Special Process: Plating System Assessment Cover Sheet	
Facility Name: Master Finish Company	
Address: 2100 Nelson Ave SE, Grand Rapids, MI, USA	
Phone Number: (616) 245-1228	
Current Quality Certification(s): ISO 9001:2015	
Number of Plating Employees at this Facility: 67	
Captive Plater (Y/N): No	
Commercial Plater (Y/N): Yes	
Date of Assessment: 06-02-2023	
Date of Previous Assessment: 06-03-2022	
Date of Re-assessment (if necessary): N/A	
Type(s) of Plating Processing at this Facility:	
Process Table A:	**Process Table F:**
Zinc No	Hard Chrome Plating No
Zinc Alloy Plating No	
Process Table B:	**Process Table G:**
Mechanical Plating No	Electroless Nickel No
Process Table C:	**Process Table H:**
Decorative Plating of Metal Substrates YES	Hydrogen Embrittlement Relief Process YES
Process Table D:	**Process Table I:**
Decorative Plating of Plastic Substrates No	Process Control and Testing Equipment Verification and Calibration
	YES
Process Table E:	
Electropolish and Chrome Flash No	
Personnel Contacted:	
Name: John Mulder	Phone: (616) 245-1228
Steve Nanninga	
Aaron Mulder	
Kevin Steele	
Auditors/Assessors:	
Name: Gordan Lozic	Phone: (616) 245-1228
Aaron Mulder	
Number of Nonconforming Findings from Section 1 and Section 2:	
None	
Number of Nonconforming Findings in the Job Audit(s):	
None	
Number of Nonconforming Findings in the Process Table(s):	
None	

	Section 1 - Management Responsibility & Quality Planning
1.1	There shall be a dedicated and qualified surface finishing person on site.

• To ensure readily available expertise, there shall be a dedicated and qualified surface finishing person on site.
• This individual shall be a full-time employee and the position shall be reflected in the organization chart.
• A job description shall exist identifying the qualifications for the position including chemical and surface finishing/surface finishing knowledge.
• The qualifications shall include a minimum of 5 years' experience in surface finishing operation or a combination of a minimum of 5 years of relevant formal education and surface finishing experience.

Guidance	Objective Evidence	Conforming Nonconforming NA
What is this person's title?	CEO	**Conforming**
Is this position reflected in the organizational chart?	Yes	**Conforming**
Is there a documented job description listing all the required qualifications and responsibilities of this position?	Yes	**Conforming**
Describe in detail this person's educational background and practical experience.	Engineering degree, Certified Electro Finisher	**Conforming**
How many years of process experience at a plating facility does this person have?	13	**Conforming**
Is this individual a full-time employee at the location being audited?	Yes	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.2	The facility shall perform advanced quality planning.

• The organization shall incorporate a documented advanced product quality planning process.
• A feasibility study shall be performed and internally approved for each new part or process. Similar parts can be grouped into part families for this effort as defined by the organization.
• After the part approval process is approved by the customer, no process changes are allowed unless approved by the customer.
• The organization shall contact the customer when clarification of process changes is required. This clarification of process changes shall be documented.

Guidance	Objective Evidence	Conforming Nonconforming NA
Does the facility use a documented advanced quality planning process?	Yes	**Conforming**
Does the facility perform a documented internal feasibility study for each part before processing? If no, does the facility perform a documented internal feasibility study for similar part types or family of parts before processing?	Yes	**Conforming**
What is the procedure for changing the process after PPAP?	Process change validation	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning

1.3	The facilities FMEAs shall be up to date and shall reflect the current process.

• The organization shall incorporate the use of a documented Failure Mode and Effects Analysis (FMEA) and ensure the FMEAs are updated to reflect current part quality status.
• The FMEA shall be written for each part or part family or they may be process-specific and written for each process.
• FMEAs shall address every process step from part receipt to part shipment.
• A cross-functional team shall be used in the development of the FMEA.
• All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the FMEA.

Guidance	Objective Evidence	Conforming Nonconforming NA
Does the facility have a documented Failure Mode and Effects Analysis (FMEA) in use?	Yes	**Conforming**
Identify the names and job function of the team members used in the development of the FMEA.	Aaron Mulder, CEO Gordan Lozic, Quality Manager Mikayla Mathewson, Quality Tech	**Conforming**
Identify if the FMEA is written for each part, part family or process specific.	Part family	**Conforming**
Are all FMEAs consistent with all associated documentation such as control plans, work instructions and shop travelers?	Yes	**Conforming**
Do all FMEAs include every process step from part receipt to part shipment?	Yes	**Conforming**
Are special characteristics, as defined by the organization and its customers, identified, defined, and addressed in the FMEAs?	Yes	**Conforming**
Provide evidence that the FMEA has been updated in response to quality issues.	Corrective Action log	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.4	The process control plans shall be up to date and shall reflect the current process.

• The organization shall incorporate the use of a documented control plan and ensure the control plans are updated to reflect current controls.
• The control plans shall be written for each part or part family or they may be process-specific.
• The control plans shall address all process steps from part receipt to part shipment and identify all equipment used and all key surface finishing process parameters as defined by the organization.
• A cross-functional team shall be used in the development of control plans, which shall be consistent with all associated documentation such as work instructions, shop travelers, and FMEAs.
• All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the control plans.
• The control plan shall detail the product and process characteristics, and controls including testing frequency and sample size.

Guidance	Objective Evidence	Conforming Nonconforming NA
Does the facility have a documented control plan in use?	Yes	**Conforming**
Identify if the control plan is written for each part, part family or process specific.	Part family	**Conforming**
Do all control plans include every process step from part receipt to part shipment?	Yes	**Conforming**

Does the control plan identify all key surface finishing process parameters?	Yes	**Conforming**
Identify the names and job function of the team members used in the development of the control plan.	Aaron Mulder, CEO Gordan Lozic, Quality Manager Mikayla Mathewson, Quality Tech	**Conforming**
Are the control plans consistent with all associated documentation such as work instructions, shop travelers, specifications and FMEAs?	Yes	**Conforming**
Provide evidence that sample sizes and frequencies for evaluation of process and product characteristics are addressed and consistent with the minimum requirements.	Control plans	**Conforming**
Are special characteristics, as defined by the organization and its customers, identified, defined, and addressed in the control plans?	Yes	**Conforming**
Provide evidence that the control plan has been updated in response to quality issues, customer requirements and process changes.	Corrective Action log	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.5	All surface finishing related and referenced specifications shall be up to date and available. For example: SAE, AIAG, ASTM, General Motors, Ford, FCA, Toyota, Volvo Truck.

A document control system is pertinent for the handling and internal distribution of received customer specifications and to keep up to date with national or global standards related to surface finishing processes. To ensure all customer requirements are understood and satisfied, the organization shall have all related surface finishing and customer referenced standards and specifications available for use and a process to ensure that they are current.
• The organization shall have a process to ensure the timely review, distribution, and implementation of all customer and industry engineering standards and specifications and changes based on customer-required schedule. This process shall be executed as soon as possible and shall not exceed two weeks.
• The organization shall document this process of review and implementation, and it shall address how customer and industry documents are obtained, how they are maintained within the organization, how the current status is established, and how the relevant information is cascaded to the shop floor within the two-week period.
• The organization shall identify who is responsible for performing these tasks.

Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
Does the organization have all related surface finishing and customer referenced standards and specifications available for use?	Yes	**Conforming**
How are standards and specifications obtained?	Provided by customers during PPAP or after revisions	**Conforming**
Describe the system and timing used to maintain the standards and specifications to ensure that they are up to date.	Customers responsible for providing updated OEM specifications	**Conforming**
Define that process used to review and communicate within the two-week period updated standards and specifications throughout the organization. Include the names and job functions of the responsible personnel.	Gordan Lozic, Quality Manager	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning

1.6	There shall be documented process instructions.

• The organization shall have written process instructions for all active parts or family of parts, including relevant part specific requirements. Examples of part specific requirements include process line, plating type, load size, rectifier settings, etc.
• These process instructions may take the form of work instructions, job card, computer-based recipes, or other similar documents.

Guidance	Objective Evidence	Conforming Nonconforming NA
Does the organization have written process instructions for all active parts or family of parts and include all relevant operating parameters?	Yes	**Conforming**
What form of process specification is used? (These may be in the form of work instructions, job card, computer-based recipes, or other similar documents.)	Work instructions, computer-based plating recipes	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.7	A valid product capability study shall be performed.

To demonstrate each process is capable of yielding acceptable product, the organization shall perform product capability studies for the initial validation of each process, after relocation of any process equipment, and after a major change of any process or equipment. The organization shall define what constitutes a major change.
• Initial product capability studies shall be conducted for all surface finishing processes per line as defined in scope of work and in accordance with customer requirements. Capability study techniques shall be appropriate for the surface finishing product characteristics, (e.g., surface finishing thickness, corrosion resistance, etc.).
• An action plan shall exist to address the steps to be followed in case capability indices fall outside customer requirements or established ranges.

Guidance	Objective Evidence	Conforming Nonconforming NA
Has an initial product capability study been performed?	Yes	**Conforming**
Are studies conducted for each surface finishing process for each line in the facility?	Yes	**Conforming**
Has a new study been completed after relocation of any process equipment, major rebuild of any equipment, or any significant change in process chemistry?	Yes	**Conforming**
How does the organization define what constitutes a major change?	Changes to the plating line, not plating recipe	**Conforming**
What steps are followed when capability indices fall outside specified requirements?	PDCA	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.8	The organization shall collect, analyze, and react to product and process data over time.

• The analysis of product characteristics and processes parameters over time can yield vital information for defect prevention efforts.
• Methods of analysis shall include ongoing trend or historical data analysis of special product and process parameters.
• The organization shall determine which parameters to include in such analysis.

Guidance	Objective Evidence	Conforming Nonconforming NA
What product characteristics and process parameters are used?	Plating thickness, visual inspection, plating adhesion, corrosion, plating baths chemical analysis	**Conforming**
How is the ongoing trend or historical data reviewed and analyzed?	SPC	**Conforming**
How does the organization use this data to prevent future failures and improve the quality system?	PDCA	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.9	All process control and testing records must be retained for a minimum of one calendar year after the year in which they were created.

Guidance	Objective Evidence	Conforming Nonconforming NA
What is the process to retain these records?	Electronic logs and databases	**Conforming**
What is the process for retention of customer specific documents with longer retention times?	Program life + 3 years	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.10	There shall be a process in place to review the monitoring systems/logs at specified intervals.

- Management or management designee shall review the monitoring systems/logs at specified intervals.
- In the case of Hydrogen Embrittlement avoidance and relief, review shall occur prior to parts being released for shipment and shall not exceed 24 hours.
- The organization shall have reaction plans for nonconformances to process requirements.

Guidance	Objective Evidence	Conforming Nonconforming NA
Define the process in place to gather and review this information.	Electronic logs, MasterTracker software	**Conforming**
Identify the manager or management designee reviewing the process records from the monitoring systems/logs.	Plating Manager, Quality Manager	**Conforming**
In the case of Hydrogen Embrittlement baking, is the review taking place within the 24 hour period?	Yes	**Conforming**
Describe reaction plans for nonconformances to the written process requirements.	Suspect Load procedure and Quality hold	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.11	Internal assessments shall be completed at a minimum once every 12 months using the latest revision of the CQI-11 Plating System Assessment.

Guidance	Objective Evidence	Conforming Nonconforming NA
What is the date of the last AIAG CQI-11 Plating System Assessment?	3-Jun-22	Conforming
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.12	There shall be an internal system in place to authorize reprocessing and it shall be documented.

• The quality management system shall include a documented process for reprocessing that shall include authorization from the quality manager or a designated individual.
• The reprocessing procedure shall describe product characteristics for which reprocessing is allowed as well as those characteristics for which reprocessing is not permissible.
• All reprocessing activity shall require a separate rework specific process control sheet or other identification method, issued by qualified technical personnel denoting the necessary surface finishing modifications.
• Records shall clearly indicate when and how any material has been reprocessed.
• The rework of material shall comply with the customer's specifications and/or requirements.

Guidance	Objective Evidence	Conforming Nonconforming NA
Describe the procedure for authorizing reprocessing of nonconforming material.	Quality department determines acceptable rework procedures	Conforming
Does the reprocessing procedure describe product characteristics that allow or not allow reprocessing?	Yes	Conforming
Did the quality manager or manager's designee authorize the rework and determine the reprocessing procedure?	Yes	Conforming
How do you identify that material has been reprocessed?	Rework tags	Conforming
Do the records clearly indicate when and how any material has been reprocessed including the quality manager's authorization of release?	Yes	Conforming
Provide evidence that the rework complies with your customer's specifications and/or requirements.	Testing data and visual inspection results	Conforming
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.13	The Quality Department shall review, address, and document customer and internal concerns.

The quality management system shall include a process for documenting, reviewing, and addressing customer concerns and any other concerns internal to the organization.

Guidance	Objective Evidence	Conforming Nonconforming NA
Describe the procedure for reviewing and addressing external customer and internal concerns.	Customer complaint log, Quality Alerts, 8D's	Conforming
Describe the problem solving approach that is used.	PDCA, 8D, 5-Why	Conforming
Describe the communication process used to respond to the originator.	As requested by customer. Internally by email.	Conforming
Provide a recent example of this procedure in use.	8D submitted to customer by email on 5/23/23	Conforming

Comments:	
	Section 1 - Management Responsibility & Quality Planning
1.14	The organization shall have a continual improvement process.

• The continual improvement process shall be designed to achieve improvements in quality and productivity.
• Identified actions shall be prioritized and shall include timing (estimated completion dates).
• The organization shall show evidence of program effectiveness.

Guidance	Objective Evidence	Conforming Nonconforming NA
Describe the continual improvement process used to achieve improvements in quality and productivity.	SPC, quality meetings, plating huddles	**Conforming**
Provide a recent example of how actions are identified, prioritized and completion dates assigned.	Daily platers huddle and weekly quality review	**Conforming**
Describe how the organization measures the effectiveness.	Daily yield and scrap reports, weekly quality review	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.15	There shall be predefined personnel responsible for management of materials in quarantine area.

Only the quality manager or designee may authorize the disposition of material from quarantine status.

Guidance	Objective Evidence	Conforming Nonconforming NA
Define the process for release of material from quarantine.	Control of non-conforming material procedure	**Conforming**
List the authorized personnel with job titles.	QA Team members	**Conforming**
Review evidence that only these persons are releasing materials from the quarantine area.	Hold sheets	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.16	There shall be documented procedures and/or work instructions for all processes and they shall be available to all of the organization's personnel.

• There shall be procedures or work instructions available to personnel covering their responsibilities.
• These documents shall include instructions for addressing potential emergencies (such as power failure), equipment start-up, equipment shut-down, product segregation (See 2.3, 2.8), product inspection, and general operating procedures.

Guidance	Objective Evidence	Conforming Nonconforming NA
Review the procedure/work instruction for process start-up and shut-down.	Start up and shut down procedures and checklists	**Conforming**
Review the procedure/work instruction for process control during operation.	Electronic plating recipes, TrueChem SPC software	**Conforming**

What is the procedure in place to address potential emergencies? (Such as power outage and/or equipment failure).	Suspect Load procedure and Quality hold	**Conforming**
Review the procedures for inspection of the product, in process or after completion.	Part specific inspection work instructions	**Conforming**
Verify that these procedures/work instructions are accessible to personnel performing the job at all times.	Hard copies located on production floor	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.17	The organization and management shall provide employee training.

• The organization shall provide employee training for all operations.
• All employees, including backup and temporary employees, shall be trained.
• Documented evidence shall be maintained showing the employees trained and the evidence shall include an employee assessment.
• Management shall define the qualification requirements for each function, and ongoing or follow-up training shall also be addressed.

Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
Review the process for initial training of all employees, including backup and temporary.	Training matrix	**Conforming**
Review the process for ongoing and/or follow-up training.	Training matrix	**Conforming**
Provide a recent copy of the training matrix.	Available on request	**Conforming**
Provide documented evidence that shows how the organization verifies effectiveness of training.	Training and auditing	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning
1.18	Essential management and supervisory functions shall be performed by qualified personnel at all times and a matrix of these essential responsibilities shall be available for review.

• The organization shall maintain a responsibility matrix identifying all essential management and supervisory functions and list the qualified personnel who may perform such functions.
• It shall identify both primary and secondary (backup) personnel for the essential functions (as defined by the organization).
• This matrix shall be readily available to management at all times.

Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
Review and provide an example of the most recent matrix.	Training matrix, DMS system	**Conforming**
Confirm that the matrix includes both primary and secondary persons.	Training matrix, DMS system	**Conforming**
Describe how and where this information is made available.	Training matrix, DMS system, Job title and description	**Conforming**
Comments:		

	Section 1 - Management Responsibility & Quality Planning

1.19	There shall be a preventive maintenance program and maintenance data shall be utilized to form a predictive/preventive maintenance program.

• The organization shall have a documented preventive maintenance program for essential process equipment (as identified by the organization).
• The program shall be a closed-loop process that tracks maintenance efforts from request to completion to assessment of effectiveness.
• Equipment operators shall have the opportunity to report problems, and problems shall also be handled in a closed-loop manner.
• Company data, e.g., downtime, quality rejects, first time-through capability, recurring maintenance work orders, and operator-reported problems, shall be used to improve the preventive maintenance program.
• Maintenance data shall be collected and analyzed as part of a preventive maintenance program.

Guidance	Objective Evidence	Conforming Nonconforming NA
Show evidence that a documented preventive maintenance program exists.	PM Database	**Conforming**
Describe the process for reporting problems.	WO Request process	**Conforming**
Provide a recent example showing that the person reporting the problem received feedback after the problem was resolved.	WO Process requires feedback of maintenance task	**Conforming**
Give a recent example of how the program was used to prevent/predict potential equipment failure.	The cable track for hoist 4 was ordered and present before the failure occurred, this reduced downtime significantly	**Conforming**
How is the data being generated reviewed with management to improve the quality system?	Equipment Management Group reoccuring meeting to review key equipment maintenance metrics	**Conforming**

Comments:

	Section 1 - Management Responsibility & Quality Planning
1.20	The organization shall develop a critical spare part list and the parts must be available to minimize production disruptions.

• Spare part suppliers, minimum quantity and lead times shall be documented.

