AEROJET ROCKETDYNE
An L3Harris Technologies Company

Supplier Material Processing Procedure (SMPP) Development Guide

Revision date: 04/11/2024

SMPP Scope

This document defines Aerojet Rocketdyne (AR) requirements for implementation of manufacturing and material process controls at supplier through the implementation of a supplier SMPP.

Requirements

The Supplier Material Processing Procedures (SMPPs) are written by the supplier to detail the step-by-step operations and controls that are specifically applied to ensure that the processed product meets all the engineering and quality requirements defined in the associated AR process specification. Each SMPP must be reviewed and formally approved by AR prior to the processing of any parts by the supplier.

The SMPP shall document, in a step-by-step manner, the nature and sequence of all of the following:

- Manufacturing operations
- Inspections
- In-process controls required to ensure compliance with all specification applicable requirements.

NOTE: The SMPP shall not be a copy or a restatement of the specification requirements. The operator performing the operation shall be able to properly complete the describe process by referring to the SMPP.

The SMPP shall have a title page that includes (as a minimum) the information outlined in the SMPP format guide below. The SMPP should be a stand alone document when suitable to the process/supplier. Reference to other supplier internal procedures within the SMPP should be kept to a minimum.

The supplier shall assign the SMPP a unique identification number and revision letter relating the SMPP to the associated specification number and revision. The SMPP revision letter shall remain the same letter through out the review and approval cycle. The supplier's SMPP documentation control number and structure of the document should be similar to the supplier's internal procedures.

The SMPP shall be submitted to the AR Buyer of record. The Buyer shall submit to Supplier Quality Assurance (group mailbox). Once the SMPP has been approved by AR Engineering Materials & Processes and Quality Process Engineering organization representatives, any changes made to the SMPP or any change by the supplier in their process parameters as stated in the approved SMPP shall require a re-submittal of the SMPP for AR approval prior to processing hardware.

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Proprietary Information

If the supplier identifies their SMPP as being proprietary, and it is written on the document, then the SMPP shall not go through the review cycle until all necessary issues pertaining to the proprietary requirements have been resolved.

Approved SMPP Changes

Any change in the supplier process that is a deviation from the approved SMPP requires a re-submittal of the updated SMPP for approval. AR specification revision may require the supplier to update their SMPP depending on the significance of the change. *AR Engineering M&P will provide the Supplier Quality Assurance group with documentation pertaining to technical or non-technical specification changes.*

SMPP Format

The following outline is a check list and guide for the preparation of an SMPP:

A. Title page

- Supplier name
- Supplier Address, City and State
- SMPP title
- SMPP identification number and revision letter
- Issue date
- AR specification number and revision letter.

B. Revision record page to document the specific changes to each SMPP revision.

C. Scope – Brief description of the applicability and intended use of the procedures established within the SMPP.

D. Applicable documents and materials – these documents may include weld parameters, heat treat parameters, chemical analysis procedures, specific materials, other specifications, etc. These documents must be called out within the body of the SMPP.

E. General notes — Information background, safety requirements, etc.

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F. Procedures

a) Sequential presentation of processing steps described in sufficient detail to ensure repeatability.
b) In-process inspection control points description (exp. Verify heat treat program specified in the approved heat treat parameter sheet is properly loaded into heat treat furnace)
c) Applicable data recording requirements are specified
d) Applicable test specimen processing described.
e) In process/part qualification procedures (If required)

G. Equipment and Tooling – Applicable equipment, special tooling, and measurement instruments listed. (If applicable per specification)

H. Quality Assurance

a) Each inspection, test, and processing control is adequately described.

b) Describe the following controls (If applicable per specification)

- Environmental and contamination
- Instrument calibration
- Equipment maintenance
- Equipment limitations
- Chemical solution controls including composition, temperature, and impurity control.
- Personnel certification/qualification
- Laboratory analysis
- Thermal survey
- Parameters

Package and Handling

Describe controls to preclude damage, contamination or corrosion during processing, handling, and shipping.

