Military Plating Specifications

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Chrome</td>
<td>MIL-C-14538A</td>
<td>As specified on drawing.</td>
<td>Color is a dull dark gray, approaching black. It shall approximate color plate 37038 of Fed. Std. No. 595.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Oxide Coating</td>
<td>MIL-C-13924B</td>
<td>No dimensional change.</td>
<td>For moving parts which cannot tolerate the dimensional change of a more corrosion resistant finish. For decorative applications and can be used to decrease light reflection.</td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td></td>
<td>Alkaline oxidizing. For wrought iron, plain carbon, and low alloy steels. Alkaline chromate. For corrosion resistant steels.</td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td></td>
<td>Fused salt oxidizing. For steels having draw temp. above 900 deg. Alkaline oxidizing. For corrosion resistant steels.</td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>QQ-P-416C</td>
<td>.0005&quot; min.</td>
<td>No supplementary treatment.</td>
</tr>
<tr>
<td></td>
<td>Type I</td>
<td>.0003&quot; min.</td>
<td>Supplementary chromate treatment.</td>
</tr>
<tr>
<td></td>
<td>Type II</td>
<td>.0002&quot; min.</td>
<td>Supplementary phosphate treatment.</td>
</tr>
<tr>
<td></td>
<td>Type III</td>
<td></td>
<td>Type II best for corrosion resistance. Type III is used as a paint base. Excellent for plating stainless steels that are to be used in conjunction with aluminum to prevent galvanic corrosion.</td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Reference

### Military Plating Specifications - Continued

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Films</strong></td>
<td>MIL-C-5541B</td>
<td>No dimensional change.</td>
<td>Class 1A is used as corrosion preventative film (unpainted) or to improve adhesion of paint finish systems. Class 3 is used as a corrosion preventative film for electrical and electronic applications, where low-resistance contacts are required. For maximum protection against corrosion, painted or unpainted. For protection against corrosion where low electrical resistance is required.</td>
</tr>
<tr>
<td>Coatings for aluminum. Color can vary from colorless to golden-iridescent-brown, or can be dyed in specific colors. Materials should conform to Mil-C-81706. Coatings shall be continuous, free from powdery areas, breaks, scratches, etc.</td>
<td>Class 1A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coatings for aluminum. Color can vary from colorless to golden-iridescent-brown, or can be dyed in specific colors. Materials should conform to Mil-C-81706. Coatings shall be continuous, free from powdery areas, breaks, scratches, etc.</td>
<td>Class 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemical Finish; Black</strong></td>
<td>MIL-F-495C</td>
<td>No dimensional change.</td>
<td>Used as base for lacquer, light oil, or wax. For decorative, optical, and corrosion retardant applications.</td>
</tr>
<tr>
<td>A uniform black corrosion retardant for copper. Coating has no abrasion resistance.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chrome</strong></td>
<td>QQ-C-320A</td>
<td>.00001-.00002&quot; As specified on drawing.</td>
<td>Bright. Satin. Decorative plating. (Usually over copper and nickel undercoats.) Engineering plating. Plated to Specified dimensions or processed to Specified dimensions after plating. Parts below Rockwell C40 and subject to static loads or designed for limited life under dynamic loads. Parts below Rockwell C40 and designed for unlimited life under dynamic loads. Parts have hardness of Rockwell C40 or above and subject to static loads or designed for limited life under dynamic loads. Parts have hardness of Rockwell C40 or above and are designed for unlimited life under dynamic loads.</td>
</tr>
<tr>
<td>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.</td>
<td>Type I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Type II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 2a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 2b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 2c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 2d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Class 2e</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- Post bake at 375 deg. +/- 25 deg.F for 3 hours or as specified.
- Shot peening and post baking not required.
- Shot peen per Mil-S-13165.
- Post bake at 375 deg. +/- 25 deg.F for 3 hours.
- Shot peen before plating. Post bake at 375 deg. +/- 25 deg.F for 3 hours.
## Reference