Guidance	Objective Evidence	Conforming Nonconforming NA
Provide the critical spare parts list.	Z:\Maintenance Department\Ashley\product key.xls	**Conforming**
Does the critical spare parts list include inventory, lead time and suppliers?	Data lives in Concur database for maintenance ordering	**Conforming**
Describe how and when the organization updates the list.	When new equipment is added the critical list is reviewed and updated	**Conforming**
What criteria is used to determine whether critical spare parts are kept at the facility or sourced off site.	Lead times, repair difficultiy	**Conforming**
Describe the process used to maintain minimum quantities.	As parts are consumed from inventory they are repleanished be ordering addiontal spare parts	**Conforming**

Comments:

	Section 2 - Floor and Material Handling Responsibility
2.1	The organization shall ensure that customer data entered into the receiving system matches the customer's shipping documents.

It is critical that all customer requirements and lot identification be correctly transferred to internal documents.
- The facility shall ensure that the data entered in the receiving system match the information on the customer's shipping documents.
- Documented processes and evidence of compliance shall exist, e.g., shop travelers, work orders, etc.
- Sometimes the material received does not precisely correspond to customer shipping documents. The facility shall have a detailed procedure in place to resolve receiving discrepancies.
- The requirements stated above apply to captive, in-house, commercial and all involved departments.

Guidance	Objective Evidence	Conforming Nonconforming NA
Describe the receiving process including listing the documentation used.	Customer Parts Receiving Process WIIC008	**Conforming**
Describe the process to identify the plating requirements.	APQP, Producion routing process PRGEN005	**Conforming**
Describe the reaction process when material received does not correspond to the customer's documents.	General Quality Incoming Audit Guidelines WIQA002	**Conforming**

Comments:

	Section 2 - Floor and Material Handling Responsibility
2.2	Is product clearly identified and stored throughout the surface finishing process and is lot traceability and integrity maintained?

Procedures are required for part and container identification to avoid incorrect processing or mixing of lots.
- As received, in-process, and finished product or material shall be properly segregated, identified, and stored in a dedicated and clearly defined area.
- Out-going lot(s) shall be traceable to the incoming lot(s).
- The discipline of precisely identifying lots and linking all pertinent information to them enhances the ability to do root cause analysis and continual improvement.

Guidance	Objective Evidence	Conforming Nonconforming NA
Describe the method that ensures the parts and lot numbers are correctly identified and maintained throughout the process.	Producion routing process PRGEN005, Inventory Control System PRIC001	**Conforming**
Verify that received, in-process, and finished product or material is properly segregated, identified, and stored in a dedicated and clearly defined area.	Inventory Control System PRIC001	**Conforming**

Comments:

	Section 2 - Floor and Material Handling Responsibility
2.3	Procedures shall be adequate to prevent movement of nonconforming product into and out of the production system.

The control of suspect or nonconforming product is necessary to prevent inadvertent shipment or contamination of other lots.
- Procedures shall be adequate to prevent movement of nonconforming product into the production system.
- Procedures shall exist addressing authorized personnel, appropriate disposition, product identification and tracking of material flow in and out of hold area.
- Nonconforming hold area shall be clearly designated to ensure segregation of such material.

Guidance	Objective Evidence	Conforming Nonconforming NA
Where is the nonconforming holding area, and how is it identified?	1 north plant hold, 1 south plant hold, both identified with signage and indicated by the color RED	**Conforming**
Describe the procedure to prevent the unauthorized movement of nonconforming products.	PRQA002 Control of Non Conforming Product, PRGEN005 Production Routing Procedure	**Conforming**
Provide evidence that material movement in and out of this area is documented.	Warehouse Management Software (Fishbowl) retains all data	**Conforming**
Comments:		

	Section 2 - Floor and Material Handling Responsibility
2.4	For bulk processing there shall be a procedure to identify trap points throughout the entire process to reduce risk of unfinished, improperly coated and mixed parts.

• The organization shall have documented procedures to identify and monitor all trap points for each process/equipment.
• Monitoring of potential trap points shall occur at minimum every part changeover.
• Trap points may include: Plating barrels, part containers, loading and unloading equipment, spin dryers, transfer belts.

Guidance	Objective Evidence	Conforming Nonconforming NA
Describe the procedure to identify and monitor all trap points for each process and/or equipment.	WIGEN006 Trap Points	**Conforming**
Provide the list of trap points.	WIGEN006 Trap Points	**Conforming**
Comments:		

	Section 2 - Floor and Material Handling Responsibility
2.5	The handling, storage and packaging shall be adequate to ensure product quality is maintained throughout the entire process.

• Handling, storage, and packaging shall be adequate to ensure product quality.
• Part cleanliness shall be maintained throughout the process.
• All parts shall be stored in a controlled environment.

Guidance	Objective Evidence	Conforming Nonconforming NA
Which process steps have dedicated in-process containers?	Customer provided packaging is used	**conforming**
How are containers maintained to preserve part cleanliness?	Customer provided packaging is used	**conforming**
Describe how the containers are inspected to ensure they are free of foreign material.	Customer provided packaging is used	**conforming**
What is used for liner material of customer containers before packing finished goods for shipment? (Materials like newspapers, used cardboard and bags should be avoided).	Customer provided packaging is used	**conforming**
Provide a list of dedicated storage areas that avoid exposure to contamination and corrosion. (Storage outdoors, near media blasting and corrosive processes such as acid tanks should be avoided).	Product is kept in separate plant until ready to be processed	**conforming**

Comments:		
	Section 2 - Floor and Material Handling Responsibility	
2.6	Each process step shall be documented and traceable.	
How does the operator verify that all process steps have been completed in specified order and in within specified time limits?		
Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
Do you have a document (shop travelers, job sheet, etc.) that specifies all the processes for each part number/part family?	Routing tags, Load tags, and Master Tracker software data, FRGEN004 Special Parts Process Authorization	**Conforming**
Define the procedure that ensures that all processes have been completed in the specified order.	Routing tags, Master Tracker software process controls	**Conforming**
Describe how time sensitive processes are completed in the specified time limits (e.g., hydrogen embrittlement baking).	Master Tracker process controls and user interface	**Conforming**
Provide documentation that this process has been followed.	Master Tracker software data is permenantly retained	**Conforming**
Comments:		
	Section 2 - Floor and Material Handling Responsibility	
2.7	Part loading shall be specified, documented and controlled.	
• Loading parameters shall be specified, documented and controlled. • Examples include: parts per rack, part position and orientation, weight per barrel or masking.		
Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
Describe how the loading parameters are communicated to the operator.	Routing tags, Work instructions, Master Tracker SW controls	**Conforming**
Identify how the loading weight or rack quantity is recorded for each load or rack.	Routing tags, Work instructions, Master Tracker SW controls	**Conforming**
Comments:		
	Section 2 - Floor and Material Handling Responsibility	
2.8	There shall be a procedure for material handling, containment action and product segregation in the event of an unplanned process interruption.	
Unplanned downtime greatly increases the risk of improper processing. • Work instructions specifically addressing potential types of unplanned process interruptions shall be accessible to operators. • Specific instructions shall address containment/reaction plans for each step of the process. Where processes are time critical, immediate actions are required. Examples include process steps exposing parts to: acidic solutions, current, bake or curing processes. • Evidence shall exist showing disposition and traceability of affected product.		
Guidance	**Objective Evidence**	**Conforming Nonconforming NA**

What procedure is used to address each step of the process?	WIHL007 Suspect Loads PRQA002 Control of Non Conforming Product FRHL001 Rework Process Tracking	**Conforming**
Provide all work instructions that address unplanned process interruptions.	WIHL007 Suspect Loads PRQA002 Control of Non Conforming Product	**Conforming**
How is the affected product traced, dispositioned and documented?	WIHL007 Suspect Loads PRQA002 Control of Non Conforming Product FRHL001 Rework Process Tracking Master Tracker data	**Conforming**
Comments:		

	Section 2 - Floor and Material Handling Responsibility
2.9	Plant cleanliness, environment, and working conditions shall be conducive to ensure product quality.

• Plant cleanliness, housekeeping, environmental, and working conditions shall be adequate to preserve product quality.
• A housekeeping policy shall be clearly defined and executed.

Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
Provide a copy of the housekeeping procedure.	Employee handbook, WIWT011 O&MPlan NESHAP	**Conforming**
Provide a copy of the procedure used to handle dropped or spilled parts.	Customer specific requirements / Instructions	**Conforming**
Describe what is done with loose parts found on the floor of the plant.	Customer specific requirements / Instructions	**Conforming**
Define the process used to review the facility for conditions that are detrimental to quality processing such as chemical spills and inadequate ventilation.	WIWT011 O&MPlan NESHAP	
Comments:		

	Section 2 - Floor and Material Handling Responsibility
2.10	Plant lighting shall be adequate in all inspection areas.

Lighting in the part and/or process inspection areas must be adequate for the intended operation.

Guidance	**Objective Evidence**	**Conforming Nonconforming NA**
How do you ensure the lighting in the part and/or process inspection areas, including loading and unloading areas, is adequate for the intended operation?	Engineered lighting distribution (plant project history)	**Conforming**
For part inspection, how do you arrange the lighting to avoid spot lighting, glare, shadows and distracting reflections?	Engineered lighting distribution (plant project history)	**Conforming**
Comments:		

Section 3 - Pyrometry

Questions can be found in Process Tables A through I and shall be answered per these requirements.

P3.1 **Thermocouples**

P3.1.1 Calibration of Thermocouples: Thermocouples shall be calibrated traceable to the National Institute of Standards and Technology (NIST) or other national standards laboratory prior to first use and in the temperature range in which they will be employed. The calibration temperature test points shall be no further than 150ºC or 250ºF apart.

P3.1.1.1 Calibration certificates shall include the following detail: the actual test temperature reading, the nominal test temperature, the corresponding correction factor (or error/deviation value) for each calibration temperature test point, the provider of the calibration data and their accreditation symbol (or equivalent) if not performed in-house, and the calibration method used.

P3.1.1.2 External sources providing calibrations shall be accredited to ISO/IEC 17025 or other national equivalent. Internal sources providing calibrations shall do so in accordance with the intent of ISO/IEC 17025 or other national equivalent.

P3.1.1.3 All thermocouples shall comply with Tables P3.1.1, P3.1.2 and P3.1.3 requirements. The time interval for the replacement of thermocouples shall commence with the date thermocouple is placed in service.

P3.1.2 Reuse of Thermocouples: The date that any thermocouple is placed in service shall be documented. The tracking of uses for non-expendable control, monitoring and recording thermocouples is not required. See Tables P3.1.1, P3.1.2 and P3.1.3 for replacement and recalibration requirements.

P3.1.2.1 Damaged thermocouples shall not be used. Examples of a damaged thermocouple would include but are not limited to; insulation not intact, hot junction broken, evidence of corrosion, crimping, termination fitting or plug has become loose or sheath material has been scratched exposing mineral insulating material.

Table P3.1.1 Calibration and Replacement Requirements for Thermocouples Used for Control, Monitoring and Recording

THERMOCOUPLE TYPE (1)	SYSTEM TYPE	CALIBRATION / REPLACEMENT INTERVAL	CALIBRATED AGAINST	INITIAL CALIBRATION ACCURACY REQUIRED
Base Metal Types (K, J, N, T)	Hydrogen Embrittlement Relief, Electroless Nickel Hardening and other Oven systems with a process temperature control tolerance of 20°C (30°F) or less	Calibrate before first use. Replace every two years (2,3)	Primary or Secondary Standard	± 1.1ºC (± 2.0ºF) or ± 0.4% whichever is greater
Base Metal Types (K, J, N, T)	Other Ovens	Calibrate before first use. Replace every four years (2,3)	Primary or Secondary Standard	± 1.1ºC (± 2.0ºF) or ± 0.4% whichever is greater
Base Metal Types (K, J, N, T)	Process Tanks	Calibrate before first use. Replace every two years (2,3)	Primary or Secondary Standard	± 1.1ºC (± 2.0ºF) or ± 0.4% whichever is greater
Noble Metal Types (B,R,S, Platinum RTD)	All Ovens and Process Tanks	Calibrate before first use. Replace or recalibrate every four years (2)	Primary or Secondary Standard	± 1.1ºC (± 2.0ºF) or ± 0.4% whichever is greater

1. Non-Expendable
2. Thermocouples shall be replaced whenever needed, e.g., failed SAT or damaged thermocouple; however, thermocouples shall be replaced minimally as stated above. Thermocouples may either be purchased calibrated or calibrated internally and shall meet requirements of P3.1.
3. Base metal thermocouples shall not be recalibrated.

Table P3.1.2 – Calibration and Replacement Requirements for Test Thermocouples Used for Temperature Uniformity Surveys (TUS) and System Accuracy Tests (SAT)

THERMOCOUPLE	THERMOCOUPLE TYPE	USE	CALIBRATION / REPLACEMENT INTERVAL	CALIBRATED AGAINST	CALIBRATION ACCURACY REQUIRED
Test Thermocouples	Base Metal Types (K, J, N, T)	TUS SAT	As per Table P3.1.3 Recalibration prohibited (1)	Primary or Secondary Standard	± 1.1ºC (± 2.0ºF) or ± 0.4% whichever is greater

1. Base metal thermocouples shall not be recalibrated.

Table P3.1.3 – Allowable Number of Uses for Thermocouples in Specific Applications

THERMOCOUPLE TYPE	USE (1)	OPERATING TEMPERATURE	MAXIMUM PERMITTED USES
Expendable Base Metal (K, J, N, T)	Temperature Uniformity Surveys (TUS) / System Accuracy Test (SAT)	≤ 430ºC (800ºF)	15 (2)
Expendable Base Metal (K, J, N, T)	Control	≤ 430ºC (800ºF)	1 (2)
Expendable Base Metal (K, J, N, T)	Monitor/Record/Load Sensing	≤ 430ºC (800ºF)	30 (2)
Non-expendable Base Metal (K, J, N, T)	Temperature Uniformity Surveys (TUS) / System Accuracy Test (SAT)	≤ 430ºC (800ºF)	2yrs maximum
Non-expendable Base Metal (K, J, N, T)	Load Sensing (part temperature)	≤ 430ºC (800ºF)	6 months

1. Thermocouples shall be dedicated to a specific, unalterable purpose (TUS, SAT, Load Sensing, Control, Monitoring or Recording). Thermocouples that have achieved their maximum permitted number of uses for this assigned application shall not be repurposed for other CQI-11 compliance requirements.
2. Under no circumstance shall any expendable base metal thermocouple be used beyond six months from date of first use.

P3.2 Instrumentation

P3.2.1 General Instrumentation Requirements: Instrumentation shall be calibrated traceable to the National Institute of Standards and Technology (NIST) or other national standards laboratory.

P3.2.1.1 External sources providing calibrations shall be accredited to ISO/IEC 17025 or other national equivalent. Internal sources providing calibrations shall do so in accordance with the intent of ISO/IEC 17025 or other national equivalent.

P3.2.1.2 Calibration frequencies and accuracies are specified in Instrumentation Table P3.2.1.

P3.2.1.3 The temperature for each oven control zone shall be recorded by a recording instrument. Recorder shall be operating during the entire time that product is in the oven. Process record shall be legible.

P3.2.1.4 Analog instrumentation shall not be allowed following three (3) years from release date of this document.

P3.2.2 Offsets: Although the use of offsets is generally discouraged, they are allowed to specifically correct for calibration errors, SAT errors or to center a TUS result.

Offset values applied are limited and shall not exceed 5°C or 10°F for the correction of instrument calibration error. An additional offset of 5°C or 10°F is allowed for the correction of an SAT error and another 5°C or 10°F of offset for the purpose of centering a TUS result.

When offsets are used a documented procedure shall exist which at a minimum describes each of the following:

- When the use of offset is permitted
- How manual (external) and electronic (internal) offsets are performed
- How the basis (calibration, SAT or TUS) for the offset is documented
- How offset is accounted for when performing calibrations
- How offset is considered when performing an SAT
- How to reintroduce any intentional offsets
- Who has the authority to approve the use of offsets
- How is this approval documented

P3.2.3 Calibration: Calibration of control, monitoring, and recording instruments shall be performed to the manufacturer's instructions or as described in P3.2.3.1.

P3.2.3.1 It is acceptable to perform calibrations on either a single point (measure) or multi-point (source) basis. The following requirements shall be met:

P3.2.3.1.1 For the calibration of control, monitoring and recording instruments on oven systems and processing tanks that are in operation and running at typical operating temperatures, a single point calibration is acceptable.

P3.2.3.1.2 Calibration of control, monitoring and recording instruments may be performed on a multi-point basis by sourcing a signal to the instrument representing the low, mid and high points of the range of the instrument.

P3.2.3.1.3 Field Test Instruments used for the calibration of control, monitoring and recording instruments shall at a minimum meet the requirements specified in Table P3.2.1. Field Test Instrument calibration reports shall indicate correction factor or error data for each test point.

P3.2.3.2 For multi-channel instruments, a calibration shall be required for each channel in use.

P3.2.4 Calibration Records: Calibration status and results shall be reported as follows:

P3.2.4.1 A calibration label shall be affixed to the instrumentation device, or in the case of panel mounted control, monitoring or recording instrumentation, on the device or as near as practical to the device(s) to indicate the most recent successful calibration. The label(s) at a minimum shall include:

- Date the calibration was performed
- Due date of the next calibration
- Technician who performed the calibration (initials are acceptable)
- Serial number of instrument

P3.2.4.2 Instrumentation calibration results shall be documented. The instrument calibration report or certificate shall include the following information:

- Oven or unit identification number
- Make, model and serial number of instrument calibrated. PLC devices/modules not serialized require unique identification. Each channel/input calibrated shall be identified
- Standard or test instrument used during calibration
- Method of calibration
- Ambient temperature and humidity
- Required accuracy (+/-2°C; +/-4°F)
- As-Found/As-Left temperature values at each calibration point (if no adjustment is made then the final value will equal the As-Found value)
- As-Found/As-Left offset/bias values (if no adjustment is made then the corrected offset/bias value will equal the As-Found value)
- Basis for offset/bias values indicated and clearly defined (Calibration, SAT, or TUS)
- Pass/Fail status
- Any limitations or restrictions of the calibration
- Date the calibration was performed
- Due date of next calibration
- Technician who performed the calibration
- Signature of the technician who performed the calibration
- Calibration company if not performed in-house
- Accreditation symbol (or equivalent) if not performed in-house
- Sign-off to include the name and title of person reviewing/approving calibration report

P3.2.4.3 In the event of a failed calibration or out of tolerance condition, appropriate corrective actions shall be taken and documented.