Attachment 1

Attachment #1 is an example of an approved SMPP. All of the applicable categories contained with the format guide of this document shall be incorporated into the SMPP. **This attachment is only a guide. The size or breath of the SMPP is dependent on the specific process/supplier.**

ATTACHMENT #1
SMPP SAMPLE

DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
# [redacted]	• *Aerojet Rocketdyne* SPECIFICATION: [redacted]	

LIST OF CONTENTS:

SECTION NUMBER:

PREPARED BY: _____
Title

AUTHORIZED BY: _____
Quality

AUTHORIZED BY: _____
Production

ATTACHMENT #1
SMPP SAMPLE

DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
# [redacted]	• *Aerojet Rocketdyne* SPECIFICATION: [redacted]	

1.0 SCOPE

This specification establishes the requirements and outlines the procedures for the electrodeposition of copper on the following *base* materials: Ferrous alloys, copper and copper base alloys, CRES type materials, iron base, cobalt base and nickel base alloys, and aluminum and aluminum base alloys. Stripping procedures are also outlined.

Copper applied in accordance with this specification meets the requirements of *Aerojet, Rocketdyne* specification [redacted], Revision *F*, [redacted] to the extent specified herein.

1.2 Classification

Copper plating covered by this specification shall be of the following classes:

Class 0 - 0.00100 to 0.00500 inch thick
Class 1 - 0.00100 inch thick (minimum)
Class 2 - 0.00050 inch thick (minimum)
Class 3 - 0.00020 inch thick (minimum)
Class 4 - 0.00010 inch thick (minimum)

2.0 APPLICABLE DOCUMENTS AND MATERIALS

2.1 Specifications and Standards:

The following documents, of the latest issue in effect, form a part of this specification to the extent specified herein.

Federal Specifications

QQ-S-571 Solder, Tin Alloy, Lead-Tin Alloy and Lead Alloy

Military Specifications:

MIL-F-14256 Flux, Soldering, Liquid (Rosin Base)

- **Military Standards:**

MIL-STD-202 F METHOD 208 H Solderability

American National Standards Institute

ANSI/J-STD-002 Solderability Test for components leads, terminations, lugs, terminals and wires

ANSI/J-STD-004 Requirements for soldering fluxes

American Society for Testing and Materials

ASTM B 568 Measurement of Coating Thickness by X-Ray Spectrometry.

ASTM B 487 Measurement of Metal and Oxide Coating Thickness by Microscopically Examination of a Cross Section.

ASTM B 499 Measurement of Coating Thicknesses by the Magnetic Method.

ASTM E-8 Tension Testing of Metallic Materials.

- ***Aerojet, Rocketdyne***

RA1609-XXX Copper Plating (Electrodeposited)

RA0116-XXX Parts Protection: General Requirements

2.2 Materials

Anodes, Carbon	Commercial
Anodes, Steel	Commercial
Anodes, Nickel	QQ-A-677
Anodes, Stainless Steel, 300 Series	Commercial
Anodes, Copper	QQ-A-673
Sulfuric Acid, Technical	O-S-809
Potassium Hydroxide, Technical	O-P-566

- *Brulin* [redacted]

Water: Deionized or distilled containing no more than 25 ppm total dissolved solids or a specific conductance of less than 50 micro-mhos (CM3).

Water: Tap, clear, with no turbidity.

3.0 GENERAL REQUIREMENTS

3.1 Safety, Health and Environmental Requirements

Hazardous chemicals used in this process shall be handled in accordance with the directives of the Safety Committee.

All materials and processes required in compliance with provisions of this specification are subject to applicable Federal, State, and local environmental, health and safety codes, standards, and regulations.

3.2 Basis Materials

The basis material shall be free of from defects that will be detrimental to the utility, form, fit, function or the protective value of the plating.

3.3 Preplating Operations

Unless otherwise specified, copper plating shall be applied after all machining, brazing, welding, forming and perforating of the article has been completed.

3.3.1 Inspection and Handling of Parts

Before plating, parts shall be examined for nicks, dents, scratches, or other damage. Parts that have been damaged to an extent that will prevent them from meeting drawing requirements after plate shall be rejected. Parts shall be handled so as to be kept clean and free of damage.

3.4 Postplating Removal of Plating Salts

Copper plating shall not be applied to assemblies, which will entrap the plating solution in edges, joints or recesses and cannot be removed. Such parts shall be plated prior to assembly. Residual plating salts shall be removed from plated articles by soaking after plating for a minimum of 3 minutes in clean hot water (200- 212 F).

3.5 Equipment and Processes

The parts to be plated shall be subjected to cleaning, pickling, and plating procedures in conformance with the requirements of 4.1 to produce a coating hereinafter specified.

3.5.1 Cleaning

All parts shall be thoroughly cleaned in accordance with Table II to remove all dirt, scale, grease, rust or other foreign materials prior to plating. No cleaning procedure shall be used in any manner to detrimentally alter the surface or shape of the part. Acid pickling on high strength steels is prohibited.