### Military Plating Specifications - Continued

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromic Anodize</td>
<td>MIL-A-8625C</td>
<td>.00005-.0003&quot;</td>
<td>Unless otherwise specified, coating will be sealed. Metal salt sealants should not be used on items that will be painted.</td>
</tr>
<tr>
<td>Color will vary from light gray to dark gray depending on alloy.</td>
<td>Type I</td>
<td>.00005-.0003&quot;</td>
<td>Non-dyed (Natural, including dichromate sealing).</td>
</tr>
<tr>
<td>New salt spray requirement is 336 hours (5% solution per method 811 of FED-STD-No. 151).</td>
<td>Class 1</td>
<td>.0001&quot;</td>
<td>Dyed.</td>
</tr>
<tr>
<td>Minimum weight for Type I coatings:</td>
<td>Class 2</td>
<td>.00005&quot;</td>
<td>Shall not be applied to aluminum alloys with over 5.0% copper, 7.0% silicon, or total alloying constituents over 7.5%. When copper content is less than 4.6% and for all suitable casting alloys, be sure aluminum is tempered (such as T-4 or T-6).</td>
</tr>
<tr>
<td>Class 1 200 Milligrams/sq. ft.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2 500 Milligrams/sq. ft.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Because of thinness, will scratch easily. Can be used for inspection of aluminum forgings or castings by noting evidence of chromic acid bleed out from laps, cracks, seams, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>MIL-C-14550A</td>
<td>Unless otherwise specified.</td>
<td>For heat treatment stop-off.</td>
</tr>
<tr>
<td>Copper to 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.</td>
<td>Class 0</td>
<td>.001-.005&quot;</td>
<td>For carburizing and decarburizing shield, also plated through printed circuit boards.</td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>.001&quot;</td>
<td>As an undercoat for nickel and other platings.</td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td>.0005&quot;</td>
<td>To prevent basis metal migration into tin (prevents poisoning solderability).</td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td>.0002&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 4</td>
<td>.0001&quot;</td>
<td></td>
</tr>
<tr>
<td>Dow #1</td>
<td>MIL-M-3171C</td>
<td>Removes metal (Approximately .0006&quot; for wrought-less for die castings.)</td>
<td>Used mainly for protecting magnesium during shipment, storage, and machining. Can be used as a paint base. Note: Must remove Type 1 coating before applying Type III and Type IV treatments.</td>
</tr>
<tr>
<td>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).</td>
<td>Type I</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Reference

**Military Plating Specifications - Continued**

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dow #7</strong></td>
<td>MIL-M-3171C</td>
<td>No dimensional change.</td>
<td>Good paint base and protective qualities for all magnesium alloys except EK30A, EK41A, EZ33A, HK31A, and M1A. Note: Pre-cleaning and pickling may result in dimensional changes due to metal loss.</td>
</tr>
<tr>
<td>A dichromate treatment for magnesium. Color varies from light brown to gray depending on alloy. Only fair corrosion resistance (less than 24 hours 20% salt spray resistance).</td>
<td>Type III</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dow #9</strong></td>
<td>MIL-M-3171C</td>
<td>No dimensional change.</td>
<td>Can be used as a paint base, and is applicable to all magnesium alloys. Used where optical properties (black) are required on close tolerance parts (camera parts, etc.). Note: Pre-cleaning and pickling may result in dimensional changes due to metal loss.</td>
</tr>
<tr>
<td>A galvanic anodize treatment for magnesium. Produces a dark brown to black coating. Designed to give a protective film on alloys which do not react to Dow No. 7 treatment. Only fair corrosion resistance (less than 24 hours 20% salt spray resistance).</td>
<td>Type IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dow #17</strong></td>
<td>MIL-M-45202B</td>
<td>Typical thickness</td>
<td>Light coating.</td>
</tr>
<tr>
<td>Light green coating is recommended for sheet magnesium. The heavier dark green coatings have greater corrosion and abrasion resistance and are applied to castings and extrusions. Coating is brittle and tends to spall from a surface that is flexed. Vinyl and epoxy coatings are applied over coating to reduce spalling.</td>
<td>Type I</td>
<td>.00030” Light coating.</td>
<td></td>
</tr>
<tr>
<td>Class C</td>
<td>.002” Heavy coating.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td></td>
<td>Dark green coating.</td>
<td></td>
</tr>
<tr>
<td>Class D</td>
<td>High density dark green.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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 salvage of mis-machined parts. Also, for inside dimensions and irregular shapes (where assembly tolerances need uniformity provided by “electroless” process).</td>
<td>Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 3</td>
<td>0.001”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade A</td>
<td>0.0005”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Reference

