SAE Aerospace
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AEROSPACE STANDARD

SAE AS7108 REV. B

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Superseding AS7108A

Nadcap AUDIT CRITERIA FOR CHEMICAL PROCESSING

1. SCOPE

This Aerospace Standard (AS) establishes the requirements for suppliers of Chemical Processing Services to be accredited by Nadcap. Nadcap accreditation is granted in accordance with SAE AS7003 after demonstrating compliance with the requirements herein. These requirements may be supplemented by additional requirements specified by Nadcap Chemical Processes Task Group. Using the audit checklist (AC7108) will ensure that accredited Chemical Process suppliers meet all of the requirements in this standard and all applicable supplementary standards.

2. REFERENCES

2.1 SAE Publications

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AS7003	Nadcap - Program Operation
AMS 2750	Pyrometry
ARP1820	Chord Method of Evaluating Surface Microstructural Characteristics
ARP4992	Periodic Test Plan for Processing Solutions
AS 9000	Aerospace Basic Quality System Standard
AS 9100	Model for Quality Assurance in Design, Development, Production, Installation, and Servicing

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2.2 PRI Publications

Available from Performance Review Institute, 161 Thornhill Road, Warrendale, PA 15086-7527.

AS7108/1 Nadcap - Requirements for Painting & Dry Film Coating
AS7108/2 Nadcap - Requirements for Etch Processes (Macrostructure, Nital, Temper, Blue Etch Audits.)
AC7004 Audit Criteria for Standard Quality Program Requirements for Special Processors for AS9000 Compliance

2.3 U.S. Government Publications

Available from DODSSP Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, Pennsylvania 19111-5094

FED-STD-141 Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing
MIL-STD-202 Test Method for Electronic and Electrical Component Parts

2.4 ASTM Publications

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

ASTM B 117 Operating Salt Spray (Fog) Apparatus
ASTM B 571 Test Methods for Adhesion of Metallic Coatings
ASTM B 678 Test Method for Solderability of Metallic-Coated Products
ASTM D 4060 Test Method for Abrasion Resistance of Organic Coatings
ASTM E 384 Test Method for Microhardness of Materials
ASTM F 519 Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments
ASTM D 1193 Standard Specification for Reagent Water

2.5 ANSI Publications

Available from ANSI, 25 West 43rd Street, 4th Floor, New York, NY 10036

ANSI INCSL Z540-1 Calibration Laboratories and Measuring and Test Equipment – General Requirements

2.6 ISO Publications

Available from ANSI, 1819 L Street, NW, Suite 600, Washington, DC 20036

ISO 10012-1 Quality Assurance Requirements for Measuring Equipment

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2.7 Definition of Terms

CONTROL LIMITS: Calculated operating limits resulting from statistical process control programs.

DEIONIZED WATER: 50,000 ohm•cm resistivity minimum.

DEIONIZED WATER FOR ANALYSIS PURPOSES (Lab Water): 500,000 ohm•cm minimum.

FIRST PIECE: First time processing a specific part number.

IN PROCESS: Parts have been accepted for processing and released to manufacturing but not yet accepted at final inspection, or scrapped. (In-processed inspections are typically "visual" (water-break uniformity, coverage, etc.) "checks" used to determine if parts should proceed to the next processing step.

JOB: All of the hardware processed to a single order control document as a lot or multiple lots with a unique control number.

LOT: Unless otherwise specified, shall be all parts of the same part number, material, size and shape, processed at the same time, using the same processing materials, under the same conditions in not more than 8 hours and presented for inspection at one time.

POLICY: A written company philosophy on how something should be done in very broad generic terms. The existence of a procedure shall satisfy the requirements for a policy.

PROCEDURE: A detailed "how to", step-by-step revision controlled document used to enforce or implement company policy.

REPLACEMENT TEST: (No Test) A test that is repeated due to a failure in the original test that is attributed to a cause indicating that the failure is not representative of the parts. (i.e., test specimens are not made of the correct material, specimens are not processed properly, test was not run to specification requirements, etc.)

RETEST: A repeat of a TEST by the same lab, using the same method, equipment (of equivalent accuracy or better), and sample. Usually performed in response to suspect or nonconforming results from the original test(s).

