

Understanding CQI-11

Plating System Assessments

Understanding Plating System Assessments

CQI-11 Version 3



© 2020, Omnex, Inc.
315 Eisenhower Parkway Suite 214
Ann Arbor, Michigan 48108
USA
734-761-4940
Fax: 734-761-4966

Second Edition
April 2020

This publication is protected by Federal Copyright Law, with all rights reserved. No part of this publication may be stored in a retrieval system, transmitted or reproduced in any way, including but not limited to photocopy, photograph, magnetic or other record, without the prior agreement and written permission of the publisher.

Omnex provides training, consulting and software solutions to the international market with offices in the USA, Canada, Mexico, China (PRC), Germany, India, the Middle East, and SE Asia. Omnex offers over 400 standard and customized training courses in business, quality, environmental, food safety, laboratory and health & safety management systems worldwide.

Email: info@omnex.com

Web: www.omnex.com



Copyright 2020 Omnex, Inc. All Rights Reserved.

3

Course Objectives

- Understand the scope of the plating system assessment
- Understand the layout and requirements of the process tables and excel file format with the form builder function.
- Prepare to conduct an assessment of a plating system in order to ensure it provides for continual improvement, emphasizing defect prevention and reduction of variation and waste in the supply chain



Copyright 2020 Omnex, Inc. All Rights Reserved.

4

Agenda

- Introduction and Overview
- Assessor Requirements
- Scope of the Plating System Assessment (PSA)
- Plating System Assessment Procedure
 - SECTION 1: Management Responsibility & Quality Planning
 - SECTION 2: Floor and Material Handling Responsibility
 - SECTION 3: Pyrometry
 - SECTION 4: Job Audit
- Process Requirement Tables
- Glossary

A BRIEF INTRODUCTION TO OMNEX



Omnex Introduction

- International consulting, training and software development organization founded in 1985.
- Specialties:
 - Integrated management system solutions.
 - Elevating the performance of client organizations.
 - Consulting and training services in:
 - Quality Management Systems, e.g., ISO 9001, IATF 16949, AS9100, QOS
 - Environmental Management Systems, e.g., ISO 14001
 - Health and Safety Management Systems, e.g., ISO 45001
- Leader in Lean, Six Sigma and other breakthrough systems and performance enhancement.
 - Provider of Lean Six Sigma services to Automotive Industry via AIAG alliance.



About Omnex

- Headquartered in Ann Arbor, Michigan with offices in major global markets.
- In 1995-97 provided global roll out supplier training and development for Ford Motor Company.
- Trained more than 100,000 individuals in over 30 countries.
- Workforce of over 700 professionals, speaking over a dozen languages.
- Former Delegation Leader of the International Automotive Task Force (IATF) responsible for ISO/TS 16949.
- Served on committees that wrote QOS, ISO 9001, QS-9000, ISO/TS 16949 and its Semiconductor Supplement, and ISO IWA 1 (ISO 9000 for healthcare).
- Former member of AIAG manual writing committees for FMEA, SPC, MSA, Sub-tier Supplier Development, Error Proofing, and Effective Problem Solving (EPS).



Omnex Worldwide Offices



Omnex is headquartered and operates from the United States through offices in Michigan.

The company maintains international operations in many countries to provide comprehensive services to clients throughout Western Europe, Latin America and the Pacific Rim.

www.omnex.com
info@omnex.com



WWW.OMNEX.COM

Copyright 2020 Omnex, Inc. All Rights Reserved.

9

Rules of the Classroom

- ✓ Start and end on time
- ✓ Return from breaks and lunch on time
- ✓ All questions welcome
- ✓ Your input is valuable and is encouraged
- ✓ Don't interrupt others
- ✓ One meeting at a time
- ✓ Listen – and respect others' ideas
- ✓ No "buts" – keep an open mind
- ✓ Cell phones & pagers off or silent mode
- ✓ Mute your audio when not commenting in the class
- ✓ No e-mails, texting or tweeting during class

If you must take a phone call or answer a text please leave the room for as short a period as possible

Copyright 2020 Omnex, Inc. All Rights Reserved.

10

Icebreaker

- Instructor Information:
 - Name
 - Background
- Student Introductions:
 - Name
 - Position / Responsibilities
 - What is your involvement in plating system assessments?
 - What are your experiences with CQI-11?
 - Please share something unique and/or interesting about yourself.



