Military Plating Specifications στο

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The Best Customer is an Educated Customer AC7004 & AC7108 Nadcap Accredited Important Hints to Remember Before and During Design of Product

1. Electroplating has irregular plating distribution, be sure to make allowances for edge and corner buildup. 9. When painting is necessary, please remember certain Military Specifications of Flight Programs that require as much as .003 total thickness of primer and

paint which does no	t include build up	on edges.	
a. Corrosion Resistance b. Surface Hardness c. Ductility d. Solderability	e. Conductivity f. Lubricity g. Esthetics of Product	h.Plating and Painting Tolerances i.Base Material Best For Application	j.Operating and Temperatu Environment

(b) det pint du clastics your lequine rents will vertical vertical entering up blueprints. Always send the latest print revision for quotation when sending yo final machined parts to vendor. Inquire as to necessary time and cost to do yo work if any special materials are needed so they can be ordered – the job will proceed much smoother if these things are in place.

(6) If you have any questions regarding your material, please call our engineering staff and we can discuss materials, tolerances, or how new prints should be drawn up. Color coded prints are preferred.

(7) Before you send your parts out, be sure parts are not damaged, count is correct and all the paperwork and specifications are in order when packaging your parts. Use white gloves. Some people have more acid in their system than others, which can leave deep fingerprints on your finished parts, which means re-working your parts before plating - especially steel and aluminum parts.

TYPE

IMPORTANT: Please allow us to assist your company prior to new product design and let us review existing product specifications. IMPORTANT: PLEASE READ ABOVE There could be appreciable time and money to be saved. Please contact our Sales department for more information. PLEASE READ ABOVE

PROCESS

The steel rod is plated .UU i mick – noise me irregularity of plating thickness on ends of rod. The plating is .001" thick, the end plating is .002" .003" thicker due to edge and corner buildup. ure Electroplating will not plate all the way into blind holes and will not cover uniformly through, or through threaded holes in excess on ½" depth and .100 diameter as illustrated. As hole becomes larger, coverage will increase. 10. Try to design the most important finish requirement first, then work down a list in priority sequence. 11. 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 Nickei will give you excellent corrosion resistance and the hardness of tool steel. 2. Electroless Plating plates uniformly within .000020 of an inch or less on all surfaces it comes in contact with. It will not plate uniformly in blind areas or blind holes unless constant turnover of solution is maintained. For example: Steel tubing .500 0.D. - .250 I.D. .001 thick. Electroless Nickel Plating after plating: .502 0.D. 12. 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. 248 I.D.
When plating, inske allowances to increase all outside diameters by twice the plating thickness. Also make allowances to increase the inside diameters 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.
4. Hardcoating builds up 50% into alloy (penetration) and 50% out on surfaces. eg. .002 thick hardcoating 6061 Al. 1" 0.D. -750 I.D. After Anodize - 1" 0.D. 1.002. r50 I.D. .748. Notice you have decreased I.D. and increased 0.D. by .002.
Rule of thumb: coverage in I.D. hardcoatings will go in to each end of the tube three times I.D. opening. In this case, .750 x 3 = 2.250 into I.D.
Caution: when stripping you will lose 50% buildup and 50% penetration, resulting in a loss of material from the original dimensions. When possible, try not to use 2024 alloy. Always specify hardcoating requirement in thickness (.001 thick, .002 thick, etc.).
5. Anodizing: When fabricating any assembly consisting of two or more parts (1) Look for best material suppliers, availability, cost, certification if needed, and hard copy confirmation of such. (2) Always review plating specifications for material you are having processed – don't ask for cold rolled steel to be passivated or any material other than aluminum or titanium to be anodized, or your parts will disappear. Any questions, please call vendor. (3) Always review final tolerance of your parts to see if they will be in tolerance after the final process you require. (4) When preparing your quotation, find the necessary vendors you will need. Make sure they are in compliance with all State and Federal regulations required for their process and that they are approved for all Military and Federal Specifications – QQ, MIL, AMS and ASTM requirements. If approved for IS09001, AS9100 or Nadcap AC7108 – make sure they are in conformance – it would be a terrible and costly situation if your vendor can't complete your job because of compliance problems (5) Get print out or discuss your requirements with vendor before drawing up