SHOP TARGET LIMITS: The processor-set operating limits, beyond which adjustments are made.

TECHNICAL BULLETIN LIMITS: The specification or manufacturer-set limits beyond which the process must be shut down.

3.0 GENERAL QUALITY SYSTEM

3.0.1 As a minimum, the Quality System shall comply with PRI AC7004. Alternative quality system standards AS 9000 or AS 9100, have been recognized, as equivalent to AC7004 by Nadcap Management Council.

The quality system requirements are a prerequisite to accreditation. Accreditation cannot be issued without evidence of compliance with these requirements.

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3.0.2 The Quality Organization shall function without a vacancy in excess of 90 days. Management shall assign duties of the vacant position in the interim.

3.0.3 The supplier shall inform PRI of any changes of ownership, location, key personnel or quality system.

3.1 Statistical Methods – Process Integrity:

Statistical Methods shall be applied in accordance with the guidelines of Appendix A.

3.1.1 The supplier shall use statistical methods as a basis for process control.

3.1.2 The supplier shall utilize "first piece"/"lot" and "in process" inspection to verify process.

3.1.3 If Statistical Techniques are not used, the supplier shall have a plan to implement Statistical Techniques which as a minimum includes the core requirements as identified in Appendix A

NOTE: Statistical Techniques Implementation Plans are subject to approval by the Chemical Processing Task Group User Members.

3.1.4 If the supplier has been accredited to AS 7108 for a period of two (2) years or greater, the supplier shall be compliant with the core requirements of Appendix A as identified with an asterisk in Appendix A of AC 7108.

3.1.4.1 For subsequent audits (for audits performed following the first audit requiring compliance with the core requirements), the supplier shall be compliant with all requirements of Appendix A for at least one additional process as directed by Pareto Analysis.

3.1.5 Inspection and test personnel shall be trained in procedures and techniques for using sampling plans.

3.1.6 If used, supplier-developed sampling plans shall be available for review and approved by the customer when required by contract.

3.2 Training, Qualification, and Evaluation of Processing, Inspection, and Testing Personnel

3.2.1 Procedures shall require periodic evaluations to ensure that approved personnel maintain proficiency in their assigned tasks.

3.2.2 Records shall indicate that evaluations are conducted and the results reviewed with employees.

3.2.3 The results of evaluations shall be used in a program of continuous improvement of personnel.

3.2.4 Records shall indicate that training is scheduled and attended in accordance with the procedure.

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3.2.5 Those personnel functions that require training and qualification shall be defined including:

a. Processing personnel
b. Testing/inspection personnel
c. Data review personnel
d. Specimen preparation personnel
e. Planning personnel

3.2.6 Testing and data review personnel shall be qualified through at least one of the following:

a. Training by personnel with technical degree and/or related experience
b. Initial technical examination
c. Periodic technical examination
d. Comparison to a standard

3.2.7 Specimen preparation personnel shall be qualified through at least one of the following:

a. Training by personnel with technical degree and/or related experience
b. Periodic review of work

3.3 Job Documentation

3.3.1 Shop paper/traveler, which accompanies each lot, shall contain as a minimum the following information:

a. Evidence of frozen process approval as required by the customer
b. Evidence of customer approval of any changes to the frozen process
c. Relevant purchase order number (or other identification) and purchase order requirements
d. Part identification, material condition, number of parts (ensuring traceability to parts)
e. A description of the number, composition and dimensions of test specimens to be processed with the parts when use of test specimens is permitted/required by the applicable specification.
f. A step for each process performed with applicable internal process/or inspection procedure numbers including as applicable

1) Incoming inspection
2) Pre-process cleaning method(s)
3) Precoat thermal treatment
4) Masking
5) Fixturing, racking
6) Etch
7) Strike/activation
8) Plate
9) Primer
10) Paint/film
11) Post-process cleaning methods
12) Post-coating thermal treatment

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3.3.1 (Continued from previous page)

13) In-process and final tests and inspections, including disposition
14) Packaging and handling
15) Shipping

g. Documentation of rework that is traceable to the shop paper/traveler and all processing performed on the parts
h. Each step, or logical group of steps in the process flow, is signed off and dated by the operator as completed
i. Unless otherwise authorized by the cognizant engineering organization, specified process parameters which are controlled by the operator are recorded for each lot of parts processed, including:

1) Masking material used
2) Estimated surface area of part
3) Temperature, time, current (as applicable) for strike/activation, plating, anodize, conversion coat, chemical milling, etching, passivation, etc.
4) Pre/post thermal treatments, racking, and fixturing

3.4 Process and Quality Planning

3.4.1 There shall be a procedure defining a system/requirements for process and quality planning which effectively ensures compliance with customer and/or specification requirements.

