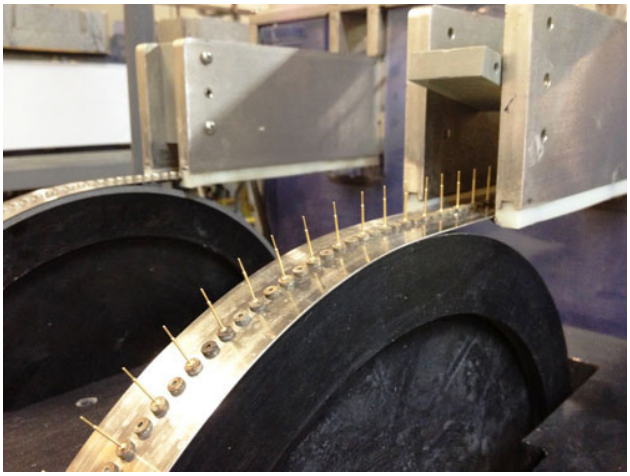
Electro-Spec
Plating Capabilities

Gold

MIL-G-45204 & MIL-DTL-45204
Type I 99.7% gold min. (Grade A, B or C)
Type II 99.0% gold min. (Grade B, C or D)
Type III 99.9% gold min. (Grade A only)
Grade A Knoop 90 max.
Grade B Knoop 91-129
Grade C Knoop 130-200
Grade D Knoop 201 and over
Class 00 .000020"min (20µ")
Class 0 .000030"min (30µ")
Class 1 .000050"min (50 µ")
Class 2 .000100"min (100 µ")
Class 3 .000200"min (200 µ")
Class 4 .000300"min (300 µ")
Class 5 .000500"min (500 µ")
Class 6 .001500"min (1500 µ")



ASTM B 488
Type 1 99.9% gold min. (Code A only)
Type 2 99.7% gold min. (Code A, B and C)
Type 3 99.0% gold min. (Code C and D)
Code A Knoop 90 max.
Code B Knoop 90-200
Code C Knoop 130-200
Class .50 .000020"min (20µ")
Class .75 .000030"min (30µ")
Class 1.0 .000040"min (40 µ")
Class 1.25 .000050"min (50 µ")
Class 2.50 .000100"min (100 µ")
Class 5.00 .000200"min (200 µ")
Class X Where X is minimum thickness requirement in micrometers.

AMS 2422
Gold plate: .000050" (50µ") (1.27µm) minimum.
Nickel strike: .000100" (100 µ") (2.5µm) minimum.
Copper flash or strike: .000100" (100 µ") (2.5µm) minimum.

Electro-Spec
Plating Capabilities

Silver

QQ-S-365
Type I Matte
Type II Semi-bright
Type III Bright
Grade A With chromate tarnish resistant treatment
Grade B No chromate tarnish resistant treatment
Unless otherwise specified, the minimum thickness shall be .000500" (500 µ").

ASTM B 700
Type 1 99.9% silver min.
Type 2 99.0% silver min.
Type 3 98.0% silver min.
Grade A Matte – Electrodeposits without luster. Obtained without the use of brighteners.
Grade B Bright by the use of brighteners
Grade C Bright by the use of mechanical or chem polishing
Grade D Semi bright by the use of addition agents
Class N No chromate tarnish resistant treatment
Class S With Chromate tarnish resistant treatment
1 µm min. .000040" (40 µ") for short term shelf life solderability
2.5 µm min. .000100" (100 µ") for contact connectors having limited wear
5 µm min. .000200" (200 µ") for thermo compression bonding
10 µm min. .000400" (400 µ") for thermo compression bonding and die attachment for semiconductors
20 µm min. .000800" (800 µ") for high quality domestic flatware
>= 40 µm .001588" (1588 µ") where very severe ware resistance is required

AMS 2412
Silver plating thickness – as specified on the customer drawing or other customer documentation.
Where "Silver Flash" is specified, plate thickness shall be approximately .000100" (100µ") (2.5µm).
Copper Strike shall be electrodeposited prior to Silver plating.