### Military Plating Specifications - Continued

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electropolishing</td>
<td>(No MIL-SPEC)</td>
<td>Typical thickness.</td>
<td>0.0002&quot; Typical dimensional change Process is not recommended for close tolerance surfaces.</td>
</tr>
<tr>
<td>Gold</td>
<td>MIL-G-45204B</td>
<td>Unless otherwise specified.</td>
<td>99.7% gold min. 95.5% gold min. 99.9% gold min. Grade A 90 Knoop max. Grade B 91-129 Knoop Grade C 130-200 Knoop Grade D 201 Knoop and over.</td>
</tr>
<tr>
<td>HAE</td>
<td>MIL-M-45202B</td>
<td>Light coating.</td>
<td>.0001-.0003&quot; Tan coating. without post treatment. With chromate seal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low voltage coating with dichromate seal.</td>
<td>.0003-.0005&quot; Heavy coating. Hard brown coating. Without post treatment. with chromate seal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Double application of Grade 4 post treatment.</td>
<td>.0006-.0011&quot; With bifluoride-dichromate seal. With bifluoride-dichromate seal and moist heat aging.</td>
</tr>
</tbody>
</table>

**Electropolishing**

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**

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.

**HAE**

A corrosion, heat, and abrasion-resistant coating for magnesium. Suitable for use on all forms and alloys of magnesium. The color of HAE shall be lustreless brown and within range form number 3010 to 3035 of Specification TT-C-595. The coating shall be able to withstand a 20% salt spray exposure of 196 hours.
**Military Plating Specifications - Continued**

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard Anodize</strong></td>
<td>MIL-A-8625C</td>
<td></td>
<td>Most aluminum alloys depending on process used. Where maximum serviceability 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 anodized areas. Non-dyed. Dyed.</td>
</tr>
<tr>
<td>Color will vary form 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. 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.</td>
<td>Type III</td>
<td>As specified on drawing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>Class 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lubricant; Solid Film</strong></td>
<td>MIL-L-8937A</td>
<td></td>
<td>Solid Film Lubricants are generally suitable for sliding motion applications such as in plain spherical bearings, flap tracks, hinges, and cam surfaces. Do not use on materials adversely affected by exposure to temperatures of 300 deg.F for 1 hour. It should no be used with oils or greases unless field use indicates otherwise.</td>
</tr>
<tr>
<td>Used to prevent galling and seizure of metals. Lubricant covered by this specification is intended for use on steel, titanium, aluminum, aluminum alloys and on other metals for which its use proves satisfactory. Useful where conventional lubricants are difficult to apply or retain or where other lubricants may be easily contaminated.</td>
<td>Unless otherwise specified. 0.0002-0.0005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Reference**