3.4.2 There shall be instructions for actions to be taken by the operator, inspector, or any other personnel, when a discrepancy is detected.

3.4.3 Repeat orders shall be reviewed for changes in requirements.

3.4.4 There shall be a procedure to specify surface area, current density, voltage, amperage, time, bath composition and concentration, temperature and other significant process variables as applicable.

3.4.5 The quality planning shall address removal of defective or nonconforming platings and coatings and their reapplication (rework) to preclude part life degradation and nonconforming part dimensions.

3.5 Purchasing-Source Selection

3.5.1 All subtier suppliers shall be taken from an approved supplier list.

3.5.2 All testing sources shall be approved in accordance with an internal supplier approval procedure meeting all contractual requirements.

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3.6 Receiving Procedure

3.6.1 The processor shall obtain, as a minimum, through customer-provided information, part identification, materials and conditions such as stress relief, hardness, whether the parts have been shot-peened, and whether the parts have been ground after heat treat.

3.6.2 The system shall provide for holding and segregation of hardware pending receipt of proper material documentation or if nonconformance is detected.

3.6.3 The supplier shall have incoming inspection procedures identifying characteristics to be checked and methods to be used, including sampling plan as defined in quality manual.

3.6.3.1 The supplier shall verify dimensional requirements in as-received condition for jobs having post-processing dimensional requirements.

3.6.4 Incoming material quality planning shall provide for shelf-life monitoring and control for materials as required.

3.7 Housekeeping

3.7.1 The company's facilities shall be clean, uncluttered, and well lighted.

3.7.2 Incompatible materials such as acids/alkalies and oxidizers/organics shall be segregated in storage.

3.7.2.1 All containers shall be legibly and indelibly labeled. Chemicals in unlabeled containers shall never be used.

3.7.3 Process materials shall be stored to preclude damage or degradation from heat, cold, water, atmospheric moisture or other environmental considerations.

3.7.4 Process materials, that are transferred from original manufacturer's containers shall be controlled, to maintain identity and to prevent contamination or degradation.

3.7.5 Training or procedures shall address cleaning of pumps and other transfer equipment after use to preclude material contamination and for operator safety.

3.8 Control of Nonconforming Parts

3.8.1 There shall be a policy to ensure that customers are informed of discrepancies affecting hardware (i.e., out of tolerance conditions).

3.8.2 Rework shall be approved by the customer when required.

3.8.3 Repair/MRB shall always be approved by the customer.

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3.9 Delivery and Service

3.9.1 There shall be a procedure to provide for the protection of parts after final inspection and during shipment that includes customer requirements.

3.9.2 Shipping documents shall conform to purchase order requirements or contracts.

3.10 Calibration of Process and Testing Equipment

3.10.1 There shall be a documented calibration program that ensures calibration to the requirements of ISO 10012-1 or ANSI INCSL Z 540-1 for:

a. All shop equipment used to control or monitor control of a process.
b. All test and inspection equipment used to accept product or control a process.

3.10.2 Pre- and post-calibration data shall be recorded as an aid in evaluation of impact of out of tolerance conditions.

3.11 Internal Quality Audits

3.11.1 There shall be a documented, comprehensive system of planned and documented internal audits (including both quality systems and processing) performed on a regular basis by knowledgeable/qualified auditors not directly responsible for the work.

3.11.2 Management shall review internal audit results periodically.

3.11.3 There shall be a record of corrective actions taken as a result of audit findings.

4. TEST & INSPECTION

4.1 Specification Compliance

4.1.1 A test matrix shall define all periodic and lot acceptance testing requirements for each process line.

4.1.1.1 Periodic and lot acceptance testing shall be in compliance with customer and/or specification requirements.

4.1.1.1.1 For testing performed internally, detailed testing procedures shall exist which comply with the applicable customer and testing specifications.