Electro-Spec
Plating Capabilities

Nickel

QQ-N-290 & AMS-QQ-N-290
Class 1 Corrosion protective plating
Class 2 Engineering plating
Grade A 0.00160" min. (1600 µ")
Grade B 0.00120" min. (1200 µ")
Grade C 0.00100" min. (1000 µ")
Grade D 0.00080" min. (800 µ")
Grade E 0.00060" min. (600 µ")
Grade F 0.00040" min. (400 µ")
Grade G 0.00020" min. (200 µ")

ASTM B 689
Type 1 Dull electrodeposited nickel
Type 2 Bright electrodeposited nickel containing sulfur
Type 3 Bright electrodeposited nickel containing submicron particles such as silicon carbide, tungsten carbide and aluminum oxide.
Class 5 5 um min. .000200" (200 µ")
Class 25 25 um min. .001000" (1000 µ")
Class 50 50 um min. .002000" (2000 µ")
Class 100 100 um min. .004000" (4000 µ")
Class 200 um min. .008000" (8000 µ")
Class X Thickness as specified

AMS 2403
General purpose Nickel plating
Thickness as specified by customer

MIL-P-27418
.002000" (2000 µ") +/- 0.000300" (300 µ") thickness unless otherwise stated

Electro-Spec
Plating Capabilities

Tri-M3

GENERAL

General * Currently there are no industry specific and/or government specifications for this finish
General Comprised of 50%-55% Copper
30%-35% Tin
10%-15% Zinc
Post treatment consists of various proprietary chemicals
500-600 HV Hardness

Electroless Nickel

MIL-C-26074 & AMS-C-26074

Class 1 As plated with no subsequent heat treatment
Class 2 Heat treated to obtain required hardness
Class 3 Non heat treatable aluminum alloys and beryllium alloys
Class 4 Heat treatable aluminum alloys
Grade A 0.0010" min. (1000 µ")
Grade B 0.0005" min. (500 µ")
Grade C 0.0015" min. (1500 µ")
Type I No requirement for phosphorous
Type IV 5-9% phosphorous
Type V 10% phosphorous and above

ASTM B656

General 1-7.5 um .000040"-.000300" (40-300 µ") for soldering
General 5-15 um .000200"-.000600" (200-600 µ") for rust prevention
General 5-25 um .000200"-.001000" (200-1000 µ") for mild wear conditions
General 13-30 um .000516"-.001190" (516-1190 µ") for moderate wear conditions
General 30-75 um .001190"-.003000" (1190-3000 µ") for severe wear
General 50-125 um .002000"-.005000" (2000-5000 µ") for severe corrosion as required for Salvage

Electro-Spec
Plating Capabilities

Electroless Nickel (cont.)

ASTM B733

Type I No requirement for phosphorous
Type IV 5-9% phosphorous
Type V 10% phosphorous and above
SC0 Minimum thickness 0.1µm .000004" (4 µ")

SC1 Light service 5 µm .000200" (200 µ")
SC2 Mild service 13 µm .000500" (500 µ")
SC3 Moderate service 25 µm .001000" (1000 µ")
SC4 Severe service 75 µm .003000" (3000 µ")

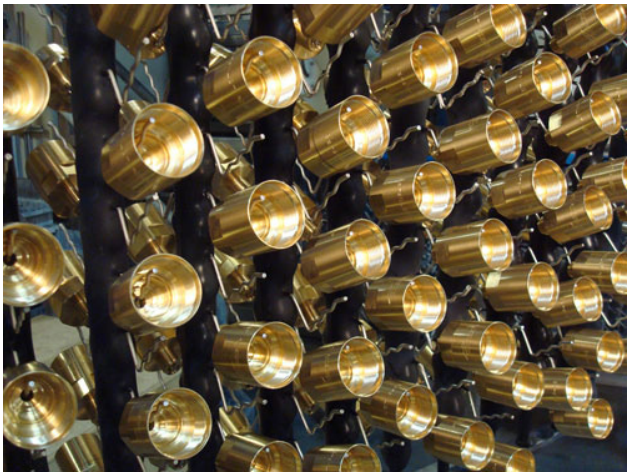
Class 1 As-deposited, no heat treatment
Class 2 Post-plate Heat Treatment at 260-400° C (500-752° F) – Min hardness of 850 HK100.
Class 3 Post-plate Heat Treatment at 180-280° C (356-536° F) for 2 – 4 hours.
Class 4 Post-plate Heat Treatment at 120-130° C (248-266° F) for min of 1 hour.
Class 5 Post-plate Heat Treatment at 140-150° C (284-302° F) for min of 1 hour.
Class 6 Post-plate Heat Treatment at 300-320° C (572-608° F) for min of 1 hour.

AMS 2404

Class 1 Except for Hydrogen Embrittlement Relief, no post plating thermal treatment.
Class 2 Thermal treatment at 450° F (232° C) or above to harden the deposit.
Class 3 Thermal treatment at 375° F (191° C) to verify adhesion on non-heat treatable aluminum and beryllium alloys. 1 -1 1/2 hours.
Class 4 Thermal treatment at 250° F (121° C) to verify adhesion on heat treatable aluminum alloys.