Table P3.2.1 – Instrument Calibration Requirements

INSTRUMENT	INSTRUMENT TYPE	MAXIMUM CALIBRATION PERIOD (MONTHS)	CALIBRATED AGAINST	CALIBRATION ACCURACY REQUIRED	USE
Field Test Instrument	Portable potentiometer or digital instrument, electronic data recorder or data acquisition system.	12	Primary or Secondary standard	± 0.6ºC (± 1.0ºF) or ± 0.1% of reading	Limited to controlling, monitoring, or recording instrument calibration, performance of system accuracy tests and temperature uniformity surveys.
Control, Monitoring or Recording Instruments	Digital, Mechanical (analog), Electro-mechanical or Thermal element.	12	Field Test Instrument (single-point or multi-point calibration)	± 2.0ºC (± 4.0ºF)	Limited to measuring, recording, and controlling the temperature of thermal processing equipment.

P3.3 System Accuracy Test (SAT)

P3.3.1 Oven control, monitoring and recording temperature systems (instrument, leadwire, and thermocouple/RTD) are verified by performing an SAT. This requirement includes load sensing thermocouples. The SAT shall be performed in accordance with Section P3.3.

P3.3.1.1 The oven SAT frequency shall be every six months.

P3.3.1.2 Process tank control temperature systems (instrument, leadwire, and thermocouple/RTD) are verified by performing daily (or as otherwise prescribed) temperature checks as per the applicable process table.

P3.3.2 Oven SAT's and Process Tank daily temperature checks shall be performed using a test thermocouple conforming to the requirements of Thermocouple Table P3.1.2 coupled with a test instrument meeting the requirements of Instrumentation Table P3.2.1.

P3.3.3 A new oven SAT shall be performed after any maintenance that could affect the SAT accuracy, e.g., the replacement of the lead wire, the control thermocouple or the replacement of the control instrument.

P3.3.4 For oven systems the SAT shall be performed while the oven is operating at a typical operating temperature using Probe Method A as detailed in Section P3.3.4.1.

P3.3.4.1 Probe Method A:

P3.3.4.1.1 Probe Method A is a check between the uncorrected reading of the oven control, monitoring and recording temperature system (instrument, leadwire, and thermocouple/RTD) and the corrected reading of a test temperature system (test instrument and test thermocouple). See Illustration P3.3.1.

P3.3.4.1.2 The tip (measuring junction) of the test thermocouple shall be no further than 50 mm (2 inches) from the tip (measuring junction) of the oven control, monitoring and recording thermocouple/RTD.

P3.3.4.1.3 The difference between the temperature indication of the oven control, monitoring and recording instrument connected to its respective thermocouple/RTD and the corrected temperature indication of the test thermocouple on a test instrument shall be within the following tolerances:

System	Maximum SAT Difference Allowed
Ovens (all)	± 5.0ºC (± 10.0ºF)

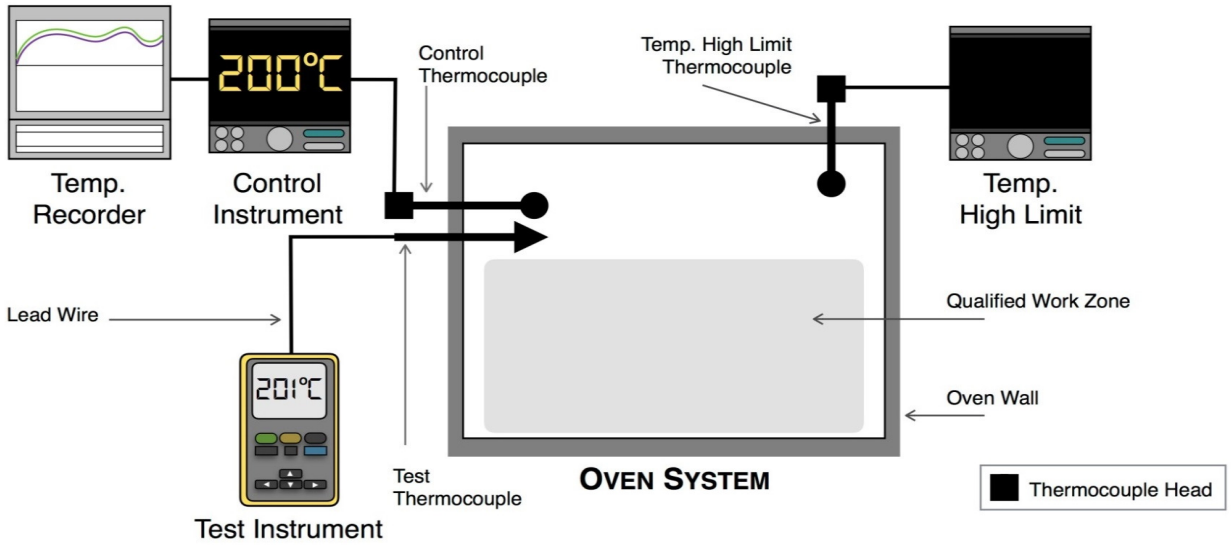
After insertion of the test thermocouple, allow sufficient time to achieve equilibrium between the test thermocouple and the oven control, monitoring and recording instrument thermocouple/RTD.

P3.3.4.1.4 If the calculated SAT difference exceeds the values stated above, the appropriate corrective action shall be taken before commencing with additional processing. Oven control, monitoring or recording thermocouples/RTD's failing to meet the requirements shall be replaced.

A new SAT shall be conducted on the replacement thermocouple/RTD. Actions taken shall be documented.

Note: When using Probe Method A, any electronic offset value introduced into the control instrument for the purpose of centering a TUS result shall be included in the SAT difference calculations. See Illustration P3.3.1.

EXAMPLE of Probe Method "A"



EXAMPLE of System Accuracy Test (SAT) Calculations - Probe Method A

CONTROL INSTRUMENT TEMPERATURE (A)	CONTROLLER TUS OFFSET (B)	ADJ. CONTROL INSTRUMENT TEMPERATURE (C)=(A)-(B)	TEST INSTRUMENT TEMPERATURE (D)	TEST THERMOCOUPLE CORRECTION FACTOR (E)	TEST INSTRUMENT CORRECTION FACTOR (F)	TRUE TEST TEMPERATURE (G)=(D)+(E)+(F)	CALCULATED SAT DIFFERENCE (C) – (G)
200°C (392°F)	0°C (0°F)	200°C (392°F)	201°C (394°F)	+ 0.3°C (+ 0.5°F)	+ 0.1°C (+ 0.2°F)	201.4°C (394.7°F)	- 1.4°C (- 2.7°F)

Illustration P3.3.1

P3.3.5 Oven System Accuracy Test Records shall include the following:

- Identification of the control, monitoring or recording thermocouple being tested
- Identification of the SAT test thermocouple
- Identification of the SAT test instrument
- Date and time of day of the test
- Observed control, monitoring or recording instrument reading
- Observed test instrument reading
- SAT test thermocouple and SAT test instrument correction factors
- Corrected SAT test instrument reading
- Calculated system accuracy test difference
- Pass/Fail status
- Identification of technician performing the test
- External calibration company if applicable
- Accreditation symbol (or equivalent) if not performed in-house
- Sign-off by plating organization to include the name and title of person reviewing and approving report

P3.4 Temperature Uniformity Surveys (TUS)

P3.4.1 General TUS Requirements: Temperature uniformity characteristics, qualified work zones, and operating temperature ranges of curing ovens, electroless nickel hardening and hydrogen embrittlement relief ovens are verified by performing an annual TUS in accordance with the requirements of this section.

P3.4.1.1 TUS's shall be performed using independent test instrumentation meeting the requirements of Table P3.2.1 – Instrument Calibration Requirements and independent test thermocouples meeting the requirements of Table P3.1.2 – Thermocouples.

Compensation for known deviations in the test instrumentation shall be made by electronic or mathematical corrections.

P3.4.1.2 Any oven modification or repair that could alter the temperature uniformity characteristics of the oven shall result in a temperature uniformity survey being performed prior to the oven system being used for processing.

Oven modifications are actions taken that change the oven from its original documented state. Following are examples of oven modifications that could alter the temperature uniformity characteristics of the oven and shall require an additional TUS:

- Increase in the maximum qualified operating temperature
- Decrease in the minimum qualified operating temperature
- Change in burner size, number, type or location
- Change in heating element number, type or location
- Changes to airflow (baffle positions, fan speed, fan quantity, etc.)
- Change of control sensor location
- Change of combustion pressure settings from original settings
- Temperature control scheme changes (proportional vs. high-low/on-off)
- Changes in temperature control tuning constants (PID)
- Work zone volume increase covering area not previously tested
- Work zone location change covering area not previously tested

Oven repairs are maintenance actions that restore the oven to its original documented condition. If repairs are not expected to impact the temperature uniformity characteristics of the oven an additional TUS shall not be required. Following are examples of oven repairs that would not require an additional TUS:

- Replacing a burner with an identical burner
- Replacing a heating element with an identical heating element
- Replacing a control thermocouple without changing its documented location
- Replacing heating system components (gas regulator, valve, metering device, etc.) with identical components and settings
- Restoring original documented combustion pressure settings
- Restoring original documented control tuning constants (PID)
- Replacing a controller with an identical controller with the same tuning constants
- System accuracy test failures
- Repair of oven door seals

P3.4.1.3 All oven modifications or repairs shall be documented and include the determination made by the responsible authority within the organization as to whether these modifications or repairs could alter the temperature uniformity characteristics of the oven.

P3.4.1.4 TUS Test Temperatures: Only the maximum temperature of the oven operating temperature range is required to be tested.

P3.4.1.5 TUS Oven Parameters: When performing the temperature uniformity survey, the oven system parameters during the test shall replicate the oven system parameters during normal production. The preheating of the oven system is permissible if the oven is preheated in normal production.

The TUS shall be performed with a dense, full production load or simulated production load which shall represent the maximum permissible load rate for the oven during normal production. Part time to temperature shall meet the most stringent applicable customer or process specification.

P3.4.2 Continuous and Semi-Continuous Ovens

P3.4.2.1 TUS Methods: Continuous and semi-continuous ovens shall be surveyed so that the volume defined as the qualified work zone is tested. TUS test sensors shall be arranged either three dimensionally (Volumetric Method) or in a plane (Plane Method).

P3.4.2.2 Number and Location of TUS Thermocouples

P3.4.2.2.1 Volumetric Method: Shall be used with semi-continuous or pusher type ovens. See Table P3.4.1 for number of TUS thermocouples. See Figure P3.4.1 to determine appropriate location of the TUS thermocouples.

P3.4.2.2.2 Plane Method: Shall be used for continuous ovens where the product is continuously moving through the oven, e.g., belt/conveyor type ovens.

The plane method shall utilize (3) TUS thermocouples attached to or buried in the load; two of the TUS thermocouples shall be located within 50 mm (2 inches) of the work zone edges and one of the TUS thermocouples shall be located at the center.

P3.4.3 TUS Data Collection:

P3.4.3.1 TUS test thermocouples shall be traversed through the entire oven at the maximum line speed used in production and representing all required test locations.

P3.4.3.2 All temperature data generated by the TUS test thermocouples and all temperature data recorded on the process record for oven zone temperature shall be recorded automatically at least every thirty seconds for the duration of the survey. Data collection shall begin when the TUS test thermocouples are loaded into the oven.

The process record for oven zone temperature shall be compared to the TUS data to ensure compliance to TUS requirements. Manual data collection is not allowed.

TUS data collected shall clearly show the time elapsed between parts entering the oven and achieving target part temperature. All TUS data collected shall clearly show the time at set temperature.

P3.4.4 Batch Ovens

P3.4.4.1 TUS Methods: Batch ovens shall be surveyed so that the volume defined as the qualified work zone is tested. TUS test thermocouples shall be arranged three dimensionally (Volumetric Method) and as required in Table P3.4.1 and Figure P3.4.1.

Batch ovens shall be loaded in a single, uninterrupted and continuous process. Incremental loading, and the subsequent need to open and close batch oven doors to accommodate this loading process, is not allowed.

P3.4.4.2 Number and Location of TUS Thermocouples

P3.4.4.2.1 Volumetric Method: Shall be used with batch ovens. See Table P3.4.1 for number of TUS thermocouples. See Figure P3.4.1 for the location and placement of the TUS thermocouples.

For oven work zone volumes greater than 8.5m³ (300ft3), the thermocouple locations shall be similar to the example in Figure P3.4.1 and the additional thermocouples shall be located to best represent the qualified work zone.

P3.4.4.3 TUS Data Collection: Data collection shall begin when the TUS thermocouples are loaded into the oven.

All temperature data generated by the TUS test thermocouples and all temperature data recorded on the process record for oven zone temperature shall be recorded automatically at least every thirty seconds for the duration of the survey.

The process record for oven zone temperature shall be compared to the TUS data to ensure compliance to TUS requirements. Manual data collection is not allowed.

P3.4.4.3.1 When the oven temperature control achieves set point temperature, displaying a normal control cycling around set point; the TUS test thermocouples have stabilized and the part time-to-temperature requirement (if applicable) has been achieved, then the TUS data collection shall continue for an additional thirty minutes minimum.

P3.4.5 Permissible TUS Test Thermocouple Failures: A temporary condition such as a short or loose connection or other identifiable cause where normal temperature readout is restored shall not be considered a failed TUS test thermocouple.

P3.4.6 TUS Pass/Fail Requirements:

P3.4.6.1 A temperature uniformity survey shall be acceptable if all previous requirements are met including the following:

- Readings of all TUS thermocouples and control thermocouples are within ±10°C (±20°F) of the temperature controller set-point value or other more stringent customer specification, process sheet or technical data sheet.
- The time required to achieve target part temperature did not exceed the time limit specified in customer specifications.
- The required time at temperature was achieved (for continuous/semi-continuous ovens only).
- The upper temperature tolerance was not exceeded at any time by any TUS thermocouple or temperature controller thermocouple.
- The lower temperature tolerance was continuously maintained after reaching the beginning of the soak period.

P3.4.6.2 Reaction to TUS Failures: If the temperature uniformity results are not within the established limits, the cause of the deviation shall be determined and documented. The equipment shall not be used for additional processing until the cause has been corrected and the TUS has been performed successfully.

P3.4.7 TUS Report: The items listed below shall be included in the temperature uniformity survey report:

- Oven identification name or number.
- Method of TUS (whether volumetric or plane).
- Survey test temperature. (temperature controller set-point and required TUS tolerance indicated).
- TUS thermocouple quantity and location identification including a detailed diagram in three dimensional space, or detailed description of any load, rack or set-up.
- Photograph showing placement of thermocouples into the load.
- TUS thermocouple calibration report to include correction factors.
- Survey test instrument identification number.
- Survey test instrument calibration report to include calibration data and correction factors for each adjustable channel or input.
- Testing company identification (if not performed in-house).
- Accreditation symbol (or equivalent) if not performed in-house.
- Name & Signature of the technician performing the TUS.
- Survey start / stop time and start / stop date.
- Corrected readings of all TUS thermocouples at each survey temperature.
- Identify time-to-temperature for the test load.
- The data collection period or soak period.
- Control instrument tuning parameters, e.g., PID values.
- Time and temperature profile data for all TUS thermocouples and temperature control thermocouples for all zones tested. Control thermocouple data shall be generated by the associated process recorder or process data acquisition system.
- Pass/Fail status (to include indication of the applicable standard or specification).
- Summary of final plus and minus readings at each test temperature.
- Sign-off by plating organization to include the name and title of person reviewing and approving report.

Table P3.4.1 - TUS Test Thermocouple
(VOLUMETRIC METHOD)

Qualified Work Zone Volume (1,2)	< 0.1 m^3 (3ft^3)	0.1 to 8.5m^3 (3ft^3 to 300ft^3)
Number of Thermocouples (3)	5 (4)	9

Note 1. For oven volumes greater than 8.5 m^3 (300ft^3), add at a minimum one thermocouple for each additional 3 m^3 (105 ft^3). For example, for a 17.50 m^3 (620 ft^3) oven, (12) TUS thermocouples shall be used at a minimum.

Note 2. For bucket carriers often used in semi-continuous hydrogen embrittlement relief oven systems, (3) TUS thermocouples shall be used. Two of the TUS thermocouples shall be located within 50 mm (2 inches) of the work zone edges and one of the TUS thermocouples shall be located at the center.

Note 3. TUS thermocouples shall be buried in the load to best represent the locations illustrated in Figure P3.4.1.

Note 4. When (5) TUS thermocouples are required they shall be placed to represent the four corner positions and the center of a rectangular qualified work zone volume or 90° apart along the periphery and the center of a cylindrical qualified work zone volume.