4.1.1.1.2 For testing performed externally, written purchase orders shall provide definition of requirements. These requirements shall comply with customer and specification requirements.

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4.2 Documentation

4.2.1 Testing records shall be traceable to both shop travelers and certification/test reports. The records shall enable the processing supplier to reconstruct the test samples or testing conditions and identify any incorrectly tested material.

4.2.1.1 Testing records shall be maintained and organized in a manner in which they are readily available for review.

4.2.2 There shall be a procedure that requires the review of test data for conformance to specification whether generated by captive or independent laboratory.

4.2.2.1 The procedure shall require that the review also include an examination for historical trends in the testing data and that negative or questionable trends be acted upon.

4.2.2.2 The responsibility for this review shall be identified in the procedure.

4.2.2.3 The person identified to conduct this review shall be someone other than the person responsible for conducting the tests.

4.2.2.4 The procedure shall require the identified person(s) to sign and date the test results as proof of review.

4.2.3 Errors in the internally generated test data shall be corrected by either 1) line out, write correction, initial, and date or 2) void the data, make corrections, and retype/reprint.

4.2.4 In the event that an error is identified in the certificate of test, test data, or testing procedure, there shall be a procedure which requires the following.

a) Identification of error cause
b) Implementation of corrective actions
c) Notification of affected customers
d) Retesting and correction of certification/test data

4.3 Test Specimens Control (Except Solution Analysis)

4.3.1 Test samples shall be traceable to material from which they are made.

4.3.2 Test samples shall be positively identified during all stages of processing and testing until disposed of (tags, bags, etc.).

4.3.3 All specimens provided for testing (internal/external lab) shall be accounted for (e.g., tested to completion/failure, or replaced).

4.3.4 There shall be documentation which provides for tracking and accountability of all test samples currently in work (processing and testing).

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4.3.5 There shall be specific shop paperwork (router, etc.) which is traceable to the test samples/parts which specifies how the samples are to be processed and which tank they were processed in.

4.3.6 All operator controlled parameters associated with the processing of the test samples/parts shall be recorded on the shop paper and traceable to the specific samples.

4.3.7 Material certifications, manufacturer's labels, and the materials themselves shall be verified against the process suppliers purchase orders in order to ensure receipt of correct material.

4.4 Test Failure, Replacement Testing and Retesting (Except Solution Analysis)

4.4.1 There shall be a procedure which establishes specific criteria for replacement and retesting, including specific responsibilities for authorization.

4.4.1.1 The procedure shall define “Replacement Testing” and “Retesting”.

4.4.1.2 Replacement and retests shall be performed, as required, as permitted by customer and specification.

4.4.2 Replacement tests, nonconforming tests, and retests shall be logged and cross indexed, including explanations with entries signed off by authorized personnel (i.e., replacement / retests traceable to the original tests).

4.4.3 There shall be a procedure which addresses the following in the event of a testing failure:

a. Immediate notification of all affected customers
b. Identification of all affected hardware shipped to the customer
c. Isolation of all affected in-house hardware
d. Immediate shutdown of the affected process/process line pending resolution
e. Investigation of failure cause and implementation of corrective action
f. Retest performed after all corrective actions and before production is restarted

4.4.4 Replacement testing and retesting data shall be reviewed at least quarterly for trends which might indicate deterioration of test procedures, methodologies and/or processing/test equipment.

4.5 Process Control Laboratory Procedures (Solution Analysis)

4.5.1 There shall be assigned responsibilities for review and approval of test results, authorization of retests, calculation of process solution additions and corrections, and the preparation and approval of test procedures.

4.5.2 These responsibilities shall be performed by a qualified individual (Ref. paragraphs 3.2.1-3.2.7), and their job responsibilities, job specification and qualifications shall be documented.