**Military Plating Specifications - Continued**

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<tr>
<th>Process</th>
<th>MIL. Spec.</th>
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<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nickel</strong></td>
<td>QQ-N-290A</td>
<td>Total thickness of copper and nickel.</td>
<td>Note: All steel parts having a tensile strength of 220,000 or greater shall not be nickel plated without specific approval of procuring agency.</td>
</tr>
<tr>
<td>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. This, 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 deg.F for 3 hours.</td>
<td></td>
<td>For decorative applications on: Steel base; Steel base; Steel base; Steel base; Copper base; Copper base; Copper base; Zinc base; Zinc base; Zinc base; For engineering applications. Type of nickel (process) should be called out. For salvage and where good hardness and corrosion req.</td>
<td></td>
</tr>
<tr>
<td><strong>Class 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type I</td>
<td>Class 1</td>
<td>.002” min.</td>
<td></td>
</tr>
<tr>
<td>Type II</td>
<td></td>
<td>.00125” min.</td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td></td>
<td>.00075” min.</td>
<td></td>
</tr>
<tr>
<td>Type IV</td>
<td></td>
<td>.00040” min.</td>
<td></td>
</tr>
<tr>
<td>Type V</td>
<td></td>
<td>.00050” min.</td>
<td></td>
</tr>
<tr>
<td>Type VI</td>
<td></td>
<td>.00030” min.</td>
<td></td>
</tr>
<tr>
<td>Type VII</td>
<td></td>
<td>.00010” min.</td>
<td></td>
</tr>
<tr>
<td>Type VIII</td>
<td></td>
<td>.00001” min.</td>
<td></td>
</tr>
<tr>
<td>Type IX</td>
<td></td>
<td>.000125” min.</td>
<td></td>
</tr>
<tr>
<td>Type X</td>
<td></td>
<td>.00075” min.</td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td></td>
<td>.00050” min.</td>
<td></td>
</tr>
<tr>
<td>Nickel plated to specified thickness or after plating dim.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Passivate</strong></th>
<th>QQ-P-35B</th>
<th>MILS-5002C</th>
<th>No dimensional change.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A process designed to remove foreign metals from the surface of stainless and corrosion resistant steels and to promote natural tendency of surface to oxidize. Does not change the appearance of the base metal. Process purifies surface which improves corrosion resistance.</td>
<td>Type I</td>
<td>Low temperature.</td>
<td>Medium temperature.</td>
</tr>
<tr>
<td></td>
<td>Type II</td>
<td>High temperature.</td>
<td>For steels containing large amounts (.015%) of sulfur or selenium.</td>
</tr>
<tr>
<td></td>
<td>Type III</td>
<td>Anodic – For high carbon martensitic (440) steels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type IV</td>
<td>Low temperature (optional).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type VI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Phosphate Coating, Light</strong></th>
<th>Cleaning Methods</th>
<th>Pretreatment Coatings</th>
<th>Light coating for use as paint base.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification covers cleaning methods and pretreatment processes.</td>
<td></td>
<td></td>
<td>Mechanical or abrasive cleaning.</td>
</tr>
<tr>
<td>Type I – Intended as a general all-purpose pretreatment prior to painting.</td>
<td>Cleaning Methods</td>
<td>Pretreatment Coatings</td>
<td>Solvent cleaning.</td>
</tr>
<tr>
<td></td>
<td>Method I</td>
<td>Type I</td>
<td>Hot alkaline.</td>
</tr>
<tr>
<td></td>
<td>Method II</td>
<td>Type II</td>
<td>Emulsion.</td>
</tr>
<tr>
<td></td>
<td>Method III</td>
<td>Type III</td>
<td>Alkaline de-rusting.</td>
</tr>
<tr>
<td></td>
<td>Method IV</td>
<td></td>
<td>Phosphoric acid.</td>
</tr>
<tr>
<td></td>
<td>Method V</td>
<td></td>
<td>Zinc phosphate.</td>
</tr>
<tr>
<td></td>
<td>Method VI</td>
<td></td>
<td>Iron phosphate.</td>
</tr>
<tr>
<td>Type II – Intended primarily for use where metal parts are to be formed after painting.</td>
<td></td>
<td></td>
<td>Organic pre-treatment coating (wash primer).</td>
</tr>
<tr>
<td>Type III – Intended for use where size and shape preclude using Type I and Type II, metal components are assembled prior to treatment.</td>
<td>Cleaning Methods</td>
<td>Pretreatment Coatings</td>
<td>Non-aqueous iron phosphate.</td>
</tr>
<tr>
<td></td>
<td>Method I</td>
<td>Type I</td>
<td></td>
</tr>
</tbody>
</table>
## Reference