Electro-Spec
Plating Capabilities

Copper



MIL-C-14550B
Class 0 0.001000"-0.00500" thick (1000-5000 µ")
Class 1 0.001000" min. (1000 µ")
Class 2 0.000500" min. (500 µ")
Class 3 0.000200" min. (200 µ")
Class 4 0.000100" min. (100 µ")

ASTM B 734
Class 25 um min. 0.001000" min (1000 µ")
Class 20 um min. 0.000800" min (800 µ")
Class 12 um min. 0.000475" min (475 µ")
Class 5 um min. 0.000200" min (200 µ")
Class X Thickness as specified

AMS 2418
Type 1 Engineering Plating
Type 2 Plating for masking
Designated thickness 13-18 µm .000500"-.000700" (500-700 µ")
Other plating thicknesses may be specified by this specification number (AMS 2418) followed by a suffix number designating the minimum thickness in ten thousandths of an inch (increments of 2.5µm). A tolerance of +.000200" 200 µ" (+5 µm) will be allowed.
AMS2418-1 = .000100"-.000300" 100-300 µ" (2.5-8.0µm)

Electro-Spec
Plating Capabilities

Passivate

QQ-P-35 & AMS- QQ-P-35

Type II Medium temperature nitric acid solution with sodium dichromate additive (20-25% by volume HNO3 with 2.5 +- 0.5% by weight NaCr2O7 processed for 20 minutes @ 120-130 degrees F) for Se, martensitic 400 series, 303, 303, 347Se, 416, 416Se, 430F, 430Fse and precipitation hardenable steels

Type VI Low temperature nitric acid solution (25-45% by volume HNO3 processed for 30 minutes @ 70-90 degrees F) used for 200 and 300 series chromium nickel and chromium grades with 17% chromium or greater

Type VII Medium temperature nitric acid solution (25-25% by volume HNO3 processed for 20 minutes @ 120-140 degrees F) used for austenitic 200 and 300 series chromium-nickel and chromium grades with 17% or greater

Type VIII Medium temperature high concentration nitric acid solution (45-55% by volume HNO3 processed for 30 mins @ 120-130 degrees F) used for high carbon and high chromium grades

ASTM A 967

Nitric 1 20-25% by volume HNO3 with 2.5 +- 0.5% by weight NaCr2O7 processed for a minimum of 20 minutes @ 120-130 degrees F
Nitric 2 25-45% by volume HNO3 processed for a minimum of 30 minutes @ 70-90 degrees F
Nitric 3 25-25% by volume HNO3 processed for a minimum of 20 minutes @120-140 degrees F
Nitric 4 45-55% by volume HNO3 processed for a minimum of 30 mins @120-130 degrees F
Nitric 5 Other combinations of temperature, time and concentration of nitric acid, with or without other chemicals

ASTM A 380

Typically referenced for cleaning prior to passivation per ASTM A 967

Electro-Spec
Plating Capabilities

Passivate (cont.)

AMS 2700
This document was revised to incorporate the essentials of AMS-QQ-P-35/QQ-P-35
Method 1 Passivation in Nitric Acid (shall be used unless Method 2 is authorized by the cognizant engineering organization)
Type 1 Low temperature Nitric Acid with Sodium Dichromate
Type 2 Medium temperature Nitric Acid with Sodium Dichromate
Type 3 High temperature Nitric Acid with Sodium Dichromate
Type 4 40% Nitric Acid for free machining steels
Type 5 Anodic, for high carbon martensitic steels
Type 6 Low temperature Nitric Acid
Type 7 Medium temperature Nitric Acid
Type 8 Medium temperature, high Nitric Acid concentration
Method 2 Passivation in Citric Acid (Electro-Spec does not provide this process)

Palladium

Mil-P-45209
Unless otherwise specified, the minimum thickness shall be 1.27µm .000050" (50µ")

Electro-Spec
Plating Capabilities

Heat Treat/Anneal

GENERAL

General *Complies to numerous industry and customer specific and/or government specifications
General Heat treating or annealing in Nitrogen environment
Temperature ranges up to 1,000 degrees (F)
Pre-Heat Treating/Annealing process that employs vacuum vapor degreasing along with special cleaning to minimize or eliminate heat scale
Hydrogen embrittlement capability

Degrease

GENERAL

General *Currently there are no industry specific and/or government specifications for this finish
General Vacuum vapor degreasing in Trichloroethylene.
Ultrasonic technology

Clean

GENERAL

Cleaning or Special Cleaning processes are typically spelled out by the customer. Cleaning is referenced in numerous industry and customer specifications.

Bright Dip

GENERAL

Bright Dip is typically spelled out by the customer. It may also be done as a "best practice" based upon; substrate, geometry, threads, dimensions to name a few.

We also perform Cross Sections and Hardness Testing.