SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS7119

Issued 2005-07

Nadcap
Aerospace Standard for
Electronics
Printed Circuit Boards

1. SCOPE:

This Aerospace Standard (AS) establishes the requirements for suppliers of Electronics Printed Circuit Boards 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 Electronics Task Group. Using the audit checklist (AC7119) will ensure that accredited Electronics Printed Circuit Boards 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

2.2 IPC Publications:

Available from http://www.ipc.org/

IPC 6012	Qualification and Performance Specification for Rigid Printed Boards
IPC A-600	Acceptability of Printed Circuit Boards
J-STD-003	Solderability Tests for Printed Boards

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

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3. DEFINITION OF TERMS:

IPC-T-50 is the reference document for terms and definitions used in this checklist and for the purposes of this document, these additional definitions apply:

1st TIER SUPPLIER: Facility or facilities being audited, which produces printed circuit boards as final product.

2nd TIER SUPPLIER: Facility or facilities being audited, which performs processes for a 1st Tier Supplier.

AUTHORIZED: by customer

FIFO: First-in first-out, based upon the date or additional methodology

FIRST ARTICLE INSPECTION: Review of the first part number for a new build, or first time processing a specific part number.

INDUCTION: Recommended time from mixing to first use to allow cross-linking of two-part epoxy or paints.

IN PROCESS: Parts have been accepted for processing and released to manufacturing but not yet accepted at final inspection or scrapped. (In process inspections are typically "visual" (water break, uniformity, coverage, etc.) "checks" 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.

KEY CHARACTERISTICS: The features of a material, process, or part whose variation has a significant influence on product fit, performance, service life, or manufacturability.

LEGEND: A format of letters, numbers, symbols and patterns that are used primarily to identify component locations and orientations for convenience of assembly and maintenance operations. Additionally, to identify supplier vendor code, supplier vendor logo, lot traceability identification, date code of manufacture and serialization, when required by the customer.

PLAN: A scheme or method of acting, proceeding, etc., developed in advance with tasks, time bound, and assignments.

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

3. (Continued):

PROCEDURE: Specified way to carry out an activity or process. When a procedure is documented, the term “written procedure” or “documented procedure” is frequently used.

SPECIAL PROCESS: A process where the conformity of the resulting product cannot be readily or economically verified.

SPURIOUS: Random and/or unwanted foil definition for above

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

4. GENERAL REQUIREMENTS:

4.1 If the supplier being audited is a 1st Tier Supplier, the supplier shall possess a valid AS9100/EN9100/JISQ 9100 certification from an acceptable registration body (listed on IAQG Oasis).

4.2 If the supplier being audited is a 2nd Tier Supplier, the supplier shall possess a valid AC7004 or AS9100/EN9100/JISQ 9100 certification.

4.3 If the Quality Organization is functioning with vacancies in excess of 90 days management shall have assigned duties of the vacant positions in the interim.

4.4 After accreditation, the supplier shall informed PRI of any changes of ownership, location, key personnel, or quality system.

4.5 There shall be a preventive maintenance plan.

4.6 The configuration management system shall address control of electronic data transfer.

4.7 Key process characteristics shall be identified, monitored, and controlled.

4.8 There shall be evidence of training.

5. SPECIAL PROCESS SUB-TIER CONTROL:

5.1 When processes are identified as outsourced and a Nadcap approval is not required, there shall be a documented procedure to ensure that the subcontractor is granted approval by the customer.

5.1.1 Applicable portions of the AC7119 checklists shall be used to qualify subcontracted special process suppliers at least yearly.

5.2 When customer supplied data is required for outsourced processes, the data shall be provided, validated and verified.

5.3 When processes are identified as outsourced and a Nadcap approval is required, there shall be proof that the subcontractor has a valid Nadcap accreditation for the process being subcontracted.

6. CAD/CAM DATA:

6.1 There shall be a documented procedure for CAD/CAM data processing.

6.2 There shall be a system for prevention of unauthorized use of tear-drop (fillet) adaptation.

6.3 There shall be a documented procedure for prevention of unauthorized removal of non-functional lands.

7. MATERIAL CONTROL: B-STAGE:

7.1 There shall be a documented procedure for storage of materials which includes FIFO.

7.2 Evidence shall exist of continuous humidity and temperature-control provisions.

7.3 There shall be a documented procedure which controls extension of shelf life for materials.

7.4 If shelf life is extended, evidence shall exist that scale flow testing for B-stage material control has been performed.