Introduction and Overview

- Plating System Assessment (PSA) requirements are developed for the automotive sector, but can also be used for other sectors.
- Plating System Assessment (PSA) requirements are used in association with customer and product standards.
- PSA can be used to assess an organization's ability to meet its own requirements as well as customer, regulatory, and other requirements.
- PSA can also be used to assess an organization's suppliers.
- Supports the process approach as described in ISO 9001 and IATF 16949.

Special Note on PSA Terminology

Shall = requirement; failure to meet the requirement results in either "Not Satisfactory" or "Needs Immediate Action"

Should = recommendation

Such as = suggestions provided for guidance only

Introduction and Overview

Plating System Assessment Goals

- Develop a plating management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the supply chain.
- Define the fundamental requirements for plating management systems when coupled with an internationally recognized QMS and applicable customer-specific requirements.
- Provide a common approach to a plating management system for automotive production and service part organizations.

Introduction and Overview

Assessment Process

- Shall be conducted annually, or as specified by the customer, to re-examine the continuing compliance with the PSA.
- Every assessment shall include a review of the organization's systems using the PSA.
- Successive job audits shall sample parts from different automotive component manufacturers that require compliance to the PSA document.
- Shall use the process approach to auditing/assessing as identified by the requirements of ISO 9001 and IATF 16949.
- Records shall be maintained as PSA compliance evidence, including all action plans addressing any unsatisfactory ratings.

Assessor Requirements

Assessor(s) shall have the following specific experience to conduct the PSA:

- Experienced QMS internal auditor trained to the latest edition of ISO 9001 or IATF 16949
- Possess plating knowledge
 - Evidence shall include a minimum of 5 years experience in plating and surface finishing or a combination of formal education in chemistry / chemical engineering and plating experience totalling a minimum of 5 years
- Possess knowledge of and be familiar with the application of automotive quality core tools (APQP, FMEA, MSA, SPC, PPAP)
- The organization must keep records of evidence of compliance to the assessor requirements, and shall be available for review by any customer requiring PSA compliance

If more than one assessor is needed to meet the above qualifications, the lead assessor shall be the person with QMS audit experience

Plating System Assessment Scope

- PSA is applicable to any organization (type, size, and product) or its suppliers performing applicable plating to:
 - Demonstrate ability to provide consistent product meeting customer and regulatory requirements, and
 - Enhance customer satisfaction through effective application and continual improvement of the PSA system.
- PSA is also applicable to sites where customer-specified parts for production and/or service are processed throughout the automotive supply chain.
- PSA requirements are generic and are intended to be followed by all organizations providing plating operations regardless of type, size and product.

Plating System Assessment Scope

- Nine Process Tables specific to plating processes have been developed to be referenced during the assessment.
- The Process Tables specify the tolerances of process parameters and the frequencies for checking process control parameters and parts.
- The Requirements and Guidance in the PSA form will identify when to refer to the Process Tables.
- Each process table has a section for Process Equipment and Test Equipment in addition to Process Table I.

Plating System Assessment Scope

Process Table A – Zinc and Zinc Alloy Plating

- Alkaline Cleaning
- Acid Pickling
- Acid Plating Bath
- Alkaline Plating Bath
- Pre-Bake Acid Treatment
- Hydrogen Embrittlement Relief
- Acid Activation
- Rinse
- Passivates
- Supplemental Treatments
- Drying

Process Table B – Mechanical Plating

- Cleaning/Conditioning in Mechanical Plating Barrel
- Mechanical Plating
- Passivates (Off Line)
- Supplemental Treatments
- Drying

Process Table C –Decorative Plating of Metal Substrates

- Polishing and Buffing
- Precleaning
- Alkaline Cleaning
- Cleaning Conditioning Steps
- Acid
- Electrolytic Strike, Immersion, or Electroless Deposits
- Acid Copper
- Copper Activation
- Semi-Bright Nickel
- High Activity Nickel
- Bright Nickel
- Satin/Specialty Nickel
- Microporous Nickel/Nobel Nickel
- Hexavalent Chromium
- Trivalent Chromium
- Chromium Post Treatment
- Rinse
- Drying

Plating System Assessment Scope

Process Table D – Decorative Plating of Plastic Substrates

- Cleaning and Pre-Etch
- Etch
- Neutralizer
- Activator
- Conductor
- Accelerator
- Electroless Plating
- Activation
- Immersion Plate
- Electrolytic Plating
- Acid Copper
- Copper Activation
- Semi-Bright Nickel
- High Activity Nickel
- Bright Nickel
- Satin/Specialty Nickel
- Microporous Nickel/Nobel Nickel