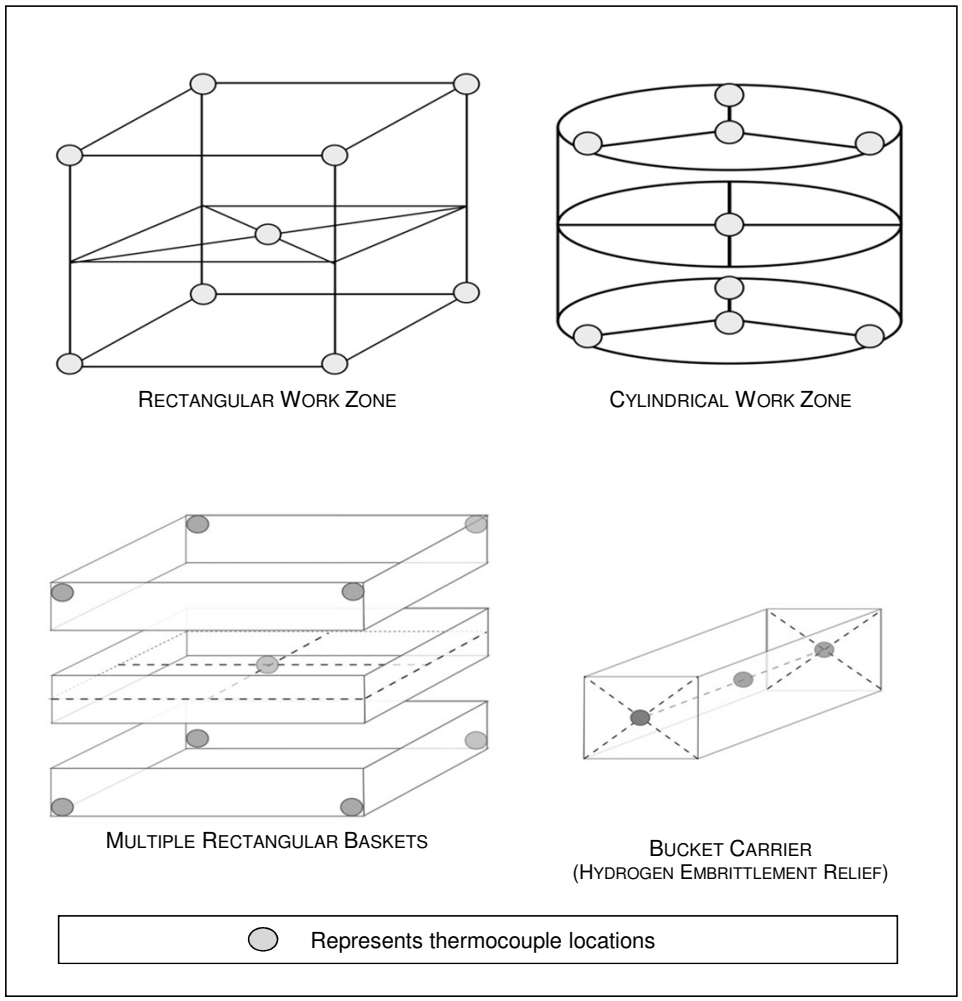


Figure P3.4.1 - TUS Test Thermocouple Locations

Section 4 - Plating System Assessment Job Audit - Finished Product Review

Job Identity:

Customer:

Shop Order Number:

Part Number: PT00034359

Part Description: Tow Hook / Automotive, Exterior / Steel

Material Substrate: Steel

Plating Requirements: Nickel 30um, Chrome 0.25um

Specification Number and Revision: PS.50019, Rev. 27-NOV-2014; PS. 50044, Rev. 04-AUG-2016

Question Number	Inspection Element	Identify Relevant Documents & Actual Condition (Provide Data or Values & Embed or Attach Documents)	Conforming Nonconforming NA
4.1	Attach evidence that the documentation for the specific part conforms to the requirements including: • Advanced quality planning process • FMEA • Process Control Plan	• Project Workbook (APQP) • FMEA (up-to-date) • Process Control Plan (up-to-date)	**Conforming**
4.2	What customer specifications or requirements are used for this part? • List the specification(s) and revision(s)	FCA PS.50019, Rev. 27-NOV-2014 PS.50044, Rev. 04-AUG-2016	**Conforming**
4.3	Provide evidence of receiving inspection.	Incoming Inspection Log	**Conforming**
4.4	Provide the job traveler or attach a copy of this traveler showing: • Customer name • Lot number • Weight/quantity • Process instructions • Inspection requirements	Routing Tag, Fishbowl information	**Conforming**
4.5	If the lot is divided how is the traceability maintained throughout the process?	Load IDs, Fishbowl information	**Conforming**
4.6	Describe the method used to document each operation as being completed. Is there a sign-off with time stamp, bar code or scan, etc., after each operation?	MasterTracker software with barcode scanning and tieme stamp at start and end of each process step	**Conforming**
4.7	Attach work instructions applicable to this part indicating proper barrel/basket mesh size or perforation (hole size), load size, appropriate rack configuration, appropriate part orientation on rack, etc.	Racking work instructions	**Conforming**
4.8	Identify each process table pertaining to this job audit. Populate the applicable process tables with the actual process results/conditions at the time this part was processed (Columns H and I in Process Tables A through H).	Process tables	**Conforming**
4.9	Were appropriate process steps on the job router/traveler signed off? For electronic systems, a screen print is acceptable.	MasterTracker software digital record	**Conforming**
4.10	Were all inspection steps, as documented in the control plan performed?	MasterTracker software digital record	**Conforming**
4.11	Were steps/operations performed that were not documented in the control plan?	MasterTracker software digital record	**Conforming**
4.12	If additional steps were performed, were they authorized?	N/A	**N/A**
4.13	If the order was certified, did the certification accurately reflect the process performed?	Plating Certification	**Conforming**

Question Number	Inspection Element	Identify Relevant Documents & Actual Condition (Provide Data or Values & Embed or Attach Documents)	Conforming Nonconforming NA
4.14	Was the certification signed by an authorized individual?	Plating Certification	**Conforming**
4.15	Are the parts and containers free of foreign objects or contamination?	General Operational procedure	**Conforming**
4.16	Are packaging requirements identified?	APQP / Project Workbook, Packing instructions	**Conforming**
4.17	Are parts packaged to prevent mixing or damage to parts (parts packed over height of container)?	Packaging instructions	**Conforming**
4.18	Are storage condition sufficient to maintain part quality. e.g., parts are stored indoors in a clean, dry environment.	Warehouse and Production Plant	**Conforming**
4.19	Were the parts properly identified and/or labeled before shipping?	Labeling instructions	**Conforming**
4.20	For the finished part, list each test and inspection requirement per customer specification.	Each part may have one or more requirements determined by the plating specification. Parts must meet each requirement. Add additional sections as needed.	
	Below is an <u>example</u> of how to fill out sections in 4.20.x	**Inspection Requirement**	**Conforming Nonconforming NA**
Example only	**Test Description:**	Corrosion Resistance	
	Test Method:	ASTM B117	
	Test frequency or quantity:	daily, 2 parts	**Conforming**
	Test Requirement:	240 hrs. no white / 1000 hours no red	
	Result: Attach evidence:	White corrosion at 168 hours, no red LAB Report 12	**Nonconforming**
	Insert audit data below this line. Add additional sections as needed.		
4.20.1	**Test Description:**	Plating Thickness	
	Test Method:	ASTM 568	
	Test frequency or quantity:	Yearly	**Conforming**
	Test Requirement:	Minimum Nickel 30 µm, Chrome 0.25 µm	
	Result: Attach evidence:	Copper 13.6 µm, Nickel 30.2 µm, Chrome 0.35 µm	**Conforming**
4.20.2	**Test Description:**	Resistance to Corrosion	
	Test Method:	ASTM B368 CASS Test, 3x22 hrs.	
	Test frequency or quantity:	Yearly	**Conforming**
	Test Requirement:	No surface defects or corrosion on all significant surfaces	
	Result: Attach evidence:	Pass. No surface defects or corrosion on significant surfaces	**Conforming**

PROCESS TABLE A - Zinc & Zinc Alloy Plating

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

For multiple tanks that serve the same purpose copy and paste sections as needed.

Columns H and I are used for the Job Audit (Section 4).
Regularly scheduled measurements (e.g., temperature, concentrations, pH) are to be entered in the appropriate row.

For sections that are not applicable mark NA in the Comments column.

Process Line Identification: N/A

Type of Line: Rack or Barrel

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		**Minimum Requirement**	**Actual Condition**	**Minimum Requirement**	**Actual Condition**	**Conforming Nonconforming NA**	**Range**	**Actual Measurements supporting time of Job Audit**
1.0	**Alkaline Cleaning**							
	Type **- Spray** **- Soak** **- Electro (anodic or cathodic)**					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
A1.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify daily.		NA		
A1.2	Concentration	Manual		Once per day.		NA		
A1.3	Time	Automatic		After any program changes.		NA		
A1.4	Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
A1.5	Amperage or Voltage Control (if applicable)	Automatic		Once every 8 hours*.		NA		
A1.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
A1.7	Impurity Content Check Per chemical supplier recommendation such as: - acid split (oil contamination) - alkalinity ratio	Manual		Once per week*		NA		
A1.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
A1.9	Ultrasonic (if applicable functionality check)	Manual		Once every 8 hours.		NA		
2.0	**Acid Pickling**							

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
A2.1	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
A2.2	Concentration	Manual		Once every 8 hours*		NA		
A2.3	Metallic impurity concentration. Obtain metallic impurity limits from chemical supplier with required corrective actions.	Manual		Once per month.		NA		
A2.4	Time (Less than 10 Minutes or Customer Specific)	Automatic		After any program changes.		NA		
A2.5	Inhibitor	Manual		Per Control Plan.		NA		
A2.6	Solution Level	Manual		Once every 8 hours.		NA		
A2.7	Flowing Rinse	Automatic		Once every 8 hours.		NA		
A2.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
3.0	**Acid Plating Bath**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
A3.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
A3.2	Time	Automatic		After any program changes.		NA		
A3.3	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
A3.4	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
A3.5	Chloride Concentration	Manual		Once per day.		NA		
A3.6	pH	Manual		Once every 8 hours.		NA		
A3.7	Plating Test Cell (Hull Cell)	Manual		Once per day.		NA		
A3.8	Plating Metal Concentration(s)	Manual		Once per day*.		NA		
A3.9	Alloying Element Concentration (e.g., Ni, Co, Sn; if applicable)	Manual		Once per day.		NA		
A3.10	Metallic impurity concentration. Obtain metallic impurity limits from chemical supplier with required corrective actions.	Manual		Once per month.		NA		
A3.11	Buffer (Ammonia / Boric Acid/Acetate per TDS)	Manual		Once per month.		NA		

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
A3.12	Filtration Pressure	Continuous		Once every 8 hours.		NA		
A3.13	Agitation (Rack only - others optional)	Continuous		Once every 8 hours.		NA		
A3.14	Proprietary chemical additives concentration (e.g., wetter, carrier, brightener)	Manual		Once per month by Supplier.		NA		
A3.15	Chemical feeders	Automatic		Once per week.		NA		
A3.16	Fallen part removal	Manual		As per preventive maintenance schedule.		NA		
A3.17	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
4.0	**Alkaline Plating Bath**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
A4.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
A4.2	Time	Automatic or Manual		Automatic - After any program changes. Manual - every load.*		NA		
A4.3	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
A4.4	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
A4.5	Plating Test Cell (Hull Cell)	Manual		Once per day.		NA		
A4.6	Zinc Generator Tank (if applicable) -Caustic Concentration -Zinc Concentration	Automatic or Manual		Once every 8 hours.		NA		
A4.7	Caustic Concentration	Manual		Once per day.		NA		
A4.8	Zinc Concentration	Manual		Once per day.		NA		
A4.9	Alloying Element Concentration (e.g., Fe, Ni, Co; if applicable)	Manual		Once per day.		NA		
A4.10	Complexor Concentration (for alloy baths)	Manual		Once per month by Supplier.		NA		
A4.11	Metallic impurity concentration. Obtain metallic impurity limits from chemical supplier with required corrective actions.	Manual		Once per month.		NA		
A4.12	Carbonate (CO_3) concentration	Manual		Once per month (Twice per month for alloy plating).		NA		
A4.13	Proprietary chemical additives concentration (e.g., carrier, brightener)	Manual		Once per month by Supplier.		NA		
A4.14	Chemical feeders	Automatic		Once per week.		NA		

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
A4.15	Agitation (Rack only - others optional)	Continuous		Once every 8 hours.		NA		
A4.16	Cathode Rod Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
A4.17	Filtration Pressure	Continuous		Once every 8 hours.		NA		
A4.18	Fallen part removal	Manual		Rack: Once every 24 hours. Barrel: Once per week and after any lost load.		NA		
A4.19	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
5.0	**Pre-bake acid treatment if baking is required (i.e., nitric, sulfuric, chromate, etc.)**							
A5.1	pH/concentration	Manual		Once every 8 hours.		NA		
A5.2	Time	Automatic		After any program changes.		NA		
A5.3	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
6.0	**Hydrogen Embrittlement Relief**							
A6.1	Refer to PT Embrittlement Bake as required					NA		
7.0	**Acid Activation (i.e., nitric, sulfuric, etc.)**							
A7.1	pH/concentration	Manual		Once every 8 hours.		NA		
A7.2	Time	Automatic*		After any program changes.		NA		
A7.3	Fallen part removal	Manual		Once every 24 hours for rack line.		NA		
A7.4	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
8.0	**Rinse (This section is to be repeated as necessary to document all individual rinse steps in the entire process line. In cases of sequential rinses this section covers the final rinse of the sequence)**							
A8.1	Rinse Type - Identify in comment section e.g., Flowing, Counter Flowing, Spray, Stagnant, Drag-in/out, etc.	NA		NA		NA		
A8.2	Water Type- Identify in comment section e.g., Municipal, Deionized (DI),Reverse Osmosis (RO), etc.	NA		NA		NA		
A8.3	Agitation type - Identify in comment section (if applicable) e.g., Mechanical (Describe), Air, Ultrasonic, etc.	NA		NA		NA		
A8.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
A8.5	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 3ºC (5ºF).		Once every 8 hours.		NA		
A8.6	Rinse Quality - Identify in comment section e.g., pH, Impurity Check, Conductivity	Manual		Once every 8 hours.*		NA		

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
A8.7	Flow rate (if applicable)	Manual		Once every 8 hours.		NA		
A8.8	Spray nozzle condition (if applicable)	Manual		Once every 8 hours.		NA		
A8.9	Verify position of incoming water feed is near the bottom (if immersion tank).	Manual		Per preventive maintenance program.		NA		
A8.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
9.0	**Passivates**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
A9.1	Concentration	Automatic or Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		
A9.2	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
A9.3	Time	Automatic or Manual		Automatic - After any program changes. Manual - every load.*		NA		
A9.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
A9.5	pH	Automatic*		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		
A9.6	Agitation	Automatic		Once every 8 hours.		NA		
A9.7	Metallic Impurity level(s) (e.g., Fe, Zn)	Manual		Once per week.		NA		
A9.8	Filtration if applicable	Automatic		Once every 8 hours.		NA		
A9.9	Fallen part removal	Manual		Once every 24 hours for rack line.		NA		
A9.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
10.0	**Supplemental Treatments - Topcoats, Sealants and Friction Modifiers**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
A10.1	Concentration	Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
A10.2	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
A10.3	pH (if applicable)	Automatic or Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		
A10.4	Time	Automatic*		After any program changes if automatic.		NA		
A10.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
A10.6	Filtration Pressure (if applicable)	Automatic		Once every 8 hours.		NA		
A10.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
11.0	**Drying**							
A11.1	Drying Time	Automatic		Per Process Sheet and TDS.		NA		
A11.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.		NA		
A11.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once per 8 hours.		NA		
A11.4	There is a procedure to ensure dryness of parts.	Manual		Every container and rack.		NA		
12.0	**Process Equipment**							
A12.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.							

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Table I?		NA
Provide the document that lists all relevant equipment identified in Process Table I.		NA
How do you ensure calibrations are up to date?		NA
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?		NA
Are calibration labels present and up to date for listed equipment?		NA
What is the reaction plan to any failed verification?		NA

A12.2	Barrels, baskets, and drive mechanism shall be maintained. Verifications shall be performed against a certified standard and data recorded.	

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
How do you inspect for the integrity of the barrels, baskets, and drive mechanism? (i.e., perforations, trap points, warpage, plugged holes, door gaps, other damage) Where are the inspection results documented?								NA
Describe your preventive maintenance program for barrels, baskets and drive mechanism.								NA
How is each barrel and basket uniquely identified for tracking purposes?								NA
A12.3	Racks and fixtures shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.							
Guidance			**Objective Evidence / Comments**					**Conforming Nonconforming NA**
How do you inspect for the integrity of the racks and fixtures? (i.e., broken electrical contacts, plating build up, plastisol rack coating and other damage) Where are the inspection results documented?								NA
Describe your preventive maintenance program for racks and fixtures.								NA
How is each rack or fixture identified for tracking purposes?								NA
A12.4	Rectifiers shall be maintained. The Plater shall have a preventive maintenance system that is documented and implemented.							
Guidance			**Objective Evidence / Comments**					**Conforming Nonconforming NA**
Describe the preventive maintenance program for rectifiers used in production and in the laboratory (i.e., voltage, amperage and ripple).								NA
Is the ripple reading within the maximum allowable limit recommended by the chemical supplier?								NA
A12.5	All Anodes, Contacts and Bussing shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.							
Guidance			**Objective Evidence / Comments**					**Conforming Nonconforming NA**
Describe the preventive maintenance program for anodes of all types including inert, consumable, bags, baskets and auxiliary.								NA
Describe the preventive maintenance program for contacts and electrical bussing including cleanliness, high electrical resistance, electrical shorts.								NA
A12.6	All filters shall be maintained. The organization shall have a preventive maintenance system that is documented and implemented.							
Guidance			**Objective Evidence / Comments**					**Conforming Nonconforming NA**
Describe the preventive maintenance program for all plating solution filters to include plate, filter bag and cartridge.								NA
Describe the preventive maintenance program for all air filters used on ovens, dryers, chillers, blowers and fans etc.								NA

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
A12.7	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.							
Guidance				**Objective Evidence / Comments**				**Conforming Nonconforming NA**
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.								NA
Provide a list of all the alarms that are tested and the test frequency.								NA
A12.8	All process equipment including the tanks have a maintenance schedule that is documented and followed.							
Guidance				**Objective Evidence / Comments**				**Conforming Nonconforming NA**
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. (i.e., Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.)								NA
Describe the method used to develop and document the maintenance schedule. (i.e., printed, electronic)								NA
Provide an example of a completed sign off record.								NA
13.0	**Test Equipment**							
A13.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.							
Guidance				**Objective Evidence / Comments**				**Conforming Nonconforming NA**
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.								NA
pH / Conductivity Meter								NA
pH / Conductivity Probes								NA
Ion Selective probes are optional.								NA
Dedicated probes must be used for chromates / passivates.								NA
Laboratory Balance (Weight Scale) (Optional)								NA
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP)								NA
X-Ray Fluorescence (XRF) - Optional for Zinc Plating, Required for Zinc Alloy Plating								NA
Lab Rectifier								NA
Hand held thermometer								NA

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
Pipettes - Before use, pipettes must be checked for broken tips								NA
Salt Spray Cabinet								NA
Thickness Tester								NA
Lab Oven								NA
Torque-tension/Friction Tester - Required for fastener plating only.								NA
Proceed to PT - H Embrittlement Bake (if required)								

PROCESS TABLE B - Mechanical Plating

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

For multiple tanks that serve the same purpose copy and paste sections as needed.

Columns H and I are used for the Job Audit (Section 4).
Regularly scheduled measurements (e.g., temperature, concentrations, pH) are to be entered in the appropriate row.

For sections that are not applicable mark NA in the Comments column.