8. INNER LAYER PHOTOPROCESS:

8.1 There shall be a documented procedure for inner layer photoprocess.

8.2 There shall be a procedure for control of airborne particulate contamination.

8.3 There shall be a procedure that ensures hold-time is consistent with the photo-resist being used.

8.4 There shall be a documented procedure for managing the relationship between light intensity and exposure time.

8.5 There shall be a documented procedure for removing static and contaminants from the surfaces of the tooling and imaging frame.

8.6 There shall be a documented procedure that restricts number of uses of phototool exposure.

9. INNER LAYER DEVELOP - ETCH - STRIP (DES):

9.1 There shall be a documented procedure for controlling the parameters of film development.

9.2 There shall be a documented procedure for inner layer etch, which includes control of chemistries.

9.3 If strip resist is used, there shall be a documented procedure for stripping resist.

10. INNER LAYER INSPECTION:

10.1 There shall be a documented procedure for inner image inspection.

10.2 There shall be a procedure to monitor and define the % of defect data to trigger corrective actions.

10.3 Capability for automated optical inspection (AOI) shall exist.

10.4 Capability for Gerber data download shall exist.

10.5 If there is circuit repair performed, there shall be objective evidence of authorization from the customer.

11. OXIDE COATING/OXIDE REPLACEMENT COATING:

11.1 There shall be a procedure for oxide coating or oxide replacement coating.

11.1.1 If oxide is used, there shall be a maximum number of rework cycles on inner layers.

12. MATERIAL LAMINATION:

12.1 There shall be a documented procedure for each lamination method.

12.2 Lamination stack-up/lay-up processes shall be clearly documented.

12.3 There shall be a procedure for laminate registration verification.

13. DRILLING:

13.1 Conventional Drilling:

13.1.1 There shall be a documented procedure for primary drilling.

13.1.2 There shall be a documented procedure for secondary drilling.

13.1.3 There shall be a documented procedure which includes registration compensation.

13.1.3.1 If manual overrides of XY hole locations are allowed, there shall be limits in place for offsets and scaling.

13.1.4 There shall be a documented procedure that includes first piece verification.

13.1.5 There shall be a documented procedure for X-ray verification.

13.2 Drill Bit Maintenance:

13.2.1 There shall be a documented procedure to address bit re-sharpening, bit replacement, and drill bit life.

13.2.2 There shall be a system for detecting broken bits and verifying drill size.

13.3 Laser Ablation (other than High Density Interconnect - HDI):

13.3.1 There shall be a documented procedure for laser ablation.

13.3.2 There shall be a documented procedure for adjusting beam focus.

13.4 Post-drill Cleaning:

13.4.1 There shall be a documented procedure for resin smear removal according to customer specifications.

13.4.2 There shall exist a documented procedure for the deburr process.

13.4.3 There shall be a documented procedure for plasma etch that covers temperature ranges, bake steps, and residue removal.

14. PLATING:

Either electroless copper OR direct metallization or both processes shall be performed at ALL plating facilities.

14.1 Electroless Copper:

14.1.1 There shall be a documented procedure for electroless copper plating.

14.1.2 There shall be an established frequency for testing of and additions to the electroless copper chemistry.

14.1.3 There shall be a system in place to verify electroless copper coverage.

14.2 Direct Metallization:

14.2.1 There shall be a documented procedure for direct metallization.

14.2.2 There shall be a documented procedure that assures that coating has reached cure for coating material.

14.3 Copper Plate:

14.3.1 There shall exist a documented procedure for copper plating.

14.3.1.1 There shall be an established test frequency for ensuring tensile and elongation properties are within specifications.

14.3.1.2 There shall be a monitoring of the chemistries for brighteners and carriers.

14.3.2 There shall be a documented procedure to limit organic buildup.

15. OUTER LAYER PHOTOPROCESS:

15.1 There shall be a documented procedure for outer layer photoprocess.

15.2 There shall be a procedure for control of airborne particulate contamination.

15.3 There shall be a procedure that ensures hold-time is consistent with the photo-resist being used.

15.4 There shall be a documented procedure for managing the relationship between light intensity and exposure time.

15.5 There shall be a documented procedure of removing static and contaminants from the surfaces.

15.6 There shall be a documented procedure that restricts number of uses of phototool exposure.

16. OUTER LAYER STRIP ETCH STRIP:

16.1 There shall be a documented procedure for controlling the parameters on the strip for the film.

16.2 There shall be a documented procedure for the etch of copper.

16.3 If the etch resist is not used as final finish, there shall be a documented procedure for removal of the etch resist.