### Military Plating Specifications - Continued

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phosphate Coating;Heavy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A coating for medium and low alloy steel. Gray to black in color. Type M is more resistant than Type Z to alkaline environments. Type M can be used up to 250 deg.F. Provides moderate corrosion resistance and prevents wear.</td>
<td>Type M</td>
<td>.0002-.0004&quot;</td>
<td>Heavy coating for corrosion and wear resistance. Manganese phosphate base coating (1500 milli-gms/ft-2).</td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td></td>
<td>Supplementary preservative oil treatment as specified.</td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td></td>
<td>Treated with lubricating oil conforming to MIL-L-3150.</td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td></td>
<td>No supplementary treatment.</td>
</tr>
<tr>
<td></td>
<td>Class 4A</td>
<td></td>
<td>Chemically converted, no supplementary treatment.</td>
</tr>
<tr>
<td></td>
<td>Class 4B</td>
<td></td>
<td>Chemically converted and treated with lubricating oil conforming to MIL-L-3150.</td>
</tr>
<tr>
<td></td>
<td>Class 4C</td>
<td></td>
<td>Chemically converted and dyed to a color, as specified.</td>
</tr>
<tr>
<td></td>
<td>Class 4D</td>
<td></td>
<td>Chemically converted, dyed to a color as specified and treated with lubricating oil conforming to MIL-L-3150.</td>
</tr>
<tr>
<td></td>
<td>Class 4E</td>
<td></td>
<td>Chemically converted and supplementary treatment.</td>
</tr>
<tr>
<td>Type Z can be used up to 200 deg.F, to prevent galling in extrusion and deep drawing. Class 2 is good for corrosion resistance.</td>
<td>Type Z</td>
<td>.0002-.0006&quot;</td>
<td>Zinc phosphate base coating (1000 milli-gms/ft-2). Supplementary preservative oil treatment, as specified. Treated with non-drying type preservative conforming to MIL-C-16173, Grade I. No supplementary treatment. Chemically converted, no supplementary treatment.</td>
</tr>
</tbody>
</table>
## Reference

### Military Plating Specifications - Continued

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phosphate Coating; Heavy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continued</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphate Coating; Heavy</td>
<td>Class 4B</td>
<td></td>
<td>Chemically converted and treated with a preservative oil or high melting wax.</td>
</tr>
<tr>
<td>Continued</td>
<td>Class 4C</td>
<td></td>
<td>Chemically converted and dyed to a color, as specified.</td>
</tr>
<tr>
<td></td>
<td>Class 4D</td>
<td></td>
<td>Chemically converted, dyed to a color as specified and treated with a preservative oil or high melting wax.</td>
</tr>
<tr>
<td></td>
<td>Class 4E</td>
<td></td>
<td>Chemically converted and supplementary treatment, as specified.</td>
</tr>
<tr>
<td><strong>Rhodium</strong></td>
<td>MIL-R-46085</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metallic and similar to stainless steel in color. Excellent corrosion resistance. Almost as hard as chromium. Very good abrasion resistance. Good solderability. Low contact resistance. Thicker coatings are very brittle. Has high reflectivity.</td>
<td>Type I</td>
<td></td>
<td>Over nickel, silver, gold, or platinum. Over other metals.</td>
</tr>
<tr>
<td></td>
<td>Type II</td>
<td>.000001-.00001</td>
<td>Used on silver for tarnish resistance. Applications range from electronic to nose cones – wherever wear, corrosion resistance, solderability, and reflectivity are important.</td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>.0000001-.00001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td>.00001-.00002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td>.00002-.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 4</td>
<td>.00001-.00025</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 5</td>
<td>.00025-.0005</td>
<td></td>
</tr>
<tr>
<td><strong>Silver</strong></td>
<td>QQ-S-365A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White matte to very bright in appearance. Good corrosion resistance, depending on base metal. Will tarnish easily. Hardness varies from about 90 Brinnell to about 135 Brinnell 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.</td>
<td>Type I</td>
<td>.0005&quot; min. unless otherwise specified.</td>
<td>Increasing use in both decorative and engineering fields, including electrical and electronic fields.</td>
</tr>
<tr>
<td></td>
<td>Type II</td>
<td>.0000001-.00001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type III</td>
<td>.0000001-.00001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grade A</td>
<td>.0000001-.00001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grade B</td>
<td>.0000001-.00001</td>
<td></td>
</tr>
<tr>
<td><strong>Sulfamate Nickel</strong></td>
<td>MIL-P-27418</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The plating conforming to this specification is intended to facilitate the formation of a seal between two metallic surfaces. Plating Hardness. Not to exceed 150 Knoop hardness (500 gm. load) after annealing.</td>
<td>Unless otherwise specified.</td>
<td>The nickel plating shall have a columnar crystalline structure before annealing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0020&quot; +/-0.003&quot;</td>
<td></td>
</tr>
</tbody>
</table>
Reference