- Hexavalent Chromium
- Trivalent Chromium
- Chromium Post Treatment
- Rinse
- Drying

Process Table E – Electropolish and Chrome Flash

- Polishing and Buffing
- Precleaning
- Intermediate Alkaline Cleaning-Soak or Electrocleaning
- Cleaning Conditioning Steps
- Acid
- Electrolytic Strike, Immersion, or Electroless Deposits
- Electropolish
- Hexavalent Chromium
- Trivalent Chromium
- Chromium Post Treatment
- Rinse
- Drying



WWW.OMNEX.COM

Copyright 2020 Omnex, Inc. All Rights Reserved.

19

Plating System Assessment Scope

Process Table F – Hard Chrome Plating

- Metal Cleaning
- Mechanical Preparation
- Acid Activation
- Chrome Plate
- Rinse
- Drying

- Electroless Nickel, Nickel Alloys, and Composites
- Post Treatment
- Drying
- Heat Treatment for Hardness

Process Table G – Electroless Nickel

- Steel, Brass, Bronze
 - Soak Cleaner
 - Ultrasonic Cleaner
 - Alkaline Electrocleaner
 - Acid Activation
- Aluminum
 - Soak Cleaner
 - Etch
 - Deoxidizer/Desmutter
 - Zincate
 - Zincate Strip
 - Rinse
 - EN Strike

Process Table H – Hydrogen Embrittlement Relief Process

Process Table I – Process Control and Test Equipment Verification and Calibration

- Process and Test Equipment
- Process Monitor Frequencies
- In-Process/Final Test Frequencies
- Test Frequencies



WWW.OMNEX.COM

Copyright 2020 Omnex, Inc. All Rights Reserved.

20

Plating System Assessment Procedure

- Ensure PSA requirements are current.
- Download the CQI 11 Excel file from AIAG website.
- Identify and record all applicable plating processes on the PSA cover sheet.
- Conduct PSA with at least one job audit during each assessment to determine the level of compliance.
- Address **Nonconforming** items and determine/implement corrective/preventive actions with root cause analysis within 90 days.
 - Maintain records of corrective action, including verification.
- Number of Process Table items found nonconforming shall be reported.
- Assessment shall be conducted annually, or when a new line is installed, or equipment modification is made, unless there is a customer specified frequency.

Plating System Assessment

- The assessment form has been designed to standardize the assessment of special processes such as plating so that it can be applied consistently and can be utilized as a benchmark against other similar plating operations
- The assessment form contains five sections excluding the cover sheet:
 - SECTION 1: Management Responsibility & Quality Planning
 - SECTION 2: Floor and Material Handling Responsibility
 - SECTION 3: Pyrometry
 - Applicable Process Table
 - SECTION 4: Job Audit

Plating System Assessment Instructions

Guidance	Objective Evidence	Conforming Nonconforming NA
----------	--------------------	-----------------------------------

- In the **Requirements and Guidance** column, the word “*shall*” indicates a requirement and the term “*such as*” indicates that any suggestions given are for guidance only
- The **Requirements and Guidance** column may indicate when and which Process Tables are to be used for the assessment
- If the question is not applicable, put NA in the Conforming/Nonconforming/NA column
- Enter observed evidence in the Objective Evidence column
 - If the observed evidence is in compliance to the question, list Conforming in the Conforming/Nonconforming/NA column
 - If the observed evidence is not in compliance, list Nonconforming in the Conforming/Nonconforming/NA column

SECTION 1

Management Responsibility & Quality Planning

SECTION 2

Floor and Material Handling Responsibility

SECTION 3

Pyrometry

CQI 11 3rd Edition Process Tables

Process Table A – Zinc and Zinc Alloy Plating

Process Table B – Mechanical Plating

Process Table C – Decorative Plating of Metal Substrates

Process Table D – Decorative Plating of Plastic Substrates

Process Table E – Electropolish and Chrome Flash

Process Table F – Hard Chrome Plating

Process Table G – Electroless Nickel

Process Table H – Hydrogen Embrittlement Relief Process

Process Table I – Process Control and Testing Equipment Verification and Calibration



WWW.OMNEX.COM

Copyright 2020 Omnex, Inc. All Rights Reserved.