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4.5.3 There shall be solution control logs which contain the following information for each tank monitored:

a. Tank identification
b. Tank contents
c. Tank size (working volume) and level
d. Analysis frequency
e. Constituents to be analyzed (note major and minor)
f. Operating tolerances (shop target limits, specification limits/technical bulletin limits, temperature, pH, etc.)
g. Date sampled and analyzed
h. Analysis values
i. Additions
j. Tank dumps
k. Reanalysis after addition when out-of-shop target limits
l. Identity of individual conducting analyses, additions, reanalysis, and dumps

4.5.4 Bath conditions shall be within the shop target limits indicated when operating.

4.5.5 The solution control log shall show that corrections and/or additions are made when shop target limits are exceeded.

4.5.6 Solution analyses shall be conducted on frequencies based on specification requirements, activity, stability, and size of tank.

4.5.6.1 Records shall show that the frequency of analysis is increased for tanks which are found to be out of shop target limits after two (2) consecutive analysis or three (3) out of the last ten, whichever occurs first. (Reference ARP 4992 for guidance.)

4.5.7 Procedures shall require, and documents shall show, the cessation of processing when any chemical constituent and/or operating parameter (i.e., temperature) does not comply with the applicable process specification or chemical supplier's technical bulletin until the process is brought into compliance.

4.5.8 There shall be detailed procedures that describe the following:

a. Solution analysis conforming to ASTM, standard laboratory, and chemical compound manufacturer's procedures.

b. Sample collection which assures that the sample is representative of the bath solution and operating condition and precludes any sample contamination.

c. Initial tank make-up and addition calculations.

d. Increase or decrease of analysis frequencies based on historical analysis test data in addition to meeting minimum frequency requirements when defined by specification

4.5.9 ACS reagent grade chemicals or equivalent shall be used in chemical analyses.

4.5.10 Laboratory chemicals shall be labeled and stored properly.

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4.5.11 Water of at least 500,000 ohm•cm shall be used for analysis purposes.

4.5.12 Certified, commercial-grade or better buffer solutions within shelf-life expiration date and covering the range of testing acceptance shall be used to standardize the pH meter to a procedure before use.

4.5.13 Standards with a limited shelf life shall be properly labeled to preclude usage after the expiration date.

4.5.13.1 Shelf-life disciplines shall be documented and maintained for standards susceptible to deterioration (e.g., evaporation of liquid standards, reaction with glass storage containers, photochemical reactions).

4.15.14 Titration solutions shall be standardized against appropriate documented, certified reference standards, and they shall be monitored for stability and protected against degradation.

5. PROCESS EQUIPMENT CONTROL AND MAINTENANCE

5.1 General

5.1.1 Current operating manuals or instructions shall be available to operators, maintenance personnel, and other personnel requiring the information.

5.1.2 Tanks shall be labeled to include identification number, contents, and temperature ranges.

5.1.2.1 The location of each process line for which Nadcap Accreditation is sought shall be summarized/defined in a revision controlled drawing or other document, and that equipment line shall be properly maintained and listed in Table 1.

5.1.3 The air supply for production use shall include particulate, moisture and oil filters with scheduled preventative maintenance.

5.2 Maintenance Procedures

5.2.1 Maintenance procedures shall be prepared with preventative maintenance as a goal and based on prior maintenance records.

5.2.2 Records shall indicate that maintenance has been performed in accordance with a procedure to a defined frequency.

5.2.3 Tanks and/or other equipment shall be equipped with filtration as required to remove contamination.

5.3 Process Line Equipment

5.3.1 Tanks and work surfaces shall be maintained free of corrosion and chemical spillage detrimental to the process.

5.3.2 Spray and rinse tanks shall:

a) Be clean, clear, free-running or monitored for contamination levels
b) Be situated in a sequence to prevent cross contamination of process tanks
c) Assure adequate neutralization and/or removal of process chemicals

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5.3.3 Process and rinse tanks shall be situated such that hardware can be maintained wet, from final cleaning and activation through the process to the final rinse, without interruption.

5.3.4 Tanks with temperature range requirements shall be equipped with thermostatic controls.

5.3.5 Tanks shall be of sufficient volume and dimensions to contain hardware during processing and assure sufficient coverage of parts.

5.3.6 Tanks that require uniformity of temperature and solution concentration shall be agitated.

5.3.7 Fixtures, workbars, electrical connections, and hard masking shall be free of corrosion and physical damage detrimental to the process while in use.