Process Line Identification:

Process Barrel size:

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
1.0	**Cleaning/Conditioning in Mechanical Plating Barrel**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
B1.1	Time	Manual		Per load		NA		
B1.2	Rotation Speed	Manual		Per load		NA		
B1.3	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
B1.4	Load Size (weight and surface area)	Manual		Per load		NA		
B1.5	Water Volume	Manual		Per load		NA		
B1.6	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Per load		NA		
B1.7	Media Mix (Ratio) Verification by operator the bead size and mix is correct.	Manual		Per load		NA		
B1.8	Media (Load Volume)	Manual		Per load		NA		
B1.9	Media Cleanliness (To Avoid Contamination)	Manual		Once per week.		NA		
B1.10	Surface Conditioner (Volume or weight)	Manual		Per load		NA		
B1.11	Surface Conditioner (Time)	Manual		Per load		NA		
B1.12	If off-line cleaning is not used, multiple cycles of surface conditioner shall be repeated, with appropriate decant processes.	Manual		Per load		NA		

B1.13	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
2.0	**Mechanical Plating**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
B2.1	Water Volume	Manual		Per load		NA		
B2.2	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Per load		NA		
B2.3	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
B2.4	Media Mix (Ratio) Verification by operator the bead size and mix is correct.	Manual		Per load		NA		
B2.5	Surface preparation (Volume or weight) - Cu Flash	Manual		Per load		NA		
B2.6	Surface preparation (Time)	Manual		Per load		NA		
B2.7	Surface condition (copper) visual inspection	Manual		Per load		NA		
B2.8	Promoter(s) (Weight)	Manual		Per load		NA		
B2.9	Promoter (Time)	Manual		Per load		NA		
B2.10	Zinc Flash (Volume or weight)	Manual		Per load		NA		
B2.11	Zinc Slurry Concentration (when added as measured volume)	Manual		Prior to the start of production and once per shift.		NA		
B2.12	Zinc Flash (Time)	Manual		Per load		NA		
B2.13	Metal Addition (Volume or weight)	Manual		Per load		NA		
B2.14	Metal Slurry Concentration Addition (when added as measured volume)	Manual		Prior to the start of production and once per shift.		NA		
B2.15	Metal Addition (Number of Additions)	Manual		Per load		NA		
B2.16	pH adjustments Confirm pH is being maintained	Manual		Before each addition.		NA		
B2.17	Metal Thickness (Alloy, if applicable)	Manual		Per load		NA		
B2.18	Water Polish (time)	Manual		Per load		NA		
B2.19	Part/Media Separation	Manual		Per load		NA		
B2.20	Water Discharge to water treatment	Manual		Per load		NA		
B2.21	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
3.0	**Passivates (Off line)**							
	Type:							
	Size, volume:					NA		
	Chemical supplier:					NA		
B3.1	Concentration	Automatic or Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		

B3.2	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Automatic - Continuous monitoring by controller and manually verify daily. Manual - every load.*		NA		
B3.3	Time	Automatic or Manual		Automatic -After any program changes. Manual - every load.*		NA		
B3.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
B3.5	pH	Automatic or Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		
B3.6	Agitation	Automatic or Manual		Per load		NA		
B3.7	Metallic Impurity level(s) (e.g., Fe, Zn)	Manual		Once per week.		NA		
B3.8	Rinse	Automatic or Manual		Once every 8 hours.		NA		
B3.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
4.0	**Supplemental Treatments - Sealers and Torque Tension Modifiers**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
B4.1	Concentration	Automatic or Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		
B4.2	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Automatic - Continuous monitoring by controller and manually verify daily. Manual - every load.*		NA		
B4.3	Time	Automatic or Manual		Automatic -After any program changes. Manual - every load.*		NA		
B4.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
B4.5	pH	Automatic or Manual		Prior to production start-up. If automatic control, once per day. If manual, once every 8 hours.		NA		
B4.6	Filtration (if applicable)	Automatic		Once per day.		NA		
B4.7	Filtration Pressure (if applicable)	Manual		Once per day.		NA		
B4.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
5.0	**Drying**							
B5.1	Drying Time	Automatic/Manual		Per Process Sheet and TDS.		NA		
B5.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.		NA		
B5.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once every 8 hours.		NA		
B5.4	There is a procedure to ensure dryness of parts.	Manual		Every container.		NA		
6.0	**Process Equipment**							

B6.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Process Table I?		NA
Provide the document that lists all relevant equipment identified in Process Table I.		NA
How do you ensure calibrations are up to date?		NA
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?		NA
Are calibration labels present and up to date for listed equipment?		NA
What is the reaction plan to any failed verification?		NA

B6.2	Barrels, baskets, and drive mechanism shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
How do you inspect for the integrity of the barrels, baskets, and drive mechanism? (i.e., perforations, trap points, warpage, plugged holes, door gaps, other damage) Where are the inspection results documented?		NA
Describe your preventive maintenance program for barrels, baskets and drive mechanism.		NA
How is each barrel and basket uniquely identified for tracking purposes?		NA

B6.3	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.		NA
Provide a list of all the alarms that are tested and the test frequency.		NA

B6.4	All process equipment including the tanks have a maintenance schedule that is documented and followed.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. There shall be a completion sign off record. Examples: Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.		NA

7.0	**Test Equipment**
B7.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.		NA
pH / Conductivity Meter		NA
pH / Conductivity Probes		NA
Ion Selective probes are optional.		NA
Dedicated probes must be used for chromates / passivates.		NA
Laboratory Balance (Weight Scale) (Optional)		NA
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP) (Optional)		NA
Hand held thermometer		NA
Pipettes - Before use, pipettes must be checked for broken tips		NA
Salt Spray Cabinet		NA
Thickness Tester		NA
Lab Oven (Optional)		NA
Torque-tension/Friction Tester - Optional for fastener plating.		NA

PROCESS TABLE C - Decorative Plating of Metal Substrates

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

Columns H and I are used for the Job Audit (Section 4).
Regularly scheduled measurements (e.g., temperature, concentrations, pH) are to be entered in the appropriate row.

For sections that are not applicable mark NA in the Comments column.

Process Overview

Provide complete process flow sequence:
For example:
1. Soak cleaner
2. Electrocleaner
3. Rinse
4. Rinse
5. Continue as required

Process Line Identification:

Type of Line: Rack or Barrel/Hoist or Return Type **Hoist Line**

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
1.0	**Polishing and Buffing**							
	Type: (Manual or Automatic)						Both manual and automatic	
	Check which metals are applicable:							
C1.1	Steel:						Yes	Incoming inspection
C1.2	Stainless Steel:						Yes	Incoming inspection
C1.3	Aluminum:						No	N/A
C1.4	Zinc die cast:						Yes	Incoming inspection
C1.5	Other (identify):						Brass	Incoming inspection
3.0	**Alkaline Cleaning**							
	Type **- Spray** **- Soak** **- Electro (anodic or cathodic)**				Soak & Electro			
	Size, volume:							
	Chemical supplier:							

C3.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified on each production shift.	Pass	See TrueChem	Pass
C3.2	Concentration	Manual		Once per day.	Once per day	Pass	See TrueChem	Pass
C3.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C3.4	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C3.5	Amperage or Voltage Control- if applicable.	Automatic		Once every 8 hours*.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C3.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C3.7	Impurity Content Check Per chemical supplier recommendation such as: - acid split (oil contamination) - alkalinity ratio.	Manual		Once per week*	See chem supplier TDS	Pass	N/A	Pass
C3.8	Ultrasonic (if applicable functionality check).	Manual		Once every 8 hours.	N/A	Pass	N/A	Pass
C3.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem records	Pass
5.0	**Acid**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C5.1	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Operated at room temperature	Pass	See TrueChem	Pass
C5.2	Concentration	Manual		Once every 8 hours*.	Once per day	Pass	See TrueChem	Pass
C5.3	Time (Per Specification)	Automatic		After any program changes.	After any recipe change.	Pass	Min. time set in software	Pass
C5.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C5.5	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.	See chem supplier TDS	Pass	N/A	Pass
C5.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem records	Pass
6.0	**Electrolytic Strike, Immersion, or Electroless Deposits**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C6.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified on each production shift.	Pass	See TrueChem	Pass
C6.2	pH (if applicable)	Manual		Once every 8 hours*.	N/A		See TrueChem	Pass

C6.3	Concentration	Manual		Once per day.	One per day	Pass	See TrueChem	Pass
C6.4	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C6.5	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C6.6	Amperage or Voltage Control- if applicable	Automatic		Once every 8 hours*.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C6.7	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C6.8	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.	Monthly	Pass	See TrueChem	Pass
C6.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem records	Pass
7.0	**Acid Copper (if applicable)**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C7.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified on each production shift.	Pass	See TrueChem	Pass
C7.2	Concentration(s)	Manual		Once per day*.	Once per day	Pass	See TrueChem	Pass
C7.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C7.4	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C7.5	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C7.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C7.7	Filtration	Continuous		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C7.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem records	Pass
8.0	**Copper Activation**							
C8.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Room temperature	Pass	See TrueChem	Pass
C8.2	Concentration(s)	Manual		Once per day*.	Daily	Pass	TrueChem	Pass
C8.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C8.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C8.5	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C8.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem records	Pass

9.0	**Semi-Bright Nickel**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C9.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified on each production shift.	Pass	See TrueChem	Pass
C9.2	Concentration(s)	Manual		Once per day*	Once per day	Pass	See TrueChem	Pass
C9.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C9.4	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C9.5	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C9.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C9.7	pH	Manual		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C9.8	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.	Once per month	Pass	See TrueChem records	Pass
C9.9	Ductility test	Manual		Once per month.	Once per month	Pass	See TrueChem	Pass
C9.10	Sulfur Concentration (as deposited).	Manual		Once per month.	Once per month	Pass	See TrueChem	Pass
C9.11	Filtration	Continuous		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C9.12	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
10.0	**High Activity Nickel (if applicable)**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C10.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified daily.	Pass	See TrueChem	Pass
C10.2	Concentration(s)	Manual		Once per day*.	Once per day	Pass	See TrueChem	Pass
C10.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C10.4	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C10.5	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C10.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass

C10.7	pH	Manual		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C10.8	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.	Once per month	Pass	See TrueChem records	Pass
C10.9	Filtration	Continuous		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C10.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
11.0	**Bright Nickel**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C11.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified daily.	Pass	See TrueChem	Pass
C11.2	Concentration(s)	Manual		Once per day*.	Once per day	Pass	See TrueChem	Pass
C11.3	Time	Automatic		After any program changes.	After any recipe changes	Pass	Min. time set in software	Pass
C11.4	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C11.5	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C11.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C11.7	pH	Manual		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C11.8	Ductility test	Manual		Once per month.	Once per month	Pass	See TrueChem	Pass
C11.9	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.	Once per month	Pass	See TrueChem records	Pass
C11.10	Filtration	Continuous		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C11.11	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
12.0	**Satin/Specialty Nickel (if applicable)**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C12.1	Process Type - Identify in comment section e.g., Batch or Continuous (for Satin nickel).				Continuous	Pass	See gloss records sheet	Pass
C12.2	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Once every 8 hours.	Continuous monitoring by controller. Manually verified daily.	Pass	See TrueChem	Pass
C12.3	Concentration(s)	Manual		Per chemical supplier recommendation.	Once per day	Pass	See TrueChem	Pass

C12.4	Appearance verification per OEM Master Standard or OEM Certified Production part.	Manual		Once every 4 hours.	Every production load	Pass	See gloss records sheet	Pass
C12.5	Time	Automatic		After any program changes.	After any recipe changes	Pass	Min. time set in software	Pass
C12.6	Agitation	Automatic		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C12.7	Current/Voltage	Automatic		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C12.8	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C12.9	pH	Manual		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C12.10	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.	Once per month	Pass	See TrueChem records	Pass
C12.11	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
13.0	**Microporous Nickel/Nobel Nickel (if applicable)**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C13.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified daily.	Pass	See TrueChem	Pass
C13.2	Concentration(s)	Manual		Once per day*.	Once per week	Pass	See TrueChem	Pass
C13.3	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.	Once per month	Pass	See TrueChem records	Pass
C13.4	Solids/Pore Count (For Microporous)	Manual		Once per day*.	Daily	Pass	TrueChem	Pass
C13.5	Filter out and recharge solids (For Microporous)	Manual		Once per week.	Once per week	Pass	See TrueChem	Pass
C13.6	Organic contamination removal (For Microporous)	Manual		Once per week*.	Once per week	Pass	See TrueChem	Pass
C13.7	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C13.8	Agitation	Automatic		Per process sheet.	Once per shift	Pass	See checklist	Pass
C13.9	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C13.10	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C13.11	pH	Manual		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C13.12	STEP Test (of final product)	Manual		Once per day*.	Once per day	Pass	See QA STEP log	Pass
C13.13	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
14.0	**Hexavalent Chromium**							
	Type:							

	Size, volume:							
	Chemical supplier:							
C14.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified daily.	Pass	See TrueChem	Pass
C14.2	Concentration(s)	Manual		Once every 4 hours*	Once per day	Pass	See TrueChem - all in spec	Pass
C14.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C14.4	Agitation (if applicable)	Automatic		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C14.5	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C14.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C14.7	Impurity Content Check Per chemical supplier recommendation e.g., metallic contamination.	Manual		Once per month.	Once per month	Pass	See TrueChem records	Pass
C14.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
15.0	**Trivalent Chromium**							
	Type:							
	Size, volume:							
	Chemical supplier:							
C15.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.	Continuous monitoring by controller. Manually verified daily.	Pass	See TrueChem	Pass
C15.2	Concentration(s)	Manual		Once every 4 hours*.	Once per week	Pass	See TrueChem - all in spec	Pass
C15.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C15.4	Agitation (if applicable)	Automatic		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C15.5	Current/Voltage	Automatic or Manual		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C15.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C15.7	Impurity Content Check Per chemical supplier recommendation e.g., Metallic contamination.	Manual		Once per week*.	Once per month	Pass	See TrueChem records	Pass
C15.8	Appearance verification per OEM Master Standard or OEM Certified Production part.	Manual		Once every 8 hours.	Each load	Pass	See appearance review records	Pass
C15.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
16.0	**Chromium Post Treatment (if applicable)**							
	Type:							

	Size, volume:							
	Chemical supplier:							
C16.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C16.2	Concentration(s)	Manual		Once per week*.	once per day	Pass	See TrueChem	Pass
C16.3	Time	Automatic		After any program changes.	After any recipe change	Pass	Min. time set in software	Pass
C16.4	Agitation (if applicable)	Automatic		Once every 8 hours.	Once per shift	Pass	See checklist	Pass
C16.5	Current/Voltage (if applicable)	Automatic		Once every 8 hours.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C16.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C16.7	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.	Once per month	Pass	See TrueChem records	Pass
C16.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
17.0	**Rinse (This section is to be repeated as necessary to document all individual rinse steps in the entire process line. In cases of sequential rinses this section covers the final rinse of the sequence)**							
C17.1	Rinse Type - Identify in comment section e.g., Flowing, Counter Flowing, Spray, Stagnant, Drag-in/out, etc.	NA		NA	All flowing and counterflow except 1st spray rinse in line			
C17.2	Water Type- Identify in comment section e.g., Municipal, Deionized (DI),Reverse Osmosis (RO), etc.	NA		NA	Municiple, soft, and RO			
C17.3	Agitation type - Identify in comment section (if applicable) e.g., Mechanical (Describe), Air, Ultrasonic, etc.	NA		NA	Air agitation, where applicable			
C17.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.	Once per shift	Pass	Reviewed visual indicators	Pass
C17.5	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Once every 8 hours.	Once per shift	Pass	See TrueChem	Pass
C17.6	Rinse Quality - Identify in comment section e.g., pH, Impurity Check, Conductivity.	Manual		Once every 8 hours.*	Once per shift	Pass	See TrueChem	Pass
C17.7	Flow rate (if applicable).	Manual		Once every 8 hours.	Once per shift	Pass	See gauges	Pass
C17.8	Spray nozzle condition (if applicable).	Manual		Once every 8 hours.	Oncer per shift	Pass	See checklist	Pass
C17.9	Verify position of incoming water feed is near the bottom (if immersion tank).	Manual		Per preventive maintenance program.	At install or tank modification	Pass	See maint. Training materials	Pass
C17.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.	TrueChem	Pass	See TrueChem	Pass
18.0	**Drying**							
C18.1	Drying Time	Automatic		Per Process Sheet and TDS.	Continuous monitoring by plating software	Pass	See OMS recipes	Pass
C18.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.	Automatic	Pass	See checklist	Pass

C18.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once per 8 hours.	Once per shift	Pass	See checklist	Pass
C18.4	There is a procedure to ensure dryness of parts.	Manual		Every container and rack.	Visual review of each load @ Pre-inspect	Pass	See pre-inspect checklist	Pass

19.0	**Process Equipment**
C19.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Process Table I?	Digital calibration log	Conforming
Provide the document that lists all relevant equipment identified in Process Table I.	Digital calibration log	Conforming
How do you ensure calibrations are up to date?	Yearly schedule with reminders	Conforming
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?	QA Team responsible for Gage Log management	Conforming
Are calibration labels present and up to date for listed equipment?	Yes	Conforming
What is the reaction plan to any failed verification?	Re-verification, re-calibration if necessary	Conforming

C19.2	Barrels, baskets, and drive mechanism shall be maintained. Verifications shall be performed against a certified standard and data recorded.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
How do you inspect for the integrity of the barrels, baskets, and drive mechanism? (i.e., perforations, trap points, warpage, plugged holes, door gaps, other damage) Where are the inspection results documented?	All barrel and drive mechanism maintenance is tracked thru our work order database. All maintenance findings and inspection notes are updated in the work order comments by the tech performing the work. All barrels are test run on the line before being put back into production.	Conforming
Describe your preventive maintenance program for barrels, baskets and drive mechanism.	Operators inspect and report equipment integrity as needed via standard work order process, proper operation is reviewed on every run of every barrel	Conforming
How is each barrel and basket uniquely identified for tracking purposes?	Number labels on the sides of barrels. These are referenced in TrueChem and maintenance records	Conforming

C19.3	Racks and fixtures shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
How do you inspect for the integrity of the racks and fixtures? (i.e., broken electrical contacts, plating build up, plastisol rack coating and other damage) Where are the inspection results documented?	Inspected and documented at pre-inspect, a tooling repair database is used for all internal tooling maintenance performed.	Conforming
Describe your preventive maintenance program for racks and fixtures.	Managed by MasterTracker software, which allows only preset number of uses before maintenance. A tooling repair database used to track maintenance performed	Conforming
How is each rack or fixture identified for tracking purposes?	ID at the top of each rack	Conforming

C19.4	Rectifiers shall be maintained. The Plater shall have a preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for rectifiers used in production and in the laboratory (i.e., voltage, amperage and ripple).	PMs are defined in PM database and referenced in Rectifier PM.docx.	Conforming