3.5.1.1 Visual Inspection

The operator shall subject all parts to a thorough visual inspection after each step in the cleaning cycle to assure a chemical clean and water-break-free surface prior to plating. Failure of any step to completely fulfill its cleaning function shall necessitate the repeating of that step.

3.5.2 Masking

Areas not to be copper plated as indicated on the engineering drawing or controlling documents, shall be properly masked-off using materials such as pressure sensitive tapes, wax-type materials, lacquers, rubber or plastic stoppers, etc., and techniques that will prevent harmful effects caused by lifting of the maskant, chemical attack or plating

room atmosphere. Masking materials shall be removed by methods that will avoid scratching the *base* metal.

3.5.3 Positioning

Parts shall be positioned in such a manner as to prevent the harmful effects of gas and solution entrapment during both the cleaning and plating cycles.

3.6 Stress Relief Treatment

*All steel parts having a hardness of 40Rc and higher which were machined, ground, cold-*worked or cold straightened shall be given a stress relief treatment of 375ºF ± 25ºF for 3 hours or more, prior to cleaning and plating for the relief of damaging residual tensile stresses.

Parts below 40Rc that are cold straightened are considered to contain damaging residual *tensile stresses, and may crack during cleaning and plating. All cold straightened steel parts shall be given a heat treatment based on the parameters of 3.6.*

The manufacturer shall notify [redacted] of the need to process hardware to this requirement. When stress relief is required, the manufacturer shall specify the PSI or Rc hardness of the alloy. Unless otherwise specified, the following alloys do not require a stress relief prior to processing.

(1) 300 series, except AS350 and AM355 steels
(2) A286 corrosion resistant steels

3.7 Hydrogen Embrittlement Relief

All steel parts having a hardness of 40Rc and higher shall be baked at 375ºF ± 25ºF (191 ± 14 C) for 24 hours, within 4 hours after plating to provide hydrogen embrittlement relief.
Plated springs and other parts subject to flexure shall not be flexed prior to the baking operation.

The manufacturer shall specify the PSI or the Rc hardness of the alloy. Unless otherwise specified, the following alloys do not require a hydrogen embrittlement bake.

(1) 300 series, except AM350 and AM355 steels
(2) A286 corrosion resistant steels

3.8 Thickness of Plating

Unless otherwise specified, the thickness of copper shall be as specified *in Table* I on all visible surfaces which can be touched by a ball 0.75 inch in diameter. The thickness of plating on surfaces that cannot be touched by a ball 0.75 inch in diameter should be sufficient for plating continuity and uniform appearance.

TABLE I THICKNESS

Class	Thickness (inch)
0	0.00100 - 0.00500
1	0.00100 minimum
2	0.00050 minimum
3	0.00020 minimum
4	0.00010 minimum

3.9 Solderability

When required by the customer, plated specimens or parts shall be easily and completely coated with solder when tested as specified in 5.5.4. The solder shall be deposited uniformly without lumps or peaks and shall be essentially free from evidence of blistering, bubbling, foaming, voids and other defects. The solder shall firmly adhere to the plating and the plating shall be firmly adherent to the *base* metal. There shall be no separation at the solder-plating interface, or at the plating-*base*-metal interface, so that they cannot be lifted when a sharp edged instrument is applied.

3.10 Adhesion

The adhesion shall be such that when examined at a magnification of four diameters, it does not show separation from the *base* metal at the interface when subjected to the test specified in 5.5.2. The interface between the copper and the *base* metal is the surface of the *base* metal before plating. The formation of cracks in the *base* metal or plate, which do not result in flaking, peeling, or blistering of the plate shall not be considered as failing this requirement.

3.11 Quality

The copper plating shall be smooth, fine-grained, adherent free from blisters, pits, scale, Nodules, and other defects which are detrimental to the utility, form, fit or function of the part.

3.12 Traceability

Unless otherwise specified, all records and documents pertaining to hardware processed in accordance with this specification shall be retained for a minimum of 20 years. Such records and documents shall be available for review upon request by *Aerojet Rocketdyne* or Government representative.

4.0 DETAIL REQUIREMENTS

4.1 General Procedures

General Procedures for cleaning the various *base* metals are outlined in Table II.

4.2 Stripping Procedures

Procedures for stripping copper and plating undercoats from the various *base* metals are outlined in Table III.