27



CQI-11 Plating
System Assessment

SECTION 4

Job Audit



WWW.OMNEX.COM

Instructions for Completing Job Audit

- Complete ***at least one*** plating part job audit during each assessment; preferably on a part identified by one or more customers as requiring compliance to CQI-11. More job audits may be done if time permits.
- Preferably, safety or critical parts should be audited.
 - This may not be easily determined with fasteners, especially if the fastener manufacturer does not identify the end customer (auto manufacturer, tier one, etc.)
- It is recommended that the job audit be performed at the end of the Plating System Assessment.
- The job audit of one part / one plating process is **not sufficient** to use as a basis to complete the other sections of the PSA

Instructions for Completing Job Audit

- The job audit is a **compliance-type audit**/review of a specific part and its related paperwork and processing, including plating equipment and processing records for that job from the beginning receipt of a part through processing in the plating operation and inspection to packaging.
 - Parts shall be taken from the shipping area at the dock or from the end of plating operation.
- If an automotive manufacturer's part is not available or cannot be identified, parts from other customers requiring compliance to CQI-11 shall be used for the assessment.

Instructions for Completing Job Audit

- To complete item 4.8 of the Job Audit, the Job Audit Measurements (columns H and I) of each process table utilized by the organization must be populated.
 - For control elements where multiple measurements are made (i.e. concentration) each measurement must be recorded.
- For the product inspection item 4.20 of the Job Audit follow the example provided.
 - For long term tests (i.e. salt spray tests) you can use the most recent results for the audit evidence.



CQI-11 Plating
System Assessment

CONCLUSION

Summary and Questions

Thank You!

Questions?



info@omnex.com
734.761.4940



Glossary

Definitions and Acronyms

Definitions and Acronyms

- **Acid Embrittlement:** A form of hydrogen embrittlement that may be induced in some metals by acid treatment.
- **Acid Pickling:** Immersion of a part in a non-electrolytic acid bath to remove oxides (scale), dirt, tarnish films and other contaminants.
- **Activation:** Elimination of a passive condition on a surface.
- **Adhesion:** The attractive force that exists between a plating and its substrate.
- **Alloy:** A substance having metallic properties and being composed of two or more elements of which at least one is a metal.
- **Alloy Plating:** The code position of two or more metallic elements on a substrate.
- **Anode:** The positive electrode in electrolysis, to which the negative ions are attracted.
- **Anodic Cleaning:** Electrolytic cleaning in which the work is the anode. Also called reverse-current cleaning.

Definitions and Acronyms

- **Automatic Control:** Equipment operating in a manner essentially independent of external influence or conscious control.
- **Barrel Plating (or Cleaning):** Plating or cleaning in which the work is processed in bulk in a rotating container.
- **Bright Dip, Bright Dipping:** A chromate or weak nitric acid dip used after zinc plating to enhance both the appearance and corrosion resistance of the zinc plating.
- **Bright Plating:** An electroplating process resulting in a smooth, lustrous surface without polishing.
- **CASS Test (Copper Accelerated Acetic Acid Salt Spray):** An accelerated test for determining the corrosion resistance of electroplated substrates, primarily applicable to copper/nickel/chromium electroplated parts.
- **Cathodic Cleaning:** Electrolytic cleaning where the work is the cathode. Also called direct cleaning.

Definitions and Acronyms

- **Calibration:** To check, adjust or systematically standardize the graduations of a quantitative measuring instrument to a known standard.
- **Certification:** A third party independent assessment declaring that specified requirements pertaining to a product, person, or process have been met.
- **Chrome Flash (CF):** Electroplating a single thin layer (0.05 – 0.125 microns) of chromium directly on to stainless steel.
- **Controller:** Regulating equipment to verify and adjust process conditions such as chemical concentration, pH, temperature, etc.
- **Current Density:** Current (amperes) per unit area.
- **Decorative Plating:** Plating for which the cosmetic appearance is a primary requirement. For the purpose of this document it is the plating types that are covered under process tables B, C and D (i.e., nickel chrome).

Definitions and Acronyms

- **Electrodeposition:** The process of depositing a substance upon an electrode by electrolysis.
- **Electroless Plating:** The catalytic deposition of a metallic coating by a controlled chemical reduction that is further catalyzed by the metal or alloy being deposited.
- **Electroplating:** The process of using electrical current to plate an electrically conductive object with a thin layer of metal.