Is the ripple reading within the maximum allowable limit recommended by the chemical supplier?	Yes	Conforming
C19.5	All Anodes, Contacts and Bussing shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for anodes of all types including inert, consumable, bags, baskets and auxiliary.	TrueChem schedule drives maintenance for soluble anodes and bags. Insoluble anodes and baskets are inspected during pump out and replaced / repaired if damaged or worn beyond our specified tolerances.	Conforming
Describe the preventive maintenance program for contacts and electrical bussing including cleanliness, high electrical resistance, electrical shorts.	Running loads in current control will elevate the voltage to keep the current where needed. Upon approaching the maximum voltage the rectifier will alarm and the rectifier / bussing will be evaluated	Conforming
C19.6	All filters shall be maintained. The organization shall have a preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for all plating solution filters to include plate, filter bag and cartridge.	TrueChem schedule drives filter maintenance including carbon additions, filter paper changes, tube or cartidge replacement, acid leeching of filter plates, etc.	Conforming
Describe the preventive maintenance program for all air filters used on ovens, dryers, chillers, blowers and fans etc.	PM system in place for Air fliter replacement of equipment	Conforming
C19.7	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.	Alarms happen when errors occur on the automation that runs the plating line, The error is corrected and the alarm is silenced by the plating staff. The errors are reviewed weekly and mainttnance schedules are adjusted	Conforming
Provide a list of all the alarms that are tested and the test frequency.	Each switch status is tested everytime a hoist moves, incorrect switch status triggers the event alarms	Conforming
C19.8	All process equipment including the tanks have a maintenance schedule that is documented and followed.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. (i.e., Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.)	Maintenance schedule is split between the TrueChem system and the maintenance preventative maintenance system, depending on what the item is.	Conforming
Describe the method used to develop and document the maintenance schedule. (i.e., printed, electronic)	Electronic	Conforming
Provide an example of a completed sign off record.	See TrueChem records or digital preventative maintenance records	Conforming
20.0	**Test Equipment**	
C20.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.	Chemical expiration log - up-to-date and nothing expired currently.	Conforming

pH / Conductivity Meter	Not required per manufacturer. Probe calibration only	Conforming
pH / Conductivity Probes	Logged digitally on pH meter itself	Conforming
Solution compatible probes must be used.	Probes are designed for plating solutions	Conforming
Laboratory Balance (Weight Scale) (Optional)	Last calibrated 11/18/21	Conforming
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP)	Calibrated before each use. Unit will not display ppm results without new calibration	Conforming
X-Ray Fluorescence (XRF) (Optional)	Last Calibrated 10/11/21	Conforming
Lab Rectifier	Last Calibrated 5/27/22	Conforming
Hand held thermometer	Disposed of annually. Log of date in service held by quality lab	Conforming
Pipettes - Before use, pipettes must be checked for broken tips	Checked all pipette tips - none broken	Conforming
CASS Cabinet	Last Calibrated 11/3/21	Conforming
Thickness Tester	Last Calibrated 10/11/21	Conforming
Lab Oven	Last Calibrated 5/20/22	Conforming
Microscope (Min 100X) with calibrated grid reticle for Pore/Crack Count	Last Calibrated 11/19/21	Conforming
Freezer	N/A	N/A
Spectrophotometer	N/A	N/A

PROCESS TABLE D - Decorative Plating of Plastic Substrates

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

Columns H and I are used for the Job Audit (Section 4).
Regularly scheduled measurements (e.g., temperature, concentrations, pH) are to be entered in the appropriate row.

For sections that are not applicable mark NA in the Comments column.

Process Overview

Provide complete process flow sequence:

For example:
1. Cleaning and Pre-Etch (If Applicable)
2. Etch
3. Rinse
4. Rinse
5. Neutralizer
6. Continue as required

Process Line Identification:

Type of Line: Rack or Barrel/Hoist or Return Type

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
1.0	**Cleaning and Pre-Etch (If Applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D1.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D1.2	Concentration	Manual		Once every 8 hours*.		NA		
D1.3	Time	Automatic		After any program changes.		NA		
D1.4	Agitation	Automatic		Per process sheet.		NA		
D1.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		

D1.6	Solution and tank clean out schedule is documented and followed - Desludging, new make-up frequency, etc.	Manual		Per preventive maintenance program.		NA		
D1.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
2.0	**Etch**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D2.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D2.2	Concentration	Manual		Once every 8 hours*.		NA		
D2.3	Verify operation of the Trivalent chromium regeneration system (Porous Pot, Membrane, Reoxidation) such as amperage, voltage, and solution flow per Process Control Plan.	Manual		Once every 8 hours.		NA		
D2.4	Impurity Content Check (Trivalent Chromium) Per chemical supplier recommendation.	Manual		Once per week*.		NA		
D2.5	Time	Automatic		After any program changes.		NA		
D2.6	Agitation	Automatic		Per process sheet.		NA		
D2.7	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D2.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
3.0	**Neutralizer**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D3.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D3.2	Concentration	Manual		Once every 8 hours*.		NA		
D3.3	Time	Automatic		After any program changes.		NA		
D3.4	Agitation	Automatic		Per process sheet.		NA		
D3.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D3.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
4.0	**Activator**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		

D4.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D4.2	Concentration	Manual		Once every 4 hours*.		NA		
D4.3	Time	Automatic		After any program changes.		NA		
D4.4	Agitation (if applicable)	Automatic		Per process sheet.		NA		
D4.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D4.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
5.0	**Conductor (if applicable for direct metallization)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D5.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D5.2	Concentration	Manual		Once every 8 hours*.		NA		
D5.3	Time	Automatic		After any program changes.		NA		
D5.4	Agitation	Automatic		Per process sheet.		NA		
D5.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D5.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program		NA		
6.0	**Accelerator**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D6.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D6.2	Concentration	Manual		Once every 8 hours*		NA		
D6.3	Time	Automatic		After any program changes.		NA		
D6.4	Agitation	Automatic		Per process sheet.		NA		
D6.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D6.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
7.0	**Electroless Plating (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		

D7.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D7.2	Concentration	Manual		Once every 4 hours.		NA		
D7.3	pH (if applicable)	Manual		Once every 4 hours.		NA		
D7.4	Time	Automatic		After any program changes.		NA		
D7.5	Agitation	Automatic		Per process sheet.		NA		
D7.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D7.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
8.0	**Activation**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D8.1	Concentration	Manual		Once every 8 hours*		NA		
D8.2	Time	Automatic		After any program changes.		NA		
D8.3	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D8.4	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
9.0	**Immersion Plate (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D9.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify once every 4 hours.		NA		
D9.2	Concentration	Manual		Once every 4 hours		NA		
D9.3	Time	Automatic		After any program changes.		NA		
D9.4	Agitation	Automatic		Per process sheet.		NA		
D9.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D9.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
10.0	**Electrolytic Plating - Strike (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D10.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify every 4 hours.		NA		

D10.2	Concentration	Manual		Once per day.		NA		
D10.3	pH (if applicable)	Manual		Once every 8 hours*.		NA		
D10.4	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D10.5	Time	Automatic		After any program changes.		NA		
D10.6	Agitation	Automatic		Per process sheet.		NA		
D10.7	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D10.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
11.0	**Acid Copper (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D11.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D11.2	Concentration(s)	Manual		Once per day*.		NA		
D11.3	Time	Automatic		After any program changes.		NA		
D11.4	Agitation	Automatic		Per process sheet.		NA		
D11.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D11.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D11.7	Filtration	Continuous		Once every 8 hours.		NA		
D11.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
12.0	**Copper Activation**							
D12.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D12.2	Concentration(s)	Manual		Once per day*.		NA		
D12.3	Time	Automatic		After any program changes.		NA		
D12.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D12.5	Agitation	Automatic		Per process sheet.		NA		
D12.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
13.0	**Semi-Bright Nickel**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		

D13.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D13.2	Concentration(s)	Manual		Once per day*		NA		
D13.3	Time	Automatic		After any program changes.		NA		
D13.4	Agitation	Automatic		Per process sheet.		NA		
D13.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D13.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D13.7	pH	Manual		Once every 8 hours.		NA		
D13.8	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.		NA		
D13.9	Ductility test	Manual		Once per month.		NA		
D13.10	Sulfur Concentration (as deposited)	Manual		Once per month.		NA		
D13.11	Filtration	Continuous		Once every 8 hours.		NA		
D13.12	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
14.0	**High Activity Nickel (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D14.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D14.2	Concentration(s)	Manual		Once per day*.		NA		
D14.3	Time	Automatic		After any program changes.		NA		
D14.4	Agitation	Automatic		Per process sheet.		NA		
D14.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D14.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D14.7	pH	Manual		Once every 8 hours.		NA		
D14.8	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.		NA		
D14.9	Filtration	Continuous		Once every 8 hours.		NA		
D14.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
15.0	**Bright Nickel**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		

D15.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D15.2	Concentration(s)	Manual		Once per day*.		NA		
D15.3	Time	Automatic		After any program changes.		NA		
D15.4	Agitation	Automatic		Per process sheet.		NA		
D15.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D15.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D15.7	pH	Manual		Once every 8 hours.		NA		
D15.8	Ductility test	Manual		Once per month.		NA		
D15.9	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.		NA		
D15.10	Filtration	Continuous		Once every 8 hours.		NA		
D15.11	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
16.0	**Satin/Specialty Nickel (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D16.1	Process Type - Identify in comment section e.g., Batch or Continuous (for Satin Nickel).					NA		
D16.2	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Once every 8 hours.		NA		
D16.3	Concentration(s)	Manual		Per chemical supplier recommendation.		NA		
D16.4	Appearance verification per OEM Master Standard or OEM Certified Production part.	Manual		Once every 4 hours.		NA		
D16.5	Time	Automatic		After any program changes.		NA		
D16.6	Agitation	Automatic		Once every 8 hours.		NA		
D16.7	Current/Voltage	Automatic		Once every 8 hours.		NA		
D16.8	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D16.9	pH	Manual		Once every 8 hours.		NA		
D16.10	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.		NA		
D16.11	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
17.0	**Microporous Nickel/Nobel Nickel (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		

D17.1	Temperature (Thermocouple)	Automatic. Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D17.2	Concentration(s)	Manual		Once per day*.		NA		
D17.3	Impurity Content Check Per chemical supplier recommendation e.g., Total Organic Contamination, metallic contamination.	Manual		Once per month.		NA		
D17.4	Solids/Pore Count (For Microporous)	Manual		Once per day*.		NA		
D17.5	Filter out and recharge solids (For Microporous)	Manual		Once per week.		NA		
D17.6	Organic contamination removal (For Microporous)	Manual		Once per week*.		NA		
D17.7	Time	Automatic		After any program changes.		NA		
D17.8	Agitation	Automatic		Per process sheet.		NA		
D17.9	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D17.10	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D17.11	pH	Manual		Once every 8 hours.		NA		
D17.12	STEP Test (of final product)	Manual		Once per day*.		NA		
D17.13	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
18.0	**Hexavalent Chromium**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D18.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D18.2	Concentration(s)	Manual		Once every 4 hours*		NA		
D18.3	Time	Automatic		After any program changes.		NA		
D18.4	Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
D18.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D18.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D18.7	Impurity Content Check Per chemical supplier recommendation e.g., metallic contamination.	Manual		Once per month.		NA		
D18.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
19.0	**Trivalent Chromium**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D19.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
D19.2	Concentration(s)	Manual		Once every 4 hours*.		NA		
D19.3	Time	Automatic		After any program changes.		NA		

D19.4	Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
D19.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
D19.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D19.7	Impurity Content Check Per chemical supplier recommendation e.g., Metallic contamination.	Manual		Once per week*.		NA		
D19.8	Appearance verification per OEM Master Standard or OEM Certified Production part.	Manual		Once every 8 hours.		NA		
D19.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
20.0	**Chromium Post Treatment (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
D20.1	Temperature (Thermocouple)	Automatic. Max SAT difference allowed +/- 3°C (5°F).		Once every 8 hours.		NA		
D20.2	Concentration(s)	Manual		Once per week*.		NA		
D20.3	Time	Automatic		After any program changes.		NA		
D20.4	Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
D20.5	Current/Voltage (if applicable)	Automatic		Once every 8 hours.		NA		
D20.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D20.7	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.		NA		
D20.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
21.0	**Rinse (This section is to be repeated as necessary to document all individual rinse steps in the entire process line. In cases of sequential rinses this section covers the final rinse of the sequence)**							
D21.1	Rinse Type - Identify in comment section e.g., Flowing, Counter Flowing, Spray, Stagnant, Drag-in/out, etc.	NA		NA		NA		
D21.2	Water Type- Identify in comment section e.g., Municipal, Deionized (DI),Reverse Osmosis (RO), etc.	NA		NA		NA		
D21.3	Agitation type - Identify in comment section (if applicable) e.g., Mechanical (Describe), Air, Ultrasonic, etc.	NA		NA		NA		
D21.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
D21.5	Temperature (Thermocouple). (if applicable)	Automatic		Once every 8 hours.		NA		
D21.6	Rinse Quality - Identify in comment section e.g., pH, Impurity Check, Conductivity.	Manual		Once every 8 hours.*		NA		
D21.7	Flow rate (if applicable)	Manual		Once every 8 hours.		NA		
D21.8	Spray nozzle condition (if applicable)	Manual		Once every 8 hours.		NA		

D21.9	Verify position of incoming water feed is near the bottom (if immersion tank).	Manual		Per preventive maintenance program.		NA		
D21.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
22.0	**Drying**							
D22.1	Drying Time	Automatic		Per Process Sheet and TDS.		NA		
D22.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.		NA		
D22.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once per 8 hours.		NA		
D22.4	There is a procedure to ensure dryness of parts.	Manual		Every container and rack.		NA		
23.0	**Process Equipment**							
D23.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.							

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Process Table I?		NA
Provide the document that lists all relevant equipment identified in Process Table I.		NA
How do you ensure calibrations are up to date?		NA
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?		NA
Are calibration labels present and up to date for listed equipment?		NA
What is the reaction plan to any failed verification?		NA

D23.2	Racks and fixtures shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
How do you inspect for the integrity of the racks and fixtures? (i.e., broken electrical contacts, plating build up, plastisol rack coating and other damage) Where are the inspection results documented?		NA
Describe your preventive maintenance program for racks and fixtures.		NA
How is each rack or fixture identified for tracking purposes?		NA

D23.3	Rectifiers shall be maintained. The Plater shall have a preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for rectifiers used in production and in the laboratory (i.e., voltage, amperage and ripple).		NA
Is the ripple reading within the maximum allowable limit recommended by the chemical supplier?		NA

D23.4	All Anodes, Contacts and Bussing shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program for anodes of all types including inert, consumable, bags, baskets and auxiliary.		NA
Describe the preventive maintenance program for contacts and electrical bussing including cleanliness, high electrical resistance, electrical shorts		NA

D23.5	All filters shall be maintained. The organization shall have a preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program for all plating solution filters to include plate, filter bag and cartridge		NA
Describe the preventive maintenance program for all air filters used on ovens, dryers, chillers, blowers and fans etc.		NA

D23.6	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.		NA
Provide a list of all the alarms that are tested and the test frequency.		NA

D23.7	All process equipment including the tanks have a maintenance schedule that is documented and followed.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. (i.e., Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.)		NA
Describe the method used to develop and document the maintenance schedule. (i.e., printed, electronic)		NA
Provide an example of a completed sign off record.		NA

24.0	**Test Equipment**
D24.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.		NA
pH / Conductivity Meter		NA

pH / Conductivity Probes		NA
Solution compatible probes must be used.		NA
Laboratory Balance (Weight Scale) (Optional)		NA
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP)		NA
X-Ray Fluorescence (XRF) (Optional)		NA
Lab Rectifier		NA
Hand held thermometer		NA
Pipettes - Before use, pipettes must be checked for broken tips		NA
CASS Cabinet		NA
Thickness Tester		NA
Lab Oven		NA
Microscope (Min 100X) with calibrated grid reticle for Pore/Crack Count		NA
Freezer		NA
Spectrophotometer		NA

PROCESS TABLE E - Electropolish and Chrome Flash

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

Process Table E is designed to cover multiple types of decorative Electropolish and Chrome Flash on Stainless Steel processes. Included are sections for each basic category/process step. The assessor is responsible to identify each process step/tank in the Process Overview section below. In addition, the assessor must copy and insert the corresponding audit detail section into the table below to create a full representation of every step of the process being audited.

Columns H and I are used for the Job Audit (Section 4).
Regularly scheduled measurements (e.g., temperature, concentrations, pH) are to be entered in the appropriate row.

For sections that are not applicable mark NA in the Comments column.