ATTACHMENT #1
SMPP SAMPLE

DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
# [redacted]	• *Aerojet Rocketdyne* SPECIFICATION: [redacted]	

TABLE [redacted] PROCEDURE FOR COPPER PLATING

OPERATION	SOLUTION CONSTITUENTS	CONCENTRATION	TEMP ºF	CURRENT DENSITY AMPS/SQ. FT.	TIME MINUTES	REMARKS
1. Inspect	----------	----------	---------	----------	----------	Check for conformance to 3.6. Count parts and insure that test panels are received and properly identified.
• 2. Alkaline cleaner [redacted]	Brulin [redacted]	[redacted]	[redacted]	-------	[redacted]	Remove grease, oil, etc
3. Stress relief	----------	----------	---------	----------	----------	Bake as specified in paragraph 3.6.
4. Mask, rack wire	----------					Per drawing requirements.
5. Abrasive Clean	(See 2.2)	----------	----------	----------	----------	Using aluminum oxide [redacted] grit. OPTIONAL
6. Activate	----------	----------	----------	----------	----------	Per addendum # 1
7. Nickel Strike	Nickel Chloride Hydrochloric Acid	[redacted]	Room	[redacted]	3 - 10	Make parts cathodic at [redacted] volts. Use nickel anodes (Note 1) (Note 2).
8. Rinse	Flowing Tap Water	----------	Room	--------	Until free of nickel strike	Flow of water shall be sufficient to change water at least every 30 minutes
• 9a.Copper Strike (Tank [redacted])	Copper as metal Potassium Carbonate Potassium Cyanide	[redacted]	[redacted]	Note 3	Note 3	Make electrical contact before immersing parts in solution and maintain contact until parts are removed. For Aluminum alloys.
• 9b.Copper Strike	Copper Metal Free Potassium Cyanide Potassium Hydroxide Potassium Carbonate	[redacted]	[redacted]	[redacted]	3 - 10 or as required to complete coverage	

ATTACHMENT #1
SMPP SAMPLE

DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
# [redacted]	• *Aerojet Rocketdyne* SPECIFICATION: [redacted]	

TABLE [redacted] PROCEDURE FOR COPPER PLATING *(continued)*

OPERATION	SOLUTION CONSTITUENTS	CONCENTRATION	TEMP DEG.F	CURRENT DENSITY AMPS/SQ. FT.	TIME MINUTES	REMARKS
10.Copper Plate	Bath A Cupralite Copper Cyannide Maintain bath as follows: Copper Metal Potasium Cyanide Potassium Hydroxide Sodium Carbonate ---------- Bath B Acid Copper Process Maintain and control as follows: CuSO4 H2SO4 Copper Metal Chloride	[redacted] ---------- [redacted]	[redacted] -------- [redacted]	[redacted] ---------- [redacted]	As needed to meet requirements of 3.8	Use mild to vigorous agitation. Use copper anodes 1-1 ratio minimum. (Note 1) ---------- Use air agitation. Use copper anodes 1-1 minimum ratio. Voltage 1-4. (Note 1)
11. Rinse	Flowing Tap Water	----------	Room	--------	Until free of copper solution	Flow of water shall be sufficient to change water at least every 30 minutes
12. Soak	Distilled or deionized water	----------	200 min.	--------	3 min.	Remove any residual plating salts to meet the requirements of 3.4. Water shall be changed at the end of the work day.
13. Dry	Clean, dry, compressed air	Under pressure	Room	------	until dry	Oil free
14. Bake	-----	---------	--------	----------	---------	All parts requiring hydrogen embrittlement relief per 3.7.

ATTACHMENT #1
SMPP SAMPLE

DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
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- **NOTES FROM TABLE [redacted]**

1. Poor adhesion caused by immersion deposits from a contained bath can be prevented by “live contact”. If the deposit from the nickel strike becomes dark and powdery, this may be regarded as evidence that the bath has become contaminated and should be purified or discarded.

[redacted]

3. For aluminum and aluminum base-alloys use a current density of 24 +/- 4 amps per square foot for 1-2 minutes and then decrease the current density to 12 +/- 2 amps per square foot for 3-5 minutes.