5.3.8 Fixtures and masking shall not entrap air or processing solution on parts.

5.3.9 Fixturing and racking shall not restrict process solution neutralization and removal during rinsing and shall minimize process solution and rinse water drag-out and cross-contamination of process tanks.

5.3.10 Fixturing and rack design, and the arrangement of workbars and anodes, shall be such that electrical contacts are solid but preclude potential pressure damage or electrical arcing.

5.3.11 Tanks for application of electrolytic coatings (plating, anodizing, etc.) shall be equipped with cathodes or anodes that can be reconfigured as needed, and conforming auxiliary electrodes shall be used for processing hardware with variable geometric configuration or for variable lot sizes to promote uniform deposition rates as necessary/required by specification and/or part/customer requirements.

5.3.12 Hoists and other lifting equipment shall be labeled as to capacity.

5.3.13 Hoists and other lifting equipment shall be electrically insulated from the work.

5.3.14 Deionized water shall be used for anodize sealant bath make-up.

5.3.15 Deionized water shall be used for make up and additions for electroless nickel and precious metal plating solutions unless there is objective evidence that the water available in the facility is acceptable for use.

5.4 Stress Relief, Hydrogen Embrittlement Relief and Cure Ovens

5.4.1 There shall be a procedure for temperature uniformity tests - whether performed internally or by an outside source.

5.4.2 A procedure shall specify the following at a minimum:

a. Test Frequency
b. Test temperature(s) and range(s)
c. Range which covers all baking operations
d. Placement and recording of thermocouples
e. Period of monitoring after temperature stabilization.

5.4.3 Uniformity surveys shall be performed at least semi-annually.

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5.4.4 Temperature uniformity surveys shall conform to the uniformity requirements of AMS 2750 unless otherwise specified by the customer.

5.4.5 System accuracy tests (i.e., probe checks) shall be performed semi-annually unless otherwise specified by the customer.

5.4.5.1 The tests shall demonstrate that the system accuracy is ± 5 °F.

5.4.6 Instruments on ovens shall be calibrated semi-annually and traceable to NIST.

5.4.7 When in use, the oven shall employ a continuous temperature recorder.

5.5 Cleaning Procedures: General

5.5.1 Cleaning procedures shall be compatible with part alloys and heat treat conditions (as applicable to the process), dissimilar components of assemblies, previously deposited coatings, and braze/solder joint material.

5.5.2 Test specimens/coupons, if permitted/required by the applicable specifications, shall be processed as required through the cleaning solutions with the hardware they represent.

5.5.3 When required by customer or specification, hardware that is susceptible to hydrogen embrittlement shall be mechanically descaled; or if chemically descaled with materials generating hydrogen, it shall be baked directly after chemically descaling.

5.5.4 Parts shall be suitably protected against recontamination prior to subsequent processing.

5.6 Mechanical Cleaning

5.6.1 Procedures and controls shall be in place to assure that proper particle size distribution is maintained and cross contamination of alloys during mechanical cleaning (e.g., aluminum and iron based alloys) is minimized.

5.6.2 When abrasive blast techniques are used, off-set distances, pressures, and media shall be recorded.

5.6.3 Standards shall be used to evaluate surface finish as required by customer or supplier.

5.6.4 Hardware shall be visually checked and documented to verify corrosion, oxides, scale, and abrasive media have been removed.

5.7 Chemical Cleaning Prior to Chemical Processing

5.7.1 Cathodic cleaning shall be prohibited with high strength steels of 180 ksi and greater (unless otherwise approved by the customer).

5.7.2 All hardware shall be maintained wet and, except for barrel plating, a water break free surface shall be observed, after the cleaning cycle.

5.7.3 Activation chemical baths shall be situated so as to permit processing immediately prior to plating and conversion operations.

5.8 Masking

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5.8.1 Procedures shall be in place for masking prior to cleaning, for visual inspection of adequate masking before and after cleaning, and for remasking when damaged during mechanical cleaning.

5.8.2 Shop paper or the traveler shall clearly show the areas to be masked and specify the masking materials to be used.

5.8.3 Masking material shall be compatible with hardware and process conditions.

5.8.4 Fixtures and masking shall be designed to assure part area to be processed is exposed and all other areas precluded as required by the customer.