GULD View to arcange color depending on proprietary process used. Will range from matte to bright finish-depending on basis metal. Good corresion resistance, and has high tarnish resistance. Provides a good conductor. Has excellent solderability. If the hardness grade for the gold coating is not specified, Type I shall be and Type II shall be furnished at hardness Grade C. For soldering, a ratin purity soft gold coating is preferrad. A minimum thickness preferrad. A minimum thickness and type I shall be furnished at hickness of .00010 inch shall be plated. 99.7 gold minimum (Grades A, B, C) 99.0 gold minimum (Grades A, B, C) Type I Type II Type III 99.9 gold minimum (Grades A, B, C) Grade A 90 Knoop maximum Grade B 91-129 Knoop maximum Grade C 130-200 Knoop maximum Grade C Grade D Class 00 Class 0 Class 1 Class 2 Class 3 Class 4 Class 5 Class 6 201 Knoop and over .00002" mir .00002" min .00003" min .00005" min .00010" min .00020" min .00030" min .00050" min .00150" min SULFAMATE NICKEL MIL-P-27418 (USAF) Electroforms, molds, electronic leads for ductility. Flexible circuits, soldering, brazing, PC boards, diffusion barrier in between gold over copper. Soft gray ductile nickel plate. Additives may be used to harder .000010 to NICKEL QQ-N-290 There is a nickel finish for almost any need. Nickel can be deposited soft or hard, dull or bright, depending on process used and conditioned employed in plating, Thus, hardness can range from 15-600 Wckers. Can be similar to stainless steel light grey (almost while) color. Corrosion resistance is a function of thickness. Has a low coefficient of thermal expansion – is magnetic. All steel parts having a hardness of RC40 or greater require a post bake at NOTE: All steel parts having a tensile strength of 220,000 or greater shall not be nickel plated without specific approval of procuring agency. Class 1 .0016" .0012" .0010" .0008" .0006" .0004" .0002" Grade A Grade B Grade C Grade D Grade E or procuring agency. For corrosion protection. Plating shall be applied over an underplating of copper or yellow brass on zinc and zinc based alloys. In no case shall the copper underplate be substituted for any part of the specified nickel thickness. Grade F Grade G Class 2 For engineering applications greater require a post bake 375°F ± 25°F for 3 hours. PASSIVATE 00-P-35 Specifications cover standard recommendation practice for cleaning and descaling stainless steel parts, equipment and systems. Cleaning includes all operations necessary for the remval of surface contarinnates from metals to ensure (1) and the metal (2) prevention of product contamination; and (3) achievement of desired appearance. No dimensional change Type II Medium temperature nitric acid solution with sodium dichromate additive. Type VI Low temperature nitric acid solution. Type VII Medium temperature nitric acid solution Type VIII Medium temperature high concentrate nitric acid solution. **CITRIC PASSIVATE** ASTM A380 200, 300, and 400 Series (except free machining alloys), duplex, precipitation hardening and maraging alloys. Code N Fully annealed only Citric acid, 1 weight % plus NaNO_{3,} 1 weight % THICK-NESS SPEC NO. & COMMENTS MIL-DTL-5541 ➡ For maximum protection agains BHODIUM MII - R-46085

PROCESS

GOLD

ANODIZE/TITANIUM

Typically used as a lubricating and anti-galing coating for elevated temperature forming, as an isolating film for increased resistance to galvanic corrosion, to provide improved wear resistance and as a pretreatment for the application of solid film lubricants, but usage is not limited to such applications.

THICK-NESS

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SPEC NO. & COMMENTS

MIL-DTL-45204

Type 2 shall be furnished unless Type 1 is specified.