ADDENDUM # 1

Base Metal	[redacted]
Inconel alloys, 300 series CRES, A286	[redacted]
Ferrous Alloys	[redacted]
Aluminum 2000 to 7000 series	[redacted]
Monel	[redacted]

ATTACHMENT #1
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DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
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TABLE [redacted] PROCEDURE FOR STRIPPING COPPER

Operation	Basis Material	Solution Constituents	Concentration	Temp. Deg .F	Immersion	Other Details
1. Strip	Low alloy & Carbon Steels 400 Series CRES Nickel & Cobalt & Iron base Alloys except Monels, Hastelloys, Nickel & Invar 36 ---------- 300 Series CRES & A286 ---------- Aluminum & Aluminum Alloys	[redacted] ---------- [redacted]	[redacted] ---------- [redacted]	Room ---------- Room	Until stripped	Non-electrolytic. Immerse completely in solution. Stripping rate will vary from 0.0002 to 0.0015 inch per hour. Agitation increases the stripping rate about 50%. Observe stainless steel, nickel-base, cobalt-base, and iron-base iron-base alloys frequently and remove as soon as possible to avoid pitting.(Note 1)
2. Rinse	All	Flowing tap water	--------	----------	----------	----------
3. Dry	All	Clean, filtered air	----------	--------	---------	Oil-free.
4. Bake	---------	----------	----------	---------	--------	All parts requiring hydrogen embrittlement relief 3.7.

NOTES FOR TABLE [redacted]

1. Because Monels, Hastelloys, Nickel and Invar 36 will undergo some attack in the stripping solution, mechanical means of removing (machining, grinding, or abrasive method) will generally be used.

5.0 QUALITY ASSURANCE PROVISIONS

5.1 Responsibility for Inspection

Unless otherwise specified in the purchase order, Quality Control Inspection is responsible for performing all inspection requirements as specified herein. Except as otherwise specified in the purchase order, Quality Control Inspection shall use in-house or other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by *Aerojet, Rocketdyne. Aerojet, Rocketdyne* shall have the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

5.2 Lot

A lot shall consist of articles of approximately the same size, form and shape and plated in the same bath at the same time, under the same conditions, to the required thickness.

5.3 Sampling

5.3.1 Acceptance Tests

Test samples shall be selected randomly from all parts in the lot to verify compliance with all requirements of this specification for visual examination and nondestructive tests for plating thickness. The minimum number of samples shall be as shown in Table IV.

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SMPP SAMPLE

DATE: [redacted]	PROCESS: COPPER PLATING (ELECTRODEPOSITED)	REV J
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TABLE XX SAMPLING FOR ACCEPTANCE TESTS

Number of Parts In Lot	***Quality (3.11)***	***Thickness (5.5.1)***
1 to 6	*All*	*4*
7 to 15	*All*	*4*
16 to 40	*10*	*4*
41 to 110	*15*	*5*
111 to 300	*25*	*6*
301 to 500	*35*	*7*
501 to 700	*50*	*8*
701 to 1200	*75*	*10*
Over 1200	*125*	*15*

5.3.2 Destructive Tests For Plating Thickness, Adhesion, Solderability, and Hydrogen Embrittlement

A random sample of four items shall be selected from each lot or four separately plated specimens shall be prepared to represent the lot for each destructive test. If the number of items in the inspection lot is 4 or less, the customer shall determine the number of items in the sample. Separate specimens shall not be used for thickness measurements unless a need has been demonstrated. The articles or specimens used for destructive thickness test, if of suitable size and form, may be used as the specimens for the adhesion test. Failure of any sample to conform to the applicable tests shall reject the lot represented.

5.3.3 Specimen Preparation

When the plated parts are of such form, shape, size and value as to prohibit use thereof, or are not readily adaptable to the test specified herein, or when destructive tests of small lot sizes are required, the test shall be made by the use of separate specimens plated concurrently with the parts represented. The separate specimens shall be of a *base* metal equivalent to that of the parts represented. Equivalent *base* metal includes chemical composition, grade, heat treated condition and finish of surface prior to plating. These specimens shall be introduced into a lot at regular intervals prior to the cleaning operations before plating and shall not be separated there from until after completion of

plating. Conditions affecting the plating of specimens including the spacing and positioning in respect to anodes and to other objects being plated shall correspond as nearly as possible to those affecting the significant surfaces of the articles represented.

5.3.3.1 For Thickness, Adhesion and Solderability Tests

If separate specimens for thickness, adhesion and solderability tests are required, they shall be strips approximately 4 inches long, 1 inch wide and 0.040 inch thick.

5.3.3.2 For Embrittlement Relief

Testing for hydrogen embrittlement relief (see 3.7) on parts which will be subjected to a sustained tensile load in use shall be made on separate specimens. When hydrogen embrittlement relief testing is specified for those parts which will be subjected to a sustained tensile load in use, separate specimens, if required, shall be prepared. They shall be round notched specimens with the axis of the specimen perpendicular to the short transverse grain flow direction. The configuration shall be in accordance with figure 8 of ASTM E 8 for rounded specimens. Specimens shall have a 60 degree V-notch located approximately at the center of the gage length. The cross section area at the root of the vee shall be approximately equal to half the area of the full cross section area of the specimen's reduced section. The vee shall have a 0.010 +/- 0.0005 inch radius of curvature at the base of the notch. Specimens shall be provided and tested by *Aerojet Rocketdyne*.