5.8.5 Adhesives, masking material, markings, and residual chemicals shall be removed after processing and before further thermal processing or shipment.

5.9 Power Supplies

5.9.1 Power supplies shall be equipped with calibrated ammeters and voltmeters.

5.9.1.1 Each tank shall have dedicated meters that are capable of reflecting actual power at the tank.

5.9.2 The resolution of the power meters shall be sufficient for the voltage and amperage range specified in the shop paper traveler.

5.9.3 Rectifiers shall be identified to the tank which they service, or if not, each tank must have an individual rheostat.

5.9.3.1 When required by specification, ripple shall be periodically verified for electrochemical rectifiers as part of calibration.

5.9.4 If a power failure occurs, there shall be a mechanism that requires the operator to physically restart the power supply to plating and anodizing tanks.

5.10 Timers

5.10.1 Timers shall be available, suitable to the purpose, calibrated, and visible from the tanks.

5.11 Etch Inspection Processes (Pre-Penetrant, Macrostructure, Blue Etch Anodize, Temper Etch)

If Pre-Penetrant, Macrostructure, Blue Etch Anodize or Temper Etching is performed, compliance with AS 7108/2 “Nadcap Audit Criteria for Etch Processes” is required.

5.12 Etching, Chemical Milling

5.12.1 Stock removal rates shall be determined to assure correct processing.

5.12.2 Stock removal panels shall be of the same alloy and in the same processed condition as the hardware and controlled for maximum number of uses.

5.12.3 Stock loss shall be determined by weight or dimensional change.

5.12.4 If masking is used, the integrity shall be checked prior to milling.

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5.12.5 Procedures shall be in place to ensure that the part is not introduced, moved, or removed from the etching process when current is applied (power on).

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5.13 Stripping

5.13.1 Chemical stripping baths shall be inhibited when required by specification and/or customer requirement.

5.13.2 The hardware shall receive an embrittlement relief bake after stripping as required by specification and/or customer requirement.

5.13.3 Masking, insulators, or similar methods shall be used to prevent Galvanic Coupling of dissimilar metals.

5.13.4 If required by the customer, the stripping of parts and the process shall be approved.

5.13.5 Work instructions shall be provided for each strip cycle and traceable to the hardware.

5.13.6 When stripping is not part of the standard process, the reason for each strip shall be recorded on the individual part/lot documentation and the rework properly authorized (by appropriate authorities) and the need for corrective action considered.

5.13.7 There shall be a procedure for mechanical stripping when it is performed.

5.14 Brush Plating

5.14.1 Operators shall be certified as required by customer or specification.

5.14.2 Anodes shall be controlled and specific to each process solution to avoid cross contamination.

5.14.3 Masking shall be adequate to protect part from corrosion and unwanted coverage.

5.14.4 Equipment and solution shall be in compliance with customer requirements where applicable.

5.15 Nickel and Copper Electroforming

5.15.1 Reusable mandrels and fixtures shall be controlled for identification and condition.

5.15.2 Stress measurement shall be performed on deposited coating when required.

5.15.3 The composition of deposited material shall be controlled in accordance with customer requirements.

5.15.4 Mandrel removal procedure shall preclude part damage.

5.16 Titanium Cleaning, Etching and Handling

5.16.1 Anodic alkaline cleaning shall be prohibited with titanium alloys.

5.16.2 Procedures for cleaning titanium surfaces shall prohibit using methanol or halogenated substances, unless permitted by customer and/or specification.

5.16.3 Water used for final rinse or spray shall be deionized or monitored for halogen content when required by specification.

5.16.4 Procedures shall require that finished parts be handled with clean, white cotton gloves.

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APPENDIX A
STATISTICAL TECHNIQUES

Appendix A shall serve as a guideline for implementation of Statistical Techniques and a standard to which the supplier's statistical program will be compared. Because of supplier diversity, all of the line items of Appendix A may not always be applicable, however, the core requirements of Appendix A must be contained in all statistical Programs. Compliance with the core requirements of Appendix A is mandatory within two (2) years of Nadcap Accreditation to AS 7108. Core requirements are identified with an asterisk in AC 7108. On successive audits, compliance with all of Appendix A requirements is mandatory.