Military Plating Specifications - Continued

<table>
<thead>
<tr>
<th>Process</th>
<th>MIL. Spec.</th>
<th>Thickness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric Anodize</td>
<td>MIL-A-8625C</td>
<td>Type II</td>
<td>.00005-.0010&quot; All aluminum alloys, but do not use where solution will entrap.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 1</td>
<td>600 Milligrams/sq. ft. Non-dyed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 2</td>
<td>2500 Milligrams/sq. ft. Dyed.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Salt spray requirement is 336 hours (5% solution per method 811 of FED-STD- No. 151).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimum weight for Type II coatings:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class 1  600 Milligrams/sq. ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class 2  2500 Milligrams/sq. ft.</td>
</tr>
<tr>
<td>Tin</td>
<td>MIL-T-10727A</td>
<td>Type I</td>
<td>As specified on drawing. Thickness Guide (not part of Spec.).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Type II</td>
<td>.0001-.00025&quot; Electro-deposited. Hot dipped.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.0002-.0004&quot; Flash for soldering.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>.0003&quot; min. Where corrosion resistance is important.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.0002-.0006&quot; To prevent formation of case during nitriding.</td>
</tr>
<tr>
<td>Vacuum Aluminum</td>
<td>MIL-C-23217B</td>
<td>Class 1</td>
<td>0.0010&quot; thick + .0005&quot; Serviceability up to 925 deg.F. No bake is required after plating.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 2</td>
<td>0.0005&quot; thick + .0002&quot; Salt-Spray Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.001&quot; Serviceability up to 925 deg.F. No bake is required after plating.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class 1  Test Period (hours) 1 336</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Class 2  Test Period (hours) 2 192</td>
</tr>
<tr>
<td>Process</td>
<td>MIL. Spec.</td>
<td>Thickness</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------</td>
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<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Vacuum Cadmium</td>
<td>MIL-C-8837A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used primarily to provide corrosion resistance to ferrous parts free from hydrogen contamination and possible embrittlement. Recommended on steels 220,000 psi or above. Coating is applied after all machining, brazing, welding and forming has been completed. Steel parts over Rc-33 shall be cleaned using materials which will have no damaging effects, including intergranular attack, etching and hydrogen embrittlement. Salt spray test for Type II is 96 hours.</td>
<td>Type I</td>
<td>.00050&quot; min.</td>
<td>Without supplementary chromate or phosphate treatment. With supplementary chromate. With supplementary phosphate.</td>
</tr>
<tr>
<td></td>
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<td>Class 1</td>
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<td>Class 2</td>
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<td>Class 3</td>
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<td></td>
<td></td>
<td>.000020&quot; min.</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>QQ-Z-325B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Either a bright or dull finish is acceptable. Bright Zinc plating closely resembles bright chromium. However, bright zinc does not have the permanence of surface appearance. Zinc coated steel will not rust even when exposed by scratches because of the galvanic protection of the zinc. On weathering, zinc turns to a drab gray color. Zinc should be deposited directly on the base metal (Nickel is permissible undercoat if base metal is a corrosion resisting steel). Parts having a hardness greater than Rc-40 must be given a heat treatment prior to plating. Springs having a hardness over Rc-40 must be given an after plating baking at 375 deg.F +/- 25 deg.F for 3 hours.</td>
<td>Class 1</td>
<td>.0010&quot;</td>
<td>The primary use of chromate finishes on zinc is to retard or prevent formation of white corrosion products on zinc surfaces.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.000050&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.00020&quot;</td>
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</tr>
<tr>
<td></td>
<td>Type I</td>
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<tr>
<td></td>
<td>Type II</td>
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<td></td>
<td>Type III</td>
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