5.4 Inspection

5.4.1 Visual Inspection

The number of items indicated in 5.3.1 shall be taken at random from the lot to be inspected and examined visually to ensure compliance with requirements of 3.11. If the number of non-conforming items in any sample exceeds the acceptance number for that sample, the lot represented by that sample shall be rejected.

5.5 Test Methods

5.5.1 Thickness Test

Unless otherwise specified, a destructive thickness measurement shall be determined in accordance with the microscopic test method ASTM B 487. At the option of [redacted], tests may be performed to ASTM B 499 (magnetic), ASTM B 567 (Beta radiation backscatter), or X-ray fluorescence (ASTM B 568).

5.5.2 Adhesion Test

5.5.2.1 Bend Test

Whenever possible the test shall be made on a specimen representing the *base* material which can be bent 180 degrees. The article or test specimen shall be clamped in a vice and the projecting portion bent back and forth repeatedly until rupture occurs. Following fracture of the *base* metal, it shall not be possible to detach any appreciable area of the coating with a sharp instrument.

5.5.2.1 Alternate Adhesion Test

When the plated articles are not readily adaptable to the bend test, adhesion may be determined on the plated article or on a separate specimen representative of the plated article (see 5.3.2) by cutting the plating from the basis metal at the interface in a continuous path. The plate shall then be examined at four diameters magnification to determine whether removal has been caused by the cutting away of an adherent plate or by lifting of a nonadherent plate.

5.5.2.3 Machining on Aluminum

When specified as an adhesion test, machining for final dimensions on aluminum and aluminum base alloys shall validate the copper bond by its capability to withstand the necessary machining operations. The adhesion of the plating shall be such that when examined at a 4x magnification it does not show separation from the *base* metal at the substrate interface. Representative test panels will not be required to determine adhesion characteristics.

5.5.3 Embrittlement Relief

When specified, samples of parts for determining compliance with 3.7 shall be taken as specified in 5.3.2. Parts such as spring pins, lock rings, etc., which are installed in holes or rods shall be similarly assembled using the applicable parts specifications or drawing tolerances which impose the maximum sustained tensile load on the coated part. The selected samples shall be subjected to a sustained tensile load equal to 115 percent of the maximum design load for which the part was designed. Parts, which require special fixture, extreme loads to comply with the above requirements, or where the maximum design load is not known, may be represented by separate specimens prepared in accordance with 5.3.2 and 5.3.3. The notched specimens shall be subject to a sustained

tensile load equal to 75 percent of the ultimate notch tensile strength of the material. Unless otherwise specified, the articles, parts or specimens shall be held under load for at least 200 hours and then examined visually for cracks or fractures.

Note: The frequency of testing may be held to monthly when satisfactory results are being obtained, otherwise testing shall be as outlined in 5.3.2.

5.5.4 Solderability

Solderability shall be determined where required by coating a *copper plated part or a copper plated* test specimen *(5.3.3.1)* with flux conforming to type R of MIL-F-14256 and then partially immersing in solder conforming to composition SN 60 of QQ-S-571 for 3 seconds at a solder pot temperature of 450+/-25 F. The test specimen shall be pre-heated prior to immersion or held in the bath until the specimen or part reaches pot temperature. A mechanical dipping device, similar to that detailed in method 208 of MIL-STD-202, may be used to immerse the test specimen at the rate of 1 +/- 1/4 inch per second. Upon removal, the test specimen shall be shaken lightly to remove excess solder and allowed to cool in air. *The solder coating shall be uniform, with no bubbles or dewetted areas, occasional drips of excess solder are permissible.* After examination, the *part or* specimen shall be subjected to the bend test described in 5.5.2.

5.5.5 Retests

Plated items that have been rejected or withdrawn because of the presence of plating defects may be resubmitted after stripping and replating or after screening of the entire lot. Replating shall be as outlined in this specification.

6.0 PACKAGING

6.1 Packaging Requirements

After completion of processing, parts shall be packaged as soon as practical, per RA0116-094 Method P-5 as a minimum, as applicable, to protect cleanliness and prevent damage during shipment and handling.