AMS-2488

TYPE CLASS

Type 2

THUCESS	CLASS	NESS	SI LO NO. & COMMENTS	THOULSS	CLASS	NESS	SI LO NO. & COMMENTS	(except free machining alloys),		annealed	1 weight %
HARD ANODIZE			MIL-A-8625	CHEMICAL FILMS			MIL-DTL-5541	duplex, precipitation hardening and maraging alloys.		only	
Color will vary from light tan to black depending on alloy and	Type III	As specified on drawing.	Hard coatings may vary in thickness from 0.0005" to 0.0045"				For maximum protection against corrosion, painted or unpainted.	RHODIUM			MIL-R-46085
thickness. Can be dyed in darker colors depending on thickness. Coating PENETRATES base metal as much as builds up on surface.		If not specified nominal thickness	Specify thickness on contract or applicable drawing.	clear to iridescent yellow or brown, inspection difficulties may arise with clear coatings because visual inspection does	Class 3	\longrightarrow	For protection against corrosion where low electrical resistance is required.	Metallic and similar to stainless steel in color. Excellent corrosion resistance. Almost	Class 1 Class 2	.000002" .00001"	Applications range from electronic to nose cones-wherever wear, corrosion resist solderability and reflectivity are
as much as builds up on surface. The term THICKNESS includes both the buildup and penetration. Provides very hard ceramic type		shall be .002"		not reveal the presence of a coating.	Type II	\longrightarrow	RoHS compliant	as hard as chromium. Very good abrasion resistance. Thicker coatings are very brittle.	Class 3 Class 4 Class 5	.00002" .00010" .00025"	important.
coating. Abrasion resistance will vary with alloy and thickness of	e will Class 1		COPPER MIL-C-14550			Has high reflectivity. Parts having hardness of RC33 or					
coating. Good dielectric properties. Do not seal coatings where main function is to obtain maximum abrasion or wear resistance. When used for exterior applications requiring corrosion	Class 2		Dyed. Specify color on contract. Process can be controlled to very close thickness tolerances. Where maximum serviceability or special properties are required, consult metal finisher for best	Copper in color and matte to very shiny finish. Good corrosion resistance when used as undercoat. A number of copper processes are available, each	Class 0	Unless otherwise specified .001005"	For heat treatment stop-off.	above shall be baked at 375°F for 3 hours prior to cleaning. Parts having hardness of RC40 and above shall be baked within 4 hours after plating at 375°F			
resistance but permitting reduced abrasion resistance, the coating shall be sealed (boiling deionized			alloy choice. Thick coatings (over .004") will tend to break down sharp edges. Typical applications: Hydraulic cylinders,	designed for a specific purpose. Brightness (to eliminate the need	Class 1	.001"	For carburizing and decarburizing shield.	for 3 hours.			QQ-S-365
water or hot 5% sodium dichromate solution, or other			wear surfaces, actuating cams, etc. Can be used as an electrical insulation coating.	for buffing); High speed (for electroforming); Fine grain (to prevent casehardening); etc.	Class 0	.0005"	also plated through printed circuit boards. As an undercoat for nickel and other	White matte to very bright in		.0005" min.	Increasing use in both decorative and
suitable chemical solutions). Abrasion resistance for unsealed coatings tested by method 6192			"Flash" hard anodize may be used instead of conventional anodize for corrosion resistance and may be more economical	Stress relief steel parts cold straightened or suspected of having residual tensile stresses	Class 2		platings.	appearance. Good corrosion resistance, depending on base metal, Will tarnish easily.		unless otherwise specified	engineering fields, including electrical and electronic fields.
of FED-STD-141 using CS-17 wheels with 1000 gm load. For 2024 and other copper bearing			in conjunction with other hard anodized areas.	(350°F ± 25°F-3 hours). Parts with tensile strength over 210	Class 3 Class 4	.0002" .0001"	To prevent basis metal migration into tin (prevents poisoning solderability).	Hardness varies from about 90 Brinnell to about 135 Brinnell	Type I		Matte
alloys the anodic coating loss shall not exceed 40 milligrams – for all				Ksi bake 24 hours for 4 hours after plating.	01d55 4	.0001		depending on process and plating conditions. Solderability is excellent, but decreases with	Type II	\longrightarrow	Semi-bright
other alloys shall not exceed 20 milligrams.				ELECTROLESS NIC	KEL		MIL-C-26074	age. Best electrical conductor. Has excellent lubricity and smear	Type III Grade A	\rightarrow	Bright Chromate post-treatment to improve
SULFURIC ANODIZ	-		MIL-A-8625	Similar to stainless steel in color. Plates uniformily in recesses		Unless otherwise	Minimum thickness of the nickel coating shall be .001 for aluminum-based alloys,	characteristics for anti-galling uses on static seals, bushing, etc. Stress relief steel parts at a			tarnish resistance.