Process Overview

Provide complete process flow sequence:

For example:
1. Electropolish
2. Rinse
3. Chromium Plate
4. (Continue as required)

Process Line Identification:

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
1.0	**Polishing and Buffing**						NA	
	Type: (Manual or Automatic)						NA	
	Check which metals are applicable:						NA	
E1.1	Steel:						NA	
E1.2	Stainless Steel:						NA	
E1.3	Aluminum:						NA	
E1.4	Zinc die cast:						NA	
E1.5	Other (identify):						NA	
2.0	**Precleaning** (Vapor Degrease/Solvent/Immersion Cleaning/ Biological Cleaning)							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E2.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify daily.		NA		

E2.2	Concentration	Manual		Once per day.		NA		
E2.3	Time	Automatic		After any program changes.		NA		
E2.4	Agitation	Automatic		Per process sheet.		NA		
E2.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E2.6	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.		NA		
E2.7	Ultrasonic (if applicable functionality check)	Manual		Once every 8 hours.		NA		
E2.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
3.0	**Intermediate Alkaline Cleaning-Soak or Electrocleaning (Anodic or Cathodic)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E3.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E3.2	Concentration	Manual		Once per day.		NA		
E3.3	Time	Automatic		After any program changes.		NA		
E3.4	Agitation	Automatic		Per process sheet.		NA		
E3.5	Amperage or Voltage Control - if applicable	Automatic		Once every 8 hours*.		NA		
E3.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E3.7	Impurity Content Check Per chemical supplier recommendation such as: - acid split (oil contamination) - alkalinity ratio.	Manual		Once per week*		NA		
E3.8	Ultrasonic (if applicable functionality check)	Manual		Once every 8 hours.		NA		
E3.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
4.0	**Cleaning Conditioning Steps**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E4.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E4.2	Concentration	Manual		Once every 8 hours*.		NA		
E4.3	Time	Automatic		After any program changes.		NA		
E4.4	Agitation	Automatic		Per process sheet.		NA		
E4.5	Amperage or Voltage Control	Automatic		Once every 8 hours*.		NA		

E4.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E4.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
5.0	**Acid**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E5.1	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E5.2	Concentration	Manual		Once every 8 hours*.		NA		
E5.3	Time (Per Specification)	Automatic		After any program changes.		NA		
E5.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E5.5	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.		NA		
E5.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
6.0	**Electrolytic Strike, Immersion, or Electroless Deposits**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E6.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E6.2	pH (if applicable)	Manual		Once every 8 hours*.		NA		
E6.3	Concentration	Manual		Once per day.		NA		
E6.4	Time	Automatic		After any program changes.		NA		
E6.5	Agitation	Automatic		Per process sheet.		NA		
E6.6	Amperage or Voltage Control- if applicable	Automatic		Once every 8 hours*.		NA		
E6.7	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E6.8	Impurity Content Check Per chemical supplier recommendation.	Manual		Once per week*.		NA		
E6.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
7.0	**Electropolish** (If Applicable)							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		

E7.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E7.2	Concentration(s)	Manual		Once per day*		NA		
E7.3	Time	Automatic or Manual		After any program changes.		NA		
E7.4	Agitation	Automatic		Per process sheet.		NA		
E7.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
E7.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E7.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
	Chromium (If Applicable)							
8.0	**Hexavalent Chromium**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E8.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E8.2	Concentration(s)	Manual		Once every 4 hours*		NA		
E8.3	Time	Automatic		After any program changes.		NA		
E8.4	Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
E8.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
E8.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E8.7	Impurity Content Check Per chemical supplier recommendation e.g., metallic contamination.	Manual		Once per month.		NA		
E8.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
9.0	**Trivalent Chromium**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
E9.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
E9.2	Concentration(s)	Manual		Once every 4 hours*		NA		
E9.3	Time	Automatic		After any program changes.		NA		
E9.4	Agitation (if applicable)	Automatic		Once every 8 hours.		NA		
E9.5	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		

E9.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E9.7	Impurity Content Check Per chemical supplier recommendation e.g., Metallic contamination.	Manual		Once per week*		NA		
E9.8	Appearance verification per OEM Master Standard or OEM Certified Production part.	Manual		Once every 8 hours.		NA		
E9.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
10.0	**Rinse (This section is to be repeated as necessary to document all individual rinse steps in the entire process line. In cases of sequential rinses this section covers the final rinse of the sequence)**							
E10.1	Rinse Type - Identify in comment section e.g., Flowing, Counter Flowing, Spray, Stagnant, Drag-in/out, etc.	NA		NA		NA		
E10.2	Water Type- Identify in comment section e.g., Municipal, Deionized (DI),Reverse Osmosis (RO), etc.	NA		NA		NA		
E10.3	Agitation type - Identify in comment section (if applicable) e.g., Mechanical (Describe), Air, Ultrasonic, etc.	NA		NA		NA		
E10.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
E10.5	Temperature (Thermocouple) (if applicable)	Automatic		Once every 8 hours.		NA		
E10.6	Rinse Quality - Identify in comment section e.g., pH, Impurity Check, Conductivity.	Manual		Once every 8 hours.*		NA		
E10.7	Flow rate (if applicable)	Manual		Once every 8 hours.		NA		
E10.8	Spray nozzle condition (if applicable)	Manual		Once every 8 hours.		NA		
E10.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
11.0	**Drying**							
E11.1	Drying Time	Automatic		Per Process Sheet and TDS.		NA		
E11.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.		NA		
E11.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once per 8 hours.		NA		
E11.4	There is a procedure to ensure dryness of parts.	Manual		Every container and rack.		NA		
12.0	**Process Equipment**							
E12.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.							

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Table I?		NA

Provide the document that lists all relevant equipment identified in Process Table I.		NA
How do you ensure calibrations are up to date?		NA
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?		NA
Are calibration labels present and up to date for listed equipment?		NA
What is the reaction plan to any failed verification?		NA
E12.2	Racks and fixtures shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
How do you inspect for the integrity of the racks and fixtures? (i.e., broken electrical contacts, plating build up, plastisol rack coating and other damage) Where are the inspection results documented?		NA
Describe your preventive maintenance program for racks and fixtures.		NA
How is each rack or fixture identified for tracking purposes?		NA
E12.3	Rectifiers shall be maintained. The Plater shall have a preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for rectifiers used in production and in the laboratory (i.e., voltage, amperage and ripple)		NA
Is the ripple reading within the maximum allowable limit recommended by the chemical supplier?		NA
E12.4	All Anodes, Contacts and Bussing shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for anodes of all types including inert, consumable, bags, baskets and auxiliary.		NA
Describe the preventive maintenance program for contacts and electrical bussing including cleanliness, high electrical resistance, electrical shorts		NA
E12.5	All filters shall be maintained. The organization shall have a preventive maintenance system that is documented and implemented.	
Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for all plating solution filters to include plate, filter bag and cartridge		NA
Describe the preventive maintenance program for all air filters used on ovens, dryers, chillers, blowers and fans etc.		NA
E12.6	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.	

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.		NA
Provide a list of all the alarms that are tested and the test frequency.		NA

E12.7	All process equipment including the tanks have a maintenance schedule that is documented and followed.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. (i.e., Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.)		NA
Describe the method used to develop and document the maintenance schedule. (i.e., printed, electronic)		NA
Provide an example of a completed sign off record.		NA

13.0	**Test Equipment**
E13.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.		NA
pH / Conductivity Meter		NA
pH / Conductivity Probes		NA
Solution compatible probes must be used.		NA
Laboratory Balance (Weight Scale) (Optional)		NA
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP)		NA
X-Ray Fluorescence (XRF) (Optional)		NA
Lab Rectifier		NA
Hand held thermometer		NA
Pipettes - Before use, pipettes must be checked for broken tips		NA
CASS Cabinet		NA
Thickness Tester		NA
Lab Oven		NA

PROCESS TABLE F - Hard Chrome Plating

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

For multiple tanks that serve the same purpose copy and paste sections as needed.

Process Line Identification:

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirements	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
1.0	**Metal Cleaning**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
F1.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Continuous monitoring by controller. Manually verify daily.		NA		
F1.2	Concentration	Manual		Once per day.		NA		
F1.3	Time	Automatic		After any program changes.		NA		
F1.4	Agitation	Automatic		Per process sheet.		NA		
F1.5	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
F1.6	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
2.0	**Mechanical Preparation (If Applicable)**							
F2.1	Polishing/Buffing:					NA		
F2.2	Wheel revolutions per minute (rpm)	Automatic or Manual		Per process sheet.		NA		
F2.3	Buffing wheel material	Manual		Per process sheet.		NA		
F2.4	Buffing wheel compound	Automatic/Manual		Per process sheet.		NA		
F2.5	Surface profile is checked after process (if applicable).	Manual		Every load.		NA		
F2.6	Abrasive Blast Process:					NA		
F2.7	Media type	Manual		Every part change.		NA		
F2.8	Blasting media size/life: - Media size is being checked on a regular schedule to determine effective cleaning and life of product mix.	Manual		Per preventive maintenance schedule, once per week minimum.		NA		
F2.9	Abrasive media flow or nozzle air pressure: - Blasting force is set and maintained within control limits.	Automatic or Manual		Per process sheet.		NA		

F2.10	Dwell time is clearly defined. - If additional blasting is required, management approval is needed.	Automatic or Manual		Per process sheet.		NA		
F2.11	Abrasive media level	Manual		Every load.		NA		
F2.12	Surface cleanliness is checked after process. Copper Sulfate Test (Hogeboom Test).	Manual		Every load.*		NA		
F2.13	Surface profile is checked after process (if applicable).	Manual		Every load.		NA		
3.0	**Acid Activation (if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
F3.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 3°C (5°F).		Continuous monitoring by controller. Manually verify daily.		NA		
F3.2	Concentration	Automatic or Manual		Once per day.		NA		
F3.3	Time	Automatic or Manual		Per process sheet.		NA		
F3.4	Agitation or Circulation (if applicable)	Automatic		Per process sheet.		NA		
F3.5	Current/Voltage (if applicable)	Automatic or Manual		Once every 8 hours.		NA		
F3.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
F3.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
4.0	**Chrome Plate**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
F4.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 1°C (2°F).		Continuous monitoring by controller. Manually verify daily.		NA		
F4.2	Concentration	Manual		Once per day.		NA		
F4.3	Metallic impurity concentrations of Fe, Cr+3, Cu, and Ni.	Manual		Once per week.		NA		
F4.4	Time	Manual		After any program changes.		NA		
F4.5	Agitation or Circulation	Automatic		At start of each shift.		NA		
F4.6	Current/Voltage	Automatic or Manual		Once every 8 hours.		NA		
F4.7	Ramp Schedule (if applicable)	Automatic or Manual		Per process sheet.		NA		
F4.8	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
F4.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
5.0	**Rinse (This section is to be repeated as necessary to document all individual rinse steps in the entire process line. In cases of sequential rinses this section covers the final rinse of the sequence)**							
F5.1	Rinse Type - Identify in comment section e.g., Flowing, Counter Flowing, Spray, Stagnant, Drag-in/out, etc.	NA		NA		NA		

F5.2	Water Type- Identify in comment section e.g., Municipal, Deionized (DI),Reverse Osmosis (RO), etc.	NA		NA		NA		
F5.3	Agitation type - Identify in comment section (if applicable) e.g., Mechanical (Describe), Air, Ultrasonic, etc.	NA		NA		NA		
F5.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
F5.5	Temperature (Thermocouple) (if applicable)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Once every 8 hours.		NA		
F5.6	Rinse Quality - Identify in comment section e.g., pH, Impurity Check, Conductivity.	Manual		Once every 8 hours.*		NA		
F5.7	Flow rate (if applicable)	Manual		Once every 8 hours.		NA		
F5.8	Spray nozzle condition (if applicable)	Manual		Once every 8 hours.		NA		
F5.9	Verify position of incoming water feed is near the bottom (if immersion tank).	Manual		Per preventive maintenance program.		NA		
F5.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
6.0	**Drying**							
F6.1	Drying Time	Automatic		Per Process Sheet and TDS.		NA		
F6.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.		NA		
F6.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once per 8 hours.		NA		
F6.4	There is a procedure to ensure dryness of parts.	Manual		Every container and rack.		NA		
7.0	**Process Equipment**							
F7.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.							

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Process Table I?		NA
Provide the document that lists all relevant equipment identified in Process Table I.		NA
How do you ensure calibrations are up to date?		NA
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?		NA
Are calibration labels present and up to date for listed equipment?		NA
What is the reaction plan to any failed verification?		NA

F7.2	Racks and fixtures shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**

How do you inspect for the integrity of the racks and fixtures? (i.e., broken electrical contacts, plating build up, plastisol rack coating and other damage) Where are the inspection results documented?		NA
Describe your preventive maintenance program for racks and fixtures.		NA
How is each rack or fixture identified for tracking purposes?		NA

F7.3	Rectifiers shall be maintained. The Plater shall have a preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for rectifiers used in production and in the laboratory (i.e., voltage, amperage and ripple).		NA
Is the ripple reading within the maximum allowable limit recommended by the chemical supplier?		NA

F7.4	All Anodes, Contacts and Bussing shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for anodes of all types including inert, consumable, bags, baskets and auxiliary.		NA
Describe the preventive maintenance program for contacts and electrical bussing including cleanliness, high electrical resistance, electrical shorts		NA

F7.5	All filters shall be maintained. The organization shall have a preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program for all plating solution filters to include plate, filter bag and cartridge		NA
Describe the preventive maintenance program for all air filters used on ovens, dryers, chillers, blowers and fans etc.		NA

F7.6	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.		NA
Provide a list of all the alarms that are tested and the test frequency.		NA

F7.7	All process equipment including the tanks have a maintenance schedule that is documented and followed.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. (i.e., Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.)		NA

Describe the method used to develop and document the maintenance schedule. (i.e., printed, electronic)		NA
Provide an example of a completed sign off record.		NA

8.0	**Test Equipment**
F8.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.		NA
pH / Conductivity Meter		NA
pH / Conductivity Probes		NA
Solution compatible probes must be used.		NA
Laboratory Balance (Weight Scale) (Optional)		NA
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP)		NA
Ion Chromatography (Optional)		NA
Selective Ion Electrodes (Optional)		NA
X-Ray Fluorescence (XRF) - (Optional)		NA
Lab Rectifier		NA
Hand held thermometer		NA
Pipettes - Before use, pipettes must be checked for broken tips		NA
Thickness Tester		NA
Lab Oven		NA

PROCESS TABLE G - Electroless Nickel

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

For multiple tanks that serve the same purpose copy and paste sections as needed.

Process Line Identification:

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		Minimum Requirement	Actual Condition	Minimum Requirement	Actual Condition	Conforming Nonconforming NA	Range	Actual Measurements supporting time of Job Audit
	STEEL, BRASS, BRONZE							
1.0	**Soak Cleaner Precleaning**							
	Type: (e.g., Alkaline, Neutral, Acidic, Spray, Immersion, Ultrasonic)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G1.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G1.2	Concentration(s)	Manual		Once per day.		NA		
G1.3	Impurity Content Check Per chemical supplier recommendation Examples: Acid split for oil loading, alkalinity ratio.	Manual		Once per week.		NA		
G1.4	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G1.5	Agitation	Automatic		Per process sheet.		NA		
G1.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G1.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
2.0	**Ultrasonic Cleaner**							
G2.1	Ultrasonics functionality check - Frequency settings of ultrasonics - Power Density (e.g., Watts per liter) - Test for output (e.g., aluminum foil).	Automatic or Manual		Once per week.		NA		
G2.2	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G2.3	Cleaner Concentration	Manual		Once per day.		NA		

G2.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G2.5	Electrical equipment inspection (connectors, diodes, generators, transducers, equipment temperature, etc.).	Manual		Once per week.		NA		
G2.6	Input voltage (with and without load, primary and secondary).	Manual		Every 6 months.		NA		
G2.7	Flowing Rinse	Automatic or Manual		Once every 8 hours.		NA		
G2.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
3.0	**Alkaline Electrocleaner**							
	Type: (e.g., Anodic, Cathodic, Periodic Reverse)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G3.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G3.2	Concentration(s)	Manual		Once per day.		NA		
G3.3	Impurity Content Check Per chemical supplier recommendation Examples: Acid split for oil loading, alkalinity ratio.	Manual		Once per week.		NA		
G3.4	Tank maintenance schedule is documented and followed. Examples: Physical tank, pumps, piping, heaters, etc.	Manual		Per preventive maintenance program.		NA		
G3.5	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G3.6	Agitation	Automatic		Per process sheet.		NA		
G3.7	Current/Voltage	Automatic or Manual		Per process sheet and TDS Once every 8 hours.*		NA		
G3.8	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G3.9	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G3.10	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
4.0	**Acid Activation**							
	Type: (e.g., Sulfuric, Hydrochloric, Acid salts)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G4.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G4.2	Concentration(s)	Manual		Once every 8 hours.*		NA		
G4.3	Metallic impurity concentration. Obtain metallic impurity limits from chemical supplier with required corrective actions.	Manual		Once per month.		NA		
G4.4	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G4.5	Agitation	Automatic		Per process sheet.		NA		
G4.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		

G4.7	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G4.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
	ALUMINUM							
5.0	**Soak Cleaner**							
	Type: (e.g., Alkaline, Neutral, Acidic)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G5.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G5.2	Concentration(s)	Manual		Once every 8 hours.*		NA		
G5.3	Impurity Content Check Per chemical supplier recommendation Examples: Acid split for oil loading, alkalinity ratio.	Manual		Once per week.		NA		
G5.4	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G5.5	Agitation	Automatic		Per process sheet.		NA		
G5.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G5.7	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G5.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
6.0	**Etch**							
	Type: (e.g., Acidic, Alkaline)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G6.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G6.2	Concentration(s)	Manual		Once every 8 hours.*		NA		
G6.3	Metallic impurity concentrations of Al and Cu. Obtain limits from chemical supplier with required corrective actions.	Per process sheet and TDS		Once per month.		NA		
G6.4	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G6.5	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G6.6	Agitation	Automatic		Per process sheet.		NA		
G6.7	Solution Level	Automatic or Manual		Once every 8 hours.		NA		
G6.8	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G6.9	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
7.0	**Deoxidizer/Desmutter**							
	Type: Acid type (e.g., Nitric, sulfuric, fluoride, salts, etc.)					NA		

	Size, volume:					NA		
	Chemical supplier:					NA		
G7.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G7.2	Concentration(s)	Manual		Once every 8 hours.*		NA		
G7.3	Metallic impurity concentrations of Al and Cu. Obtain limits from chemical supplier with required corrective actions.	Per process sheet and TDS		Once per month.		NA		
G7.4	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G7.5	Agitation	Automatic		Per process sheet.		NA		
G7.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G7.7	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G7.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
8.0	**Zincate (and second Zincate)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G8.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G8.2	Concentration(s)	Manual		Once every 8 hours.		NA		
G8.3	Bath Life: - Aluminum impurity concentrations - Surface area processed per gallon of solution	Per process sheet and TDS		Once per month.		NA		
G8.4	Time	Automatic or Manual		Per Process Sheet and TDS.		NA		
G8.5	Agitation	Automatic or Manual		Per Process Sheet and TDS.		NA		
G8.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G8.7	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G8.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
9.0	**Zincate Strip (when double Zincate)**							
	Type: (e.g., Nitric, Proprietary acid mixtures)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G9.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G9.2	Concentration(s)	Manual		Once every 8 hours.*		NA		

G9.3	Bath Life - Zinc impurity concentrations - Acid ratio Obtain limits from chemical supplier with required corrective actions.	Per process sheet and TDS		Once per month.		NA		
G9.4	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G9.5	Agitation	Automatic		Per process sheet.		NA		
G9.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G9.7	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
10.0	**Rinse (This section is to be repeated as necessary to document all individual rinse steps in the entire process line. In cases of sequential rinses this section covers the final rinse of the sequence)**							
G10.1	Rinse Type - Identify in comment section e.g., Flowing, Counter Flowing, Spray, Stagnant, Drag-in/out, etc.	NA		NA		NA		
G10.2	Water Type- Identify in comment section e.g., Municipal, Deionized (DI),Reverse Osmosis (RO), etc.	NA		NA		NA		
G10.3	Agitation type - Identify in comment section (if applicable) e.g., Mechanical (Describe), Air, Ultrasonic, etc.	NA		NA		NA		
G10.4	Solution Level - Parts, heaters, and transducers are completely submerged..	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G10.5	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours. Automatic.		NA		
G10.6	Rinse Quality - Identify in comment section e.g., pH, Impurity Check, Conductivity	Manual		Once every 8 hours.*		NA		
G10.7	Flow rate (if applicable)	Manual		Once every 8 hours.		NA		
G10.8	Spray nozzle condition (if applicable)	Manual		Once every 8 hours.		NA		
G10.9	Verify position of incoming water feed is near the bottom (if immersion tank)	Manual		Per preventive maintenance program.		NA		
G10.10	Spray nozzle condition (if applicable)	Manual		Once every 8 hours.		NA		
G10.11	Tank maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
G10.12	Verify position of incoming water feed is near the bottom of the immersion tank	Manual		Per preventive maintenance program.		NA		
G10.13	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
11.0	**EN Strike (optional process)**							
	Type: (e.g., Alkaline, Acid)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G11.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify every 30 minutes. Automatic.		NA		

