us review any existing product specification. There could be appreciable time and money to be saved. Please contact Elliott Wilke or Bob Gillingham

- Anodizing:** When fabricating any assembly consisting of two or more parts, make certain the same alloy and the same finish is specified from all vendors. If this is not precisely followed, finish will not match when parts are assembled, especially when a color or anodize is used. Note: Always put hardware into part after anodizing or chromating.
- When making machine parts try to eliminate blind tapped and straight diameter holes. Radius all inside and outside corners which will allow more uniform plating over.
- When fabricating steel metal allow enough relief on lapped bends and all seams tack welded. For proper rinsing of plating solutions, entrapped chemicals cause numerous problems later in production with the integrity of the parts and with subsequent painting procedures.
- Do not overlook baking specification prior to and after plating operations of steel alloys 40RC and over. Also alloys with tensile strength of 1000 MPA and over, these baking procedures are mostly for relief of hydrogen embrittlement.
- When painting is necessary, please remember some Military specifications on Flight Programs that require as much as .003 total thickness of primer and paint which does not include build up on edges.
- Try to design the most important finish requirement first, then work down a list in priority sequence:
  - Corrosion Resistance
  - Lubricity
  - Esthetics of Product
  - Plating and Painting Tolerances
  - Base material best for application
  - Operating & Temperature environment
- Substantial cost savings can be achieved by utilizing various metal alloys and various combinations of plating finishes to substitute for using very expensive and hard to machine alloys. eg. Using cold rolled steel with .001-.002 Electroless Nickel will give you excellent corrosion resistance and the hardness of Tool Steel.
- Always keep communication lines open between machining, Fabricating, Electroplating and Painting Vendors. This will save unlimited amounts of time and money which in turn produces a more timely and superior product.

## IMPORTANT PLEASE READ ABOVE

## PROCESS TYPE CLASS THICKNESS COMMENTS & SPEC NO.

### BLACK CHROME MIL-C-14538C

A hard, non-reflective, abrasion resistant, heat and corrosion resistant coating. Black Chromium has poor throwing power and conforming anodes are necessary for intricate shapes. Apply after heat treatment and all mechanical operations are performed. The Black Chrome surface may be waxed or oiled to darken the surface.

### BLACK OXIDE COATING MIL-C-13924C

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).

### CADMIUM QQ-P-416F

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 I plating shall show no red rust. Type II shall show no surface or basic metal corrosion products after 96 hours salt spray exposure except that white corrosion products at the edges of specimens shall not constitute failure. Corrosion test shall conform to ASTM B117 (MIL-STD-1312, test 1 for fastener hardware). Type II shall be aged at room temperature for 24 hours before subject to salt spray. Unless otherwise specified, steel parts with tensile strength greater than 240,000 lbs. per sq. inch shall not be plated. All steel parts having 150,000 psi and above, which are machined, ground, cold formed or cold straightened, after heat treatment, shall be baked at a minimum of 375°F ± 25°F for 3 hours or more before cleaning and plating.

### CHEMICAL FILMS MIL-C-5541E

Materials qualified produce coatings that range in color from clear to iridescent yellow or brown. Inspection difficulties may arise with clear coatings because visual inspection does not reveal the presence of a coating.

### CHEMICAL FINISH: BLACK MIL-F-495E

A uniform black corrosion retardant for copper. Coating has no abrasion resistance.

### CHROME QQ-C-320B

Excellent hardness (Rc68-74), wear resistance, and erosion resistance. Has low coefficient of friction, and is resistant to heat. In addition to above properties, can be rendered porous for lubrication purposes.

### CHROMIC ANODIZE MIL-A-8625E

Minimum weight Type I coatings after sealing: Class 1 - 200 milligrams/sq. ft. Class 2 - 500 milligrams/sq. ft. Corrosion Resistance Requirements: Salt spray requirement is 336 hours, 5% solution per method 811.1 of FED-STD-151 or ASTM B117 (surface inclined approximately 6 degrees from the vertical). The specimen panels or finished products shall show no more than a total of 15 isolated spots or pits, none larger than 1/32 inch in diameter, in a total of 150 sq. in. of test area grouped from 5 or more test pieces, or no more than 5 isolated spots or pits in a total of 30 sq. in. from one or more test pieces.

### COPPER MIL-C-14550B

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 electroforming), Fine grain (to prevent casehardening), etc. Stress relief steel parts cold straightened or suspected of having residual tensile stresses (SSP ± 25°F/3 hours). Parts with tensile strength over 210 ksi bake 24 hours within 4 hours after plating.

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### SULFAMATE NICKEL MIL-P-27418 (USAF)

Soft gray ductile nickel plate. Additives may be used to harden.

## PROCESS TYPE CLASS THICKNESS COMMENTS & SPEC NO.

### DOW PROCESSES MIL-M-3171C

A chrome pickle treatment for magnesium. Color varies from matte gray to yellow-red. Only fair corrosion resistance (less than 24 hours 20% salt spray resistance).

### DOW PROCESSES MIL-M-3171C

A dichromate treatment for magnesium. Color varies from light brown to dark brown by grade depending on alloy. Only fair corrosion resistance (less than 24 hours 20% salt spray resistance).

### DOW PROCESS #17 MIL-M-45202C

Coatings range from thin clear to light gray-green, to thick dark green coatings. The clear coatings are used as a base for subsequent clear lacquers or paints to produce a final appearance similar to clear anodizing on aluminum. The light gray-green coatings are used in most applications which are to be painted. The thick, dark green coating offers best combination of abrasion resistance, protective value and paint base characteristics.