17. OUTER LAYER INSPECTION:

17.1 There shall be a documented procedure for outer image inspection.

17.2 There shall be a sampling plan for outer layer inspection.

17.3 There shall be documentation that validates the selection of inspection techniques and equipment.

17.4 If AOI is performed, a documented procedure shall exist.

17.5 If AOI is performed, the capability of Gerber data download shall exist.

17.6 A procedure shall exist to monitor and define the % of defect data to trigger corrective actions.

18. FINAL FINISHES:

18.1 Hot Air Solder Leveling (HASL):

18.1.1 There shall be a documented procedure for HASL.

18.1.1.1 The maximum permitted thermal excursions shall be specified.

18.1.1.2 If max is over 3, there shall be evidence to support effectiveness of this process.

18.2 Fused Tin Lead:

18.2.1 If the maximum number of reflow cycles is greater than 3, there shall be evidence to support effectiveness of this process.

18.2.2 There shall be a documented procedure for fused tin lead finishing.

18.2.3 There shall be a clean process for removal of flux after fusing.

18.3 Selective Solder Strip/Plate:

18.3.1 There shall be a documented procedure for controlling selective solder plate.

18.3.2 There shall be a documented procedure for controlling selective solder strip.

18.4 Electroless Nickel - Immersion Gold (ENIG):

18.4.1 There shall be a documented procedure for the ENIG finish.

18.4.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.5 Immersion Silver:

18.5.1 There shall be a documented procedure for immersion silver finishing.

18.5.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.6 Immersion Tin:

18.6.1 There shall be a documented procedure for immersion tin finishing.

18.6.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.7 Electroplated Nickel-Gold:

18.7.1 There shall be a documented procedure for electroplated nickel-gold finishing.

18.7.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.8 Electroplated Hard Gold - Tab:

18.8.1 There shall be a documented procedure for electroplated gold tab.

18.8.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.9 Electroplated Silver:

18.9.1 There shall be a documented procedure for electroplated silver finishing.

18.9.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.10 Electroplated Nickel:

18.10.1 There shall be a documented procedure for electroplated nickel finishing.

18.10.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.10.3 If there is a requirement for hardness testing, there shall be traceability to The National Institute for Standards and Technology (NIST).

18.11 Electroplated Palladium:

18.11.1 There shall be a documented procedure for electroplated palladium finishing.

18.11.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

18.12 Final Plating Rinse:

18.12.1 There shall be a documented procedure for final plating rinse.

18.13 Organic Solder Preservative (OSP):

18.13.1 There shall be a documented procedure for OSP finishing.

18.13.1.1 The procedure shall require handling after the OSP finish is applied to be made with gloves.

18.13.2 There shall be a documented procedure to establish that chemical parameters are within the chemistry suppliers' recommendations.

19. SOLDERMASK:

19.1 Liquid Photo Imageable (LPI):

19.1.1 There shall be a documented procedure for LPI.

19.1.1.1 The tack cure bake cycle shall be controlled for time and temperature.

19.1.2 There shall be a documented procedure for managing the relationship between light intensity and exposure time.

19.1.3 There shall be a documented procedure of removing static and contaminants from the surfaces of the image machine.

19.1.4 There shall be a documented procedure that restricts number of uses of phototool exposure.

19.2 Dry Film Soldermask:

19.2.1 There shall be a documented procedure for applying dry film soldermask that ensures compliance to specifications for location, coverage, sealing vias, registration and thickness.