G11.2	Nickel Concentration	Automatic or Manual		Prior to production start-up. Automatic: verify daily. Manually: Frequency of manual tests shall ensure a minimum 80% activity concentration, or per specifications.		NA		
G11.3	Time	Automatic or Manual		Per process sheet and after program changes.		NA		
G11.4	Agitation	Automatic		Per process sheet.		NA		
G11.5	Solution pumps turn over rate is minimum 10 times per hour.	Manual		Per preventive maintenance program		NA		
G11.6	Hypophosphite concentration	Manual		Prior to production start-up and once every 8 hours.*		NA		
G11.7	Solution loading (surface area of parts per volume plating solution)	Manual		Per process sheet.		NA		
G11.8	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G11.9	pH	Automatic or Manual		Once every 30 minutes while running.*		NA		
G11.10	Continuous filtration	Automatic		Visual for good solution flow/clogged filters every 8 hours.		NA		
G11.11	Bath life (metal turnovers) (calculate by specific gravity or orthophosphite or nickel adds made)	Manual		Per process sheet. Continuous tracking of nickel additions, and titration of Orthophosphite/specific gravity minimum 1 per week.		NA		
G11.12	Process water conductivity	Manual, per supplier recommendation		Once per day.		NA		
G11.13	Contamination (e.g., Nitrates, Zinc, Iron and Aluminum) Obtain limits from chemical supplier with required corrective actions.	Manual		Once per day.		NA		
G11.14	Flowing Rinse (optional)	Automatic		Once every 8 hours.		NA		
G11.15	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
12.0	**Electroless Nickel, Nickel Alloys, and Nickel Composites**							
	Type: (High phos, Mid Phos, Low Phos, Nickel Boron, Nickel Teflon, etc.)					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G12.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify every 30 minutes. Automatic.		NA		
G12.2	Time (and thickness)	Manual (per thickness)		Per process sheet.		NA		
G12.3	Agitation	Automatic		Per process sheet and supplier TDS.		NA		
G12.4	Nickel Concentration	Automatic or Manual		Prior to production start-up. Automatic: verify daily. Manually: once every 30 minutes while running. Frequency of manual tests shall be increased for high volume loading to maintain a minimum 80% activity concentration, or per specification.		NA		
G12.5	Specialty Electroless Nickel Alloy and Composite concentration	Automatic or Manual		Prior to production start-up. Automatic: verify daily. Manually: once every 30 minutes while running. Frequency of manual tests shall be increased for high volume loading to maintain a minimum 80% activity concentration, or per specification.		NA		
G12.6	Hypophosphite concentration or Reducing agent (for specialty alloys)	Manual		Prior to production start-up and once every 8 hours.*		NA		

G12.7	Solution loading (surface area of parts per volume plating solution)	Manual		Verify each lot against process sheet.		NA		
G12.8	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G12.9	Bath life (metal turnovers) Calculate by specific gravity or orthophosphite content or nickel adds made	Manual		Per process sheet and TDS. Continuous (Daily) tracking of nickel additions, and titration of orthophosphite/specific gravity minimum 1 per month.		NA		
G12.10	pH	Automatic or Manual		Once every 30 minutes while running.*		NA		
G12.11	Filtration - Solution Turn-over - Filter micron size	Continuous with solution turn-over rate per process sheet & TDS		For bag filters: Visual for good solution flow/clogged/ evidence of plate-out of filters every 8 hours. For cartridge filters: Measure pressure drop/back pressure every 8 hours.		NA		
G12.12	Anodic protection (if applicable) - Voltage - Cathode surface area (300 to 400:1 of anode:cathode) - Stripping/replacement of cathode	Manual, per supplier recommendation		Voltage and surface area: Once every 8 hours. Cathode maintenance: As required to maintain proper anode:cathode ratio.		NA		
G12.13	Equipment plate-out	Manual		Manually verify every 30 minutes while running.		NA		
G12.14	Hardness Test (if applicable)	Manual		Per Process Sheet and TDS.		NA		
G12.15	Phosphorous or alloy content	Manual		Per Process Sheet and TDS.		NA		
G12.16	Water quality	Manual, per supplier recommendation		Once per day.		NA		
G12.17	Contamination (e.g., Nitrates from stripping tanks) Obtain limits from chemical supplier with required corrective actions.	Manual, per supplier recommendation		Once per day.		NA		
G12.18	Flowing Rinse	Automatic		Once every 8 hours.		NA		
G12.19	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
13.0	**Post Treatment (Seals, Blackeners, Rinse Aids, etc. if applicable)**							
	Type:					NA		
	Size, volume:					NA		
	Chemical supplier:					NA		
G13.1	Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5ºC (10ºF).		Continuous monitoring by controller. Manually verify once every 8 hours.		NA		
G13.2	Concentration(s)	Manual		Once every 8 hours.		NA		
G13.3	Impurities Obtain limits from chemical supplier with required corrective actions.	Per process sheet and TDS		Once per month.		NA		
G13.4	Time	Automatic or Manual		Per Process Sheet and TDS.		NA		
G13.5	Agitation	Automatic or Manual		Per Process Sheet and TDS.		NA		
G13.6	Solution Level - Parts, heaters, and transducers are completely submerged.	Automatic or Manual		Continuous monitoring by controller. Manually verify daily for automatic controls, every 8 hours for systems without controllers.		NA		
G13.7	Flowing Rinse	Automatic		Once every 8 hours.		NA		

G13.8	Tank and solution maintenance schedule documented and followed.	Manual		Per preventive maintenance program.		NA		
14.0	**Drying**							
G14.1	Drying Time	Automatic		Once per day.		NA		
G14.2	Drying Temperature (Thermocouple)	Automatic Max SAT difference allowed +/- 5°C (10°F).		Per Process Sheet and TDS.		NA		
G14.3	Verify operation of blowers and/or rotation of dryer.	Manual		Once per 8 hours.		NA		
G14.4	There is a procedure to ensure dryness of parts.	Manual		Every container and rack.		NA		
15.0	**Heat Treatment for Hardness (if applicable)**	**Covered by Pyrometry - Unique conditions to emphasize below**						
G15.1	Inert gas pressure set point(s) and limits are verified and documented.	Manual		Start of bake cycle and every batch change.		NA		
G15.2	Bake - time delay between plating and bake - total time documented	Automatic/Manual		Every baking batch.		NA		
16.0	**Process Equipment**							
G16.1	Process equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.							

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
What is the internal system used for conducting and managing calibration of all relevant equipment identified in Process Table I?		NA
Provide the document that lists all relevant equipment identified in Process Table I.		NA
How do you ensure calibrations are up to date?		NA
How do you ensure new equipment has been added to the calibration list, and inactive equipment has been removed?		NA
Are calibration labels present and up to date for listed equipment?		NA
What is the reaction plan to any failed verification?		NA

G16.2	Racks and fixtures shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**
How do you inspect for the integrity of the racks and fixtures? (i.e., broken electrical contacts, plating build up, plastisol rack coating and other damage) Where are the inspection results documented?		NA
Describe your preventive maintenance program for racks and fixtures.		NA
How is each rack or fixture identified for tracking purposes?		NA

G16.3	Rectifiers shall be maintained. The Plater shall have a preventive maintenance system that is documented and implemented.

Guidance	**Objective Evidence / Comments**	**Conforming Nonconforming NA**

Describe the preventive maintenance program for rectifiers used in production and in the laboratory (i.e., voltage, amperage and ripple).		NA
Is the ripple reading within the maximum allowable limit recommended by the chemical supplier?		NA

G16.4	All Anodes, Contacts and Bussing shall be maintained. Organization shall have preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program for anodes of all types including inert, consumable, bags, baskets and auxiliary.		NA
Describe the preventive maintenance program for contacts and electrical bussing including cleanliness, high electrical resistance, electrical shorts.		NA

G16.5	All filters shall be maintained. The organization shall have a preventive maintenance system that is documented and implemented. If bag filters are stripped and reused, the number of re-use shall be tracked, and not exceed 3 strip/reuse cycles. Cartridge filters shall not be reused.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program for all plating solution filters to include plate, filter bag and cartridge.		NA
Describe the preventive maintenance program for all air filters used on ovens, dryers, chillers, blowers and fans etc.		NA

G16.6	All process and equipment alarms shall be tested on a quarterly basis at a minimum. The organization shall have a preventive maintenance system that is documented and implemented.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Describe the preventive maintenance program where alarms are used for amperage, voltage, heating, cooling, level control, air circulation and air agitation etc.		NA
Provide a list of all the alarms that are tested and the test frequency.		NA

G16.7	All process equipment including the tanks have a maintenance schedule that is documented and followed.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
The preventive maintenance schedule should include a list of equipment that is in use with the associated process. (i.e., Tanks, liners pumps, plumbing, heaters, ventilation, coalescer, rectifier, heating, cooling, level control, air circulation and air agitation etc.).		NA
Describe the method used to develop and document the maintenance schedule. (i.e., printed, electronic).		NA
Provide an example of a completed sign off record.		NA

17.0	**Test Equipment**
G17.1	Test Equipment shall be verified and calibrated per Process Table I. Calibrations shall be certified, posted and up to date. A system shall be used to track calibration dates of equipment. Complete the audit for these identified elements in Process Table I.

Guidance	Objective Evidence / Comments	Conforming Nonconforming NA
Wet Analysis: Before use, chemicals must be checked for shelf life and/or expiration date.		NA
pH / Conductivity Meter		NA
pH / Conductivity Probes		NA
Solution compatible probes must be used.		NA
Dedicated probes must be used for chromates / passivates.		NA
Laboratory Balance (Weight Scale) (Optional)		NA
Atomic Absorption (AA) or Inductively Coupled Plasma (ICP)		NA
X-Ray Fluorescence (XRF)		NA
Lab Rectifier		NA
Hand held thermometer		NA
Pipettes - Before use, pipettes must be checked for broken tips		NA
Salt Spray Cabinet		NA
Thickness Tester		NA
Lab Oven		NA
Profilometer (Optional)		NA

PROCESS TABLE H - Hydrogen Embrittlement Relief Process

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. When performing the job audit, the auditor shall verify plater is conforming to customer requirements.

This table shall be completed separately for each hydrogen embrittlement relief oven.

Definitions:

Time from the end of the plating tank: This is the time at which the parts exit the electrolytic plating step and before entering any rinses, passivates, etc.

Process Line Identification: Automated Hoist / Rack Plating Line

Type of Oven: Batch or Continuous

	Category/Process Steps	Type of Control		Monitoring Frequency		Observation/ Comments	Job Audit Measurements	
ITEM #		**Minimum Requirement**	**Actual Condition**	**Minimum Requirement**	**Actual Condition**	**Conforming Nonconforming NA**	**Range**	**Actual Measurements supporting time of Job Audit**
1.0								
H1.1	Process must be in place that limits the acid immersion time in the plating process.	Automatic	automatic	No more than ten minutes. If more than ten minutes, parts need to be quarantined, and follow customer reaction plan.	max 3 min	Conforming	N/A	N/A
H1.2	All parts for hydrogen embrittlement relief must reach bake temperature within two hours after exiting the electroplating tank. Refer to Pyrometry Section for probe placement.	Automatic/Manual	Manual	1. Time from parts exiting plating tank to exiting plating line. 2. Time required for sufficient amount of parts to be loaded into the de-embrittlement oven. The amount of parts shall represent the maximum load size/rate into the oven. 3. Time to temperature per TUS for a maximum load. The total accumulated time for items 1-3 shall be under 2 hours.	All loads are tracked digitally and time into baking is displayed on screen to ensure operators are informed and compliance is achieved	Conforming	N/A	N/A
H1.3	Oven temperature set point(s) and limits are verified and documented.	Automatic Max SAT difference allowed +/- 5°C (10°F)		Start of bake cycle and every batch change.	Annual Calibration completed	Conforming	N/A	N/A
H1.4	Oven temperature is monitored and recorded.	Automatic		A continuous data recorder must be used with a temperature control alarm.	Continuous data recorder with alarm	Conforming	N/A	N/A
H1.5	For hydrogen embrittlement relief ovens, are temperature uniformity surveys performed as defined by Pyrometry Section 3.	Manual		Uniformity survey must show that ovens were tested with a full production load. The applicator shall demonstrate that the time from plating to baking temperature can be reached within the time limit set by customer requirements.	Temperature reached within the time limit	Conforming	N/A	N/A

H1.6	For hydrogen embrittlement relief ovens, are thermocouples checked and/or replaced as defined by Pyrometry Sections 3, 3.1 and 3.3.	Manual		Plater shall have preventive maintenance system that is documented and implemented.	PM system documented	Conforming	N/A	N/A
H1.7	Electronic or mechanical records (not hand-written) must be kept for the following: - Time out of plating line - Time at start of bake cycle - Time at end of bake cycle	Automatic/Manual		For every oven batch the applicator shall record: - Time out of plating line - Time at start of bake cycle - Time at end of bake cycle	All records are retained digitally, all baking requirements are part specific and managed via production software	Conforming	N/A	N/A
H1.8	Air filter (if used) change as scheduled.	Manual		Per oven manufacturer, filter supplier recommendation	See PM system database		N/A	N/A
H1.9	Bake oven logs for each oven batch are reviewed and verified.	Manual		Before shipment of each batch, an independent inspector (other than operator) shall verify: - Time out of plating line - Time at the start of bake cycle - Time at end of bake cycle Additionally verify the following meet process specifications: - Time to temperature - Length of bake cycle at temperature	All records are displayed on a screen by the ovens for supervisors and/or lead inspectors to review multiple times per shift or as necessary	Conforming	N/A	N/A
H1.10	Hydrogen embrittlement relief must be performed per customer requirements before rework.			The rework documents must include: - Time out of plating line - Time at the start of bake cycle - Time at end of bake cycle	All records are retained digitally, all baking requirements are part specific and managed via production software	Conforming	N/A	N/A

PROCESS TABLE I - Process Control and Testing Equipment Verification and Calibration

All requirements given below are subordinate to applicable customer/OEM specific requirements.

The customer may have additional requirements, e.g., inspection testing, greater frequencies, etc. The auditor shall verify plater is conforming to customer requirements.

***If minimum requirements are not met, provide supporting records to justify actual conditions. To justify reduced monitoring frequencies, a minimum of 30 consecutive measurements (data points) at stated frequencies must be documented. If any data points at reduced monitoring frequencies are outside of control limits, then revert back to the frequencies stated under the minimum requirements.**

For multiple tanks that serve the same purpose copy and paste sections as needed.

ITEM #	EQUIPMENT TYPE	Verification Frequency	Conforming Nonconforming NA	Calibration / Certification Frequency	Conforming Nonconforming NA	Observation / Comments
1.0						
I1.1	Before use, chemicals must be checked for shelf life and/or expiration date.	Daily	Conforming	NA	Conforming	Before each use
I1.2	Temperature Controller	Per Section 3 Pyrometry	Conforming	Annually	Conforming	
I1.3	Thermocouple	Per Section 3 Pyrometry	Conforming	Per Section 3 Pyrometry	Conforming	
I1.4	pH Meter	Per equipment manufacturer's specifications	N/A	Annually	N/A	Calibration required for the probe, not the meter
I1.5	pH Probe	Once every 4 hours, using a minimum of 2 buffer solutions near the min and max of the chemical control range.	Conforming	NA	Conforming	Before each use
I1.6	Conductivity Meter	Per equipment manufacturer's specifications	N/A	Annually	N/A	
I1.7	Conductivity Probe	Once every 4 hours, using a minimum of 2 reference solutions near the min and max of the chemical control range.	N/A	NA	N/A	
I1.8	Ion Selective (ISE) Probe	Once every 4 hours, using a minimum of 2 reference solutions near the min and max of the chemical control range.	N/A	NA	N/A	Test method uses mV readings directly - no calibration required
I1.9	Laboratory Balance	Monthly using a minimum of 2 reference mass standards.	Conforming	Annually	Conforming	
I1.10	Atomic Absorption (AA)	Before each use.	Conforming	Annually	Conforming	
I1.11	Inductively Coupled Plasma (ICP)	Before each use.	N/A	Annually	N/A	
I1.12	Ion Chromatography (IC)	Before each use.	N/A	Annually	N/A	
I1.13	X-Ray Fluorescence (XRF)	Daily. Thickness and alloy for each combination of plating and substrate.	Conforming	Annually	Conforming	
I1.14	Hardness Tester	Daily	N/A	Annually	N/A	
I1.15	Profilometer	Daily	N/A	Annually	N/A	
I1.16	Lab Rectifier	NA	Conforming	Annually	Conforming	
I1.17	Hand held digital thermometer	NA	N/A	Annually	Conforming	Replaced annually
I1.18	Glass thermometer	Visual inspection before each use.	N/A	Annually	N/A	
I1.19	Pipettes - Before use, pipettes must be checked for broken tips	Before each use	Conforming	NA	Conforming	
I1.20	Salt Spray Cabinet	Daily	Conforming	Annually	Conforming	
I1.21	Thickness Tester	Every 8 hours	Conforming	Annually	Conforming	
I1.22	CASS Cabinet	Daily	Conforming	Annually	Conforming	
I1.23	Microscope (Min 100X) with calibrated grid reticle for Pore/Crack Count	Daily	Conforming	Annually	Conforming	
I1.24	Lab Oven	Per Section 3 Pyrometry	Conforming	Annually	Conforming	
I1.25	Torque-tension/Friction Tester	NA	N/A	Annually	N/A	
I1.26	Refractometer	Monthly	N/A	NA	N/A	
I1.27	Spectrophotometer	Monthly	N/A	Annually	N/A	
I1.28	Color Meter	Daily	Before use	Annually	Conforming	Before use
I1.29	Gloss Meter	Monthly	N/A	Annually	N/A	
I1.30	Digital Temperature Recorder (i.e., DataPaq)	NA	N/A	Annually	N/A	