Minimum weight Type II coatings after sealing: Class 1-600 milligrams/sq.ft. Class 2-2500 milligrams/sq.ft.	Type II	.00007"- .0010"	Conventional coatings from sulfuric acid bath for all aluminum alloys, but not to be used where solution will entrap. Intended to improve surface corrosion protection	and cavities (does not build up on edges). Corrosion resistance is good for coatings over .001" thickness. Electroless nickel is		specified	.0005 for copper, nickel, cobalt, titanium and Be alloys, and .0015 for iron-based alloys.	minimum 375°F ± 25°F or more prior to cleaning and plating if they contain or are suspected of	Grade B	\rightarrow	No supplementary treatment.
(For wrought alloy 2000 series and casting alloys with 1.0% or greater copper content minimum			under severe service conditions or as a base for paint systems.	used extensively in salvage of mis-machined parts. Also, for inside dimensions and irregular	Class 1	\rightarrow	As plated, no subsequent heat treatment. A bake for hydrogen embrittlement relief is not considered a treatment.	having damaging residual tensile stresses. Embittlement relief all steel parts RC40 and above at			
weight shall be 1400 milligrams/sq.ft.) Corrosion resistance requirements (same	Type IIB		Thin sulfuric acid anodizing for use as a non-chromate alternative for Type I and Type IIB coatings.	shapes (where assembly tolerances need uniformity	Class 2		Heat treated to obtain required hardness. May be used on all metals not affected by	375°F ± 25°F for 3 hours within 4 hours after plating.			
as chromic anodize). Type III processes may be used to	Class 1 Class 2	\rightarrow	Non-dyed.	provided by "electroless" process). Precoating and postcoating procedures:	Class 3	 →	heating to 500°F and above. Aluminum alloys non-heat-treatable, and	TIN			MIL-T-10727
produce Type II coatings.			Dyed. Specify color on contract.	-Class 1- below RC40. Bake at 375°F ± 25°F at users option			beryllium alloys processed to improve adhesion of the nickel deposit.	Color is gray-white in a plated condition. Has very high luster	Type I	\longrightarrow	Electrodeposited
A uniform black coating for ferrous metals. Mostly a decorative coating. Only very	Class 4	No dimensional change	For moving parts which cannot tolerate the dimensional change of a more corrosion resistant finish. For decorative applications	-Class 1- RC40 and above. Bake at 375°F ± 25°F for 3 hours. Shot peen steel parts designed for unlimited life under dynamic	Class 4 Grade A	001"	Aluminum alloy, heat treatable, processed to improve adhesion of the nickel deposit.	in fused condition. Soft, but is very ductile. Soderability is excellent. Tin is not good for low temperature applications		.0001- .00025" .00020004" .0003" min.	Flash for soldering. To prevent galling and seizing. Where corrosion resistance is important. To prevent formation of case during
limited corrosion protection under mild corrosion conditions. Black oxide coatings should normally be given a supplementary		onango	and can be used to decrease light reflection. Alkaline oxidizing. For 300 series corrosion resistant steel alloys only.	loads prior to plating. -Class 2-below RC40. Shot penned parts designed for unlimited life prior to plating.	Grade B			(changes structure and loses adhesion when exposed to temperatures below 40°C). Customer to specify bright or		.0003 1111.	nitrìding.
treatment (i.e., oil displacement per MIL-C-16173 Grade 3 or				Post plating bake 3 hours min. 350°F.				dull.			MIL D 04700
protective treatments of MIL-C- 16173).				-Class 2 coating. Shall have minimum hardness of 850 knoop (100gm load).	Grade C	.0015" min		TIN LEAD Excellent solderability. Either a		Unless	MIL-P-81728
CADMIUM			QQ-P-416	-Class 3. Post bake 1-1½ hours at 375°F ± 25°F. -Class 4. Post bake heat				matte or bright luster is acceptable. For electronic		otherwise	Lead remainder.
Bright silvery white. Supplementary treatments for Type II can be golden, iridescent, amber, black, olive drab.	Type I Type II	\rightarrow	As plated. Supplementary chromate treatment.	treatable alloys 1-1½ hours at 240°F-260°F.				components use only parts with a matte or flow brightened finish.	60/40	.0003" .0005"	