19.2.2 There shall be a documented procedure for managing the relationship between light intensity and exposure time.

19.2.3 There shall be a documented procedure for removing static and contaminants from the surfaces.

19.2.4 There shall be a documented procedure that restricts number of uses of phototool exposure.

19.3 Soldermask Develop and Cure:

19.3.1 There shall be a documented procedure for soldermask develop and cure.

20. LEGEND:

20.1 There shall be a documented procedure for the legend to ensure compliance with customer requirements.

20.2 If two-part resin systems are used, there shall be a documented procedure for mixing.

21. FINAL CLEAN:

21.1 There shall be a documented procedure that defines cleanliness levels and frequency of cleanliness testing.

22. ROUTING:

22.1 There shall be a documented procedure for final route/contour process.

22.1.1 Cutter compensation shall be addressed.

22.1.2 Stack height parameters shall be addressed.

22.1.3 Feed and speed parameters shall be addressed.

22.1.4 Handling parameters shall be addressed.

22.2 There shall be a plunge point offset or double-cut to minimize crazing and dust build-up.

22.3 If depth routing is performed, there shall be a procedure for controlled depth routing.

22.4 There shall be a procedure for the countersink and counterbore process.

22.5 If chamfering is used, there shall be a procedure for the chamfering process.

22.6 If the V-groove process is performed, there shall be a procedure for the V-groove process.

22.7 There shall be a procedure for deburr.

23. ELECTRICAL TEST:

23.1 There shall be a documented procedure for electrical test.

23.2 There shall be a documented procedure for failure analysis.

23.3 If there is controlled impedance testing performed, there shall be a documented procedure.

23.4 A procedure shall exist to monitor and define the % of defect data to trigger corrective actions.

24. FINAL VALIDATION:

24.1 There shall be a documented procedure for final validation.

24.2 There shall be objective evidence of material certifications.

24.3 There shall exist objective evidence of test results (Acceptance Testing and Frequency Matrix, Table 4-3 of IPC-6012).

24.4 There shall be training to IPC-A-600, or equivalent workmanship standard.

24.5 There shall be objective evidence of a valid First Article Inspection on file.

24.6 There shall be records that identify scrap with each of the process steps.

24.7 There shall be objective evidence of final count of the processed lot.

24.8 There shall be objective evidence of final yield information per lot.

24.9 There shall be a closed-loop method for feedback and corrective action of yield results.

24.10 There shall be objective evidence of authorized repair, where required.

25. PACKAGING:

25.1 There shall be documented procedures for packaging to ensure compliance with customer requirements.

25.2 There shall be a procedure for FIFO for finished goods.

26. SPECIAL PROCESSES:

26.1 Where specialized technologies not covered in IPC 6011 or its sub-tier standards are involved in the fabrication process, procedures and conformance requirements shall exist.

COMPLIANCE

27. JOB IDENTITY INFORMATION

28. GENERAL:

28.1 Process procedures shall be at latest revision and available at point of use.

28.2 Customer-supplied documents shall be on site and at latest revision.

28.3 Schedules, list of personnel, list of trained personnel, list of customers, statistical techniques program, and the organization chart shall be on site and accessible to the auditor as per AC7119 paragraph 1.2.1.

28.4 There shall be objective evidence that the preventative maintenance procedure is being followed.

29. CAD/CAM DATA:

29.1 If there are modifications of the input CAD data for the etching process, these modifications shall be documented.

29.2 If there are modifications of the input CAD data for outer and inner photoprocesses, these modifications shall be documented or automated.

29.3 If there are CAD/CAM changes beyond standard fabrication allowance, they shall be communicated with the customer.

29.4 Parameters shall be clearly stated on the CAD/CAM instructions for material growth/shrink.

29.5 Parameters for panel configuration shall have clearly defined origins and off-sets.

30. MATERIAL CONTROL: B-STAGE:

30.1 There shall be chart recorders or electronic data collection files for the temperature and humidity readings.

30.2 The lot number shall be traceable on the traveler.

30.3 The temperature range shall be monitored so that limits are not exceeded.

30.4 Humidity level shall be monitored so that limits are not exceeded.

30.5 Materials shall be identified with expiration dates and receipt dates.

31. INNER LAYER PHOTOPROCESS:

31.1 There shall be environmental controls for temperature and humidity for photo-tooling inspection and/or storage.

31.2 There shall be chart recorders or electronic data collection files for the temperature and humidity readings.

31.3 Light source intensity shall be monitored.

31.4 There shall be objective evidence that the number of uses of the phototool film is being limited as outline in the procedure.

31.5 Dimensional accuracy of the photoplotter shall be verified.

32. INNER LAYER DEVELOP - ETCH - STRIP (DES):

32.1 If the system is not automated, the break or set points shall be identified for each lot through the develop-etch-strip process.

32.2 If the system is automated, there shall be setup for the break points or set points.

32.3 There shall be special handling steps after etch to ensure minimal handling damage.

33. INNER LAYER INSPECTION:

33.1 The inner layer Automated Optical Inspection (AOI) shall be used to monitor process control.

33.2 Line width and space parameters shall be monitored.

33.3 There shall be a closed loop method for feedback and corrective action of yield results.

34. OXIDE COATING/OXIDE REPLACEMENT COATING:

34.1 There shall be monitoring of the copper reduction through the oxide process.

35. MATERIAL LAMINATION:

35.1 Where custom-machining on copper layers occurs where thickness is greater than 0.0014 inches (34.3 µm), procedures shall be in place for prevention of spurious foil prior to lamination.