The intent of AC7108 Appendix A is to ensure that Nadcap Chemical Processing Accredited suppliers maintain and use continuous improvement techniques to routinely apply to appropriate processes as identified by management analysis of data (such as Pareto analysis). This analysis must include all Nadcap Accredited Chemical Process areas and must be performed on a periodic basis not to exceed one year.

The Task Group stresses that supplier management use this data to choose where these tools are applied. The supplier is free to apply these techniques that the data (e.g. Pareto of rework, customer returns, etc.) identifies as a priority. Management does, however, need to identify (in writing based on the above data) the reason for selection of the particular process(es).

The Task Group is concerned however that this may be seen as license to avoid application of these tools to Chemical Processes. The auditor will expect to see that Nadcap Accredited Chemical Processes are included in the above analysis. This is not limited to the “traditional processes” but also applies to system elements (contract review / flowdown, planning, calibration, etc.).

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A1. STATISTICAL TECHNIQUES-PROGRAM PLANS

A1.1 There shall be a policy to support top-down management commitment to a Statistical Techniques Program. (Core)

A1.2 There shall be a documented milestone plan for the progressive application of the statistical program that includes control/responsibility and that is reviewed annually by management (if a system, compliance with the core requirements of this appendix is not already in place). (Core)

A1.3 The functions/titles and responsibilities of those individuals responsible for the statistical program shall be documented. (Core)

A1.4 There shall be a documented training program, for all levels of employees as applicable to their responsibilities, covering principles and usage of statistical techniques. (Core)

A1.5 The appropriate tools, such as statistical reference materials, charts, and measuring equipment shall be employed.

A2. DEVELOPMENT OF CONTROL PLAN

A2. 1 Procedures shall be established and maintained that specify data collection, determination of capabilities, and process monitoring.

A2.2 A steering committee (or central focal person) shall be assigned to give direction and oversee activities. (Core)

A2.3 Individuals and/or teams shall be assigned to work centers or operations. (Core)

A2.4 Discussion with employees shall indicate management's commitment to statistical techniques.

A2.5 In addition to management, other personnel shall be included in the data gathering activities.

A2.6 Teams and/or individuals shall conduct Pareto or other methods of analysis of nonconformances by percent of total, percent of cost, and/or other criteria and it shall be reviewed by management. (Core)

A2.7 The supplier shall conduct analysis to determine possible causes of nonconformances.

A2.8 Process maps (flow charts) shall be generated for each process performed. (Core)

A2.9 Teams shall conduct Failure Mode & Effects Analyses (FMEA's) for each process map developing risk priority factors for each process step. (Core)

A2.10 A list of characteristics to be controlled (control plan) shall be developed based on risk priority factors derived from the FMEA's. (Core)

A3. CAPABILITY AND CALCULATION OF CONTROL LIMITS

A3.1 Capability (MSA) studies shall be conducted on measuring systems used for data collection.

A3.2 There shall be provisions to assure that machine and/or process capability studies are not conducted until assignable causes are identified.

A3.3 Machine and/or process capability studies shall be conducted.

A3.4 Data for key characteristics shall be charted where applicable.

A3.5 A statistically valid sampling and frequency plan shall be defined in order to determine process capability.

A3.6 Control limits shall be calculated for key characteristics.

A4 PROCESS CONTROL

A4.1 There shall be documented criteria for determining that a process or process variable is in control. (Core)

A4.2 Process changes shall be documented and the process monitored for measured impact to the process output as a result of the change.

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A4.3 There shall be a response plan listing courses of action (including the identification of assignable causes and the implementation of corrective action and follow up) to address out-of-control conditions of varying degrees.

A4.4 There shall be documented, traceable evidence that out-of-control conditions have been responded to in accordance with the plan.

A4.5 In areas where control is demonstrated, there shall be a procedure for process centering as applicable.

A4.6 Cpk's shall be calculated for processes that have been shown to be in control.

A5. CONTINUOUS IMPROVEMENT

A5.1 There shall be procedures which promote continuous improvement by reducing process variation and/or by process improvements. (Core)

A5.2 There shall be documented evidence of the reduction in process variation.

A5.3 There shall be documented evidence of management prioritization of process improvements.

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