Corrosion resistance is very good, especially with Type II finish. Type Label a beau and more red with Class			instal be Class 2 minimum thickness, If the maximum thickness for Class 1 is not specified in the contract, in. order or applicable drawing, the thickness shall not exceed 0.0006 in h(0.8 mi), Where Class 2 is specified, all other visible surfaces shall be Class 3 minimum thickness. Where Class 1 is specified, and other visible surfaces shall be not kess than 0.00015 inch minimum thickness. For tackness that August of thickness other visible drawing and the Class 3 thickness potentiation. There shall be not have ranks are been as the class other visible surfaces and the class of the Class 3 thickness potentiation. There shall be not have ranks are been as the class other visible surfaces and the class of the class potentiation. There shall be not have ranks are been as the class other visible surfaces and the class of the class potentiation. There shall be not have ranks are been as the class other visible surfaces and the class of the class potentiation. There shall be not have ranks are been as the class other visible surfaces and the shall be not have ranks are been as the class other visible surfaces and the shall be not be an example.	ELECTROPOLISHING		(NO MIL-SPEC NO.)	SUBSTRATES and MECHANICAL CLEANING				
Ipating shart show no surface nor basis metal correstion products after 96 hours sait spray exposure except that white correstion products after 96 hours sait spray exposure except that white correstion products the constitute failure. Corresion test shall conform to ASTM 8117 (MilL- STD-312) exit 1 for fastener.	.0002" min.	Process electrolytically removes or diminishes scratches, burrs and urwartet sharp edges from most metals. Finishes from satin to mirrot-bright are produced by controlling time, temperature, or both.		Typical dimensional change. Process is not recommended for close tolerance surfaces.	We regularly pass 300 degrees Celsius and in some cases as high as 450 degrees Celsius af plating depending on the base material. This allows for high temperature soldering, brazing, post machining operations after plating. Please inquire about any special applications that y may require. If you do not see your substrate material listed, please call and speak with us. V welcome the opportunity to research plating on new materials and are always willing to samples for customer approval.						
hardware). Type II shall be aged at room temperature for 24 hours			other than fastener hardware the cadmium plating shall be Class 1 thickness unless otherwise specified in the contract. Articles with portions externally	ADDIT	IONAI	L SPECIE	ICATIONS	ALBeMet® BRASS ALSIC BRONZE		VAR IVAR	NICKEL STAINLESS STEEL NIOBIUM TECU
before subjection to salt spray. Unless otherwise specified, steel parts with tensile strength greater than 240,000 lbs. per sq. inch shall act be olded. All steel orte begins			threaded shall have a minimum of Class 2 thickness on the threaded portions. Holes and other openings and articles with internal threads from which the	AMS 2400 AMS 2420 AMS 2403 AMS 2422 AMS 2404 AMS 2423	AMS AMS AMS	2477 2482	AMS-QQ-P-35 ASTM B545 AMS-QQ-P-416 ASTM B579 AMS-STD-753 ASTM B580	ALUMINUM COPPER E MATERIAL MOLY /COPPE BeCu INCONEL	MO	OLYBDENUM ONEL	NOB METALLICS THERMKON® Ph BRONZE TITANIUM SILVER TUNGSTEN
not be plated. All skeel 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.			external environment is completely excluded shall not be subjected to thickness requirements but shall show evidence of coating. There shall be no bare areas. Type II best for corrosion resistance. Excellent for plating stainless steles that are to be used in conjunction with auminum to prevent galvanic corrosion. Cadmium deposition should not be used when an alternate process, meets the performance	AMS 2405 AMS 2424 AMS 2408 AMS 2425 AMS 2410 AMS 2426 AMS 2411 AMS 2469 AMS 2412 AMS 2469 AMS 2413 AMS 2471 AMS 2414 AMS 2471 AMS 2413 AMS 2471 AMS 2414 AMS 2472	AMS- AMS- AMS- AMS-	2700 -A-8625 -C-26074 -M-3171 -P-81728 -P-27418	ASTM A380 ASTM B689 ASTM A967 ASTM B700 ASTM B253 ASTM B733 ASTM B281 ASTM B734 ASTM B449 ASTM B766 ASTM B441 ASTM B912 ASTM B488 ASTM F86	aid in increasing the adherence for metal finishing. Mechanical contaminants. In these situations or similar mechanical cleaning.	of coating cleaning a s it is poss Blasting v	gs. This proces also provides s sible to remove with a suitable	I or aluminum oxide. This process can ss can also be used to prepare materials surface cleaning for hard to remove the contamination with a blast operation media can remove dirt, mill scale, rust a profile that gives good coating adhesion.
2018 Revision			requirements of this specification.		AMS-	QQ-N-290		o, providuo coaurigo norri a SUDS		nanny a sundo	o promo una greco good coauny autesion.

- 248 I.D.

The steel rod is plated .001" thick - note the

.001 1 1/2"

Steel Rod

PROCESS

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bits, and a set of the set of

 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 all

7. When fabricating sheet 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 the plater and with the integrity of the parts and with subsequent painting procedures.

Do not overlook baking specifications prior to and after plating operations of steel alloy RC40 and over. Also alloys with tensile strength of 1000 MPA and over, these baking procedures are mostly for relief of hydrogen embrittlement.

TYPE CLASS

THICK-NESS SPEC NO. & COMMENTS