35.2 Temperature profiles and chart records, or electronic data-profiles shall be traceable for each lot processed through lamination.

35.3 Vacuum shall be applied for each lamination cycle.

35.4 The cool-down cycle shall be controlled.

35.5 If a post-lamination bake is used to reach full cure, substantiation shall be provided for its use based on material type.

35.6 Lamination plates shall be cleaned after each lamination cycle and inspected for cleanliness.

35.7 The lamination cycle shall be defined and documented for each material configuration and readily available at the operation.

35.8 Preventative maintenance shall be performed on the vacuum system.

35.9 The press platens shall be profiled for temperature uniformity.

36. DRILLING:

36.1 Conventional Drilling:

36.1.1 The drill data shall be verified from traveler instructions.

36.1.2 A vacuum system shall be present at the hole during the drilling process.

36.1.3 If high-aspect ratio boards (9:1 or better) are being run, there shall be hole-check capability.

36.1.4 There shall be verification of drill sizes for each lot processed.

36.1.5 There shall be verification of first piece set up for each new lot processed.

36.1.6 Program download shall be controlled.

36.1.7 Preventative maintenance shall be performed on the vacuum system.

36.1.8 There shall be records of the XY position and run-out testing for each machine as part of a scheduled maintenance.

36.1.9 There shall be an X-ray verification used for each lot prior to production drilling.

36.2 Laser Ablation (other than High Density Interconnect - HDI):

36.2.1 The plasma plume shall be monitored for removal.

36.2.2 The power level shall be monitored for constancy.

36.3 Post-Drill Cleaning:

36.3.1 The deburring process shall be monitored for hole-quality.

36.3.2 There shall be cascading rinses.

37. PLATING:

37.1 General Plating:

37.1.1 Rack mount bars shall be cleaned.

37.1.2 Cable contact points shall be cleaned.

37.1.3 If no software controlled system exists, the rectifiers shall be calibrated and checked for ripple.

37.2 Direct Metallization:

37.2.1 There shall be monitoring of solution for concentration levels.

37.3 Electroless Copper:

37.3.1 Frequencies shall be recorded as part of the quality record.

37.3.2 There shall be records for electroless copper concentrations.

37.3.3 An agitation system shall be in place during the process.

37.4 Copper Plate:

37.4.1 There shall be mechanical or fluid agitation.

37.4.2 The agitation shall assure solution flow through the holes.

37.4.3 There shall be an established frequency of additions for maintaining all concentration levels.

37.4.4 There shall be monitoring for the copper bath for copper concentrations.

37.4.5 The chemical records shall be maintained on analysis and adds.

37.4.6 Brighteners, etc. shall be maintained at manufacturer's recommendations.

37.4.7 The process for copper plate shall be monitored and controlled for temperature per manufacturer's specifications.

37.4.8 Preventative maintenance shall be performed for cleaning of electrical contact areas.

37.4.9 There shall be a monitoring of the chemistries for brighteners and carriers.

37.4.10 The copper plating bath shall be monitored for levels of contamination using hull cell analysis, Cyclic Voltemmetric Stripping (CVS) Analysis, or spectrographic analysis.

38. OUTER LAYER PHOTOPROCESS:

38.1 There shall be environmental controls for temperature and humidity for photo-tooling storage and/or inspection.

38.2 Light source intensity shall be monitored.

38.3 There shall be objective evidence that the number of uses of the phototool film is being limited as outline in the procedure.

38.4 Dimensional accuracy of the photoplotter shall be verified.

38.5 There shall be chart recorders or electronic data collection files for the temperature and humidity readings.

39. OUTER LAYER STRIP ETCH STRIP:

39.1 Spray nozzles shall be maintained.

39.2 The process for strip etch strip shall be monitored and controlled for temperature per manufacturer's specifications.