### ELECTROLESS NICKEL MIL-C-26074E

Similar to stainless steel in color. Plates uniformly in recesses and cavities (does not build up on edges). Corrosion resistance is good for coatings over .001" thickness. Electroless nickel is used extensively in the aircraft industry for its excellent corrosion resistance, excellent paint adhesion, and its ability to be painted. It is used for electrical contact surfaces and irregular shapes (where assembly tolerances need uniformity provided by "electroless" process). Preplating and postplating procedures:

### ELECTROPLATING (NO MIL-SPEC NO.)

Process electrolytically removes or diminishes scratches, burrs and unwanted sharp edges from most metals. Finishes from satin to mirror-bright are produced by controlling time, temperature, or both.

### GOLD MIL-G-45204C

Yellow to orange color depending on proprietary process used. Will range from matte to bright finish depending on basis metal. Good corrosion resistance, and has high tarnish resistance. Provides a low contact resistance, and is a good conductor. Has excellent solderability. If the hardness grade for the gold coating is not specified, Type I shall be furnished at hardness Grade A, and Type II shall be furnished at hardness Grade C.

### HARD ANODIZE MIL-A-8625E

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 the buildup and penetration. Provides very hard ceramic type coating. Abrasion resistance will vary with alloy and thickness of coating. Good dielectric properties.

### LUBRICANT, SOLID FILM MIL-L-8937D

Used to prevent galling and seizure of metals. Lubricant coating by thickness is intended for use on aluminum, copper, steel and stainless steel, titanium, and chromium and nickel bearing surfaces. Useful where conventional lubricants are difficult to apply or retain or where other lubricants may be easily contaminated. Cured lubricant film is highly resistant to conventional fluid lubricants.

### NICKEL QQ-N-290A

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 Kickers. Can be similar to stainless steel in color, or can be a dull grey or light grey (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.

## PROCESS TYPE CLASS THICKNESS COMMENTS & SPEC NO.

### PALLADIUM MIL-P-45209B

A gray, dense deposit, good for undercoats. Good wear characteristics, corrosion resistance and catalytic properties. Good conductivity.

### PASSIVATE QQ-P-35C

Specification covers standard recommendation practice for cleaning and descaling stainless steel parts, equipment and systems. Cleaning includes all operations necessary for the removal of surface contaminants from metals to ensure (1) maximum corrosion resistance of the metal; (2) prevention of product contamination; and (3) achievement of desired appearance.

### PHOSPHATE COATING: LIGHT TT-C-490C

Specification covers cleaning methods and pretreatment processes. Type I intended as a general all purpose pretreatment prior to painting. Type II and IV - Intended primarily for use where metal parts are to be formed after painting.

### PHOSPHATE COATING: HEAVY DOD-16232-F

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 resistance and prevents wear.

### RHODIUM MIL-R-46085B

Metallic and similar to stainless steel in color. Excellent corrosion resistance. Almost as hard as chromium. Very good abrasion resistance. Thicker coatings are very brittle. Has high reflectivity.

### SILVER QQ-S-365D

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, bushing, etc. Stress relief steel parts at a minimum 375°F ± 25°F or more prior to cleaning and plating if they contain or are suspected of having damaging residual tensile stresses. Embrittlement relief all steel parts RC40 and above at 375°F ± 25°F for 3 hours within 4 hours after plating.

### SULFURIC ANODIZE MIL-A-8625E

Minimum weight Type II coatings after sealing: Class 1-600 milligrams/sq. ft. Class 2-2500 milligrams/sq. ft. (For wrought alloy 2000 series and casting alloys with 1.0% or greater copper content minimum weight shall be 1400 milligrams/sq. ft.) Corrosion resistance requirements (same as chromic anodize). Type III processes may be used to produce Type II coatings.

### TIN MIL-T-10727B

Color is gray-white in a plated condition. Had very high luster in fused condition. Soft, but is very ductile. Corrosion resistance is good. (Coated items should meet 24 hour 5% salt spray requirement). Solderability is excellent. Tin is not good for low temperature applications (changes structure and loses adhesion when exposed to temperatures below -40°C).

### TIN LEAD MIL-P-81728B

Excellent solderability. Either a matte or bright luster is acceptable. For electronic components, use only parts with a matte or flow brightened finish.

### PAINTING SPECIFICATIONS FOR MILITARY MISSILE, ELECTRONIC, COMMUNICATION AEROSPACE FEDERAL STANDARD NO. 595A COLORS

Paint & Silkscreening application on all substrates: Wood, metal, plastic, glass, exotic alloy, beryllium, titanium, high nickel alloys, and chromium.

### ZINC ASTM-B633-78

This specification covers requirements for electroplated zinc coatings applied to iron or steel articles to protect them from corrosion. It does not cover zinc-coated wire or sheets.

### ZINC ASTM-B633-78

High strength steels (tensile strength greater than 1700 MPa) shall not be electroplated. Stress relief: All parts with ultimate tensile strength 1000 MPa and above at min. 190°C for 3 hours or more before cleaning and plating.

### ZINC ASTM-B633-78

Hydrogen embrittlement relief: All electroplated parts 1200 MPa or higher shall be baked at 190°C for 3 hours or more within 4 hour after electroplating.

### ZINC ASTM-B633-78

Corrosion Resistance Requirements: Types II and III. Test Period: 96 hours.

### ZINC ASTM-B633-78

TABLE I Thickness Classes for Coatings: Classification Number and Conversion Coating Surface Service Condition/θ Thickness Minimum μm

### ZINC ASTM-B633-78

A Iron or steel with zinc electroplate. Numerical indicates thickness in micrometers. B See Appendix XZ. C Where service conditions are valid only for coatings with chromate conversion coating. Type II for SC 4 and SC 3 and Type III for SC 2 and SC 1.

### ZINC ASTM-B633-78

Contact your plating & painting vendor to confirm specifications are to the latest revision. Thank you and have a good day. Printing in 1985.