39.3 The process for strip etch strip shall be monitored and controlled for chemistry per manufacturer's specifications.

39.4 Conveyor speed rates shall be defined.

40. OUTER LAYER INSPECTION:

40.1 There shall be inspection for underetch or overetch throughout the panel area.

40.2 The outer layer image shall be validated after etch.

40.3 If Automated Optical Inspection (AOI) is used for validation, Gerber reference data shall be used.

40.4 Inspection yields shall be monitored.

40.5 There shall be a closed loop method for feedback and corrective action of yield results.

41. FINAL FINISHES:

41.1 Hot Air Solder Leveling (HASL):

41.1.1 There shall be records for solder reservoir testing for copper and impurities.

41.1.2 There shall be monitoring of solder temperature per process lot.

41.1.3 If rework is performed, records for rework shall not exceed the maximum number stated in the procedure.

41.1.4 Copper concentration in the solder pot shall be monitored.

41.2 Fused Tin Lead:

41.2.1 The thickness of the fused tin lead shall be recorded as a quality record.

41.2.2 There shall be a preheat bath for the reflow process.

41.2.3 There shall be a separate bath for final fuse.

41.2.4 There shall be a cleaning step for removal of flux.

41.2.5 If hot oil fusing is used, the process for hot oil fusing shall be monitored and controlled for temperature per manufacturer's specifications.

41.2.6 If infrared fusing is used, the energy level shall be monitored for infrared in the fusing process.

41.2.7 The final finish shall be evaluated with respect to wetting of the tin-lead coating.

41.2.8 If the final clean process uses manual scrubbing of fused tin lead, there shall be an inspection to assure that there is no smear between traces.

41.2.9 Preventative maintenance shall be performed for cleaning of electrical contact areas.

41.3 Electroless Nickel Immersion Gold (ENIG):

41.3.1 The thickness of the nickel and gold shall be recorded as a quality record.

41.3.2 The process for ENIG finish shall be monitored and controlled for temperature per manufacturer's specifications.

41.3.3 The nickel bath chemistry shall be monitored and controlled per manufacturer's recommendations.

41.3.4 If the final clean process uses manual scrubbing of immersion gold, there shall be an inspection to assure that there is no smear between traces.

41.4 Immersion Silver:

41.4.1 The thickness of the immersion silver finish shall be recorded as a quality record.

41.4.2 The process for immersion silver finish shall be monitored and controlled for temperature per manufacturer's specifications.

41.4.3 If the final clean process uses manual scrubbing of immersion silver, there shall be an inspection to assure there is no smear between traces.

41.5 Immersion Tin:

41.5.1 The copper level shall be monitored for maximum copper concentration in a ppm level.

41.5.2 The thickness of the immersion tin finish shall be recorded as a quality record.

41.5.3 The process for immersion tin finish shall be monitored and controlled for temperature per manufacturer's specifications.

41.5.4 The additives shall be controlled to prevent whiskers.

41.5.5 The time in solution shall be monitored and controlled.

41.5.6 The pH or acidity shall be monitored to control the solution for optimum performance.

41.5.7 If the final clean process uses manual scrubbing of immersion tin, there shall be an inspection to assure that there is no smear between traces.

41.5.8 The thickness shall be measured to achieve the minimum thickness to the customer specification.

41.5.9 The chemistry shall contain a component to inhibit whisker growth.

41.6 Electroplated Nickel-Gold:

41.6.1 The plating bath of electroplated nickel shall be monitored for minimum nickel concentration levels.

41.6.2 The plating bath of electroplated gold shall be monitored for minimum gold concentration levels.

41.6.3 The process for electroplated gold finish shall be monitored and controlled for temperature per manufacturer's specifications.

41.6.4 The process for electroplated nickel finish shall be monitored and controlled for temperature per manufacturer's specifications.

41.6.5 Preventative maintenance shall be performed for cleaning of electrical contact areas.

41.6.6 If the final clean process uses manual scrubbing of electroplated gold, there shall be an inspection to assure that there is no smear between traces.

41.7 Electroplated Gold - Tab:

41.7.1 The thickness of the electroplated gold finish shall be recorded as a quality record.

41.7.2 Preventative maintenance shall be performed for cleaning of electrical contact areas.

41.8 Electroplated Silver:

41.8.1 The agitation shall assure solution flow through the holes.

41.8.2 The thickness of the electroplated silver finish shall be recorded as a quality record.

41.8.3 The process for electroplated silver finish shall be monitored and controlled for temperature per manufacturer's specifications.

41.8.4 Preventative maintenance shall be performed for cleaning of electrical contact areas.

41.8.5 If the final clean process uses manual scrubbing of electroplated silver, there shall be an inspection to assure that there is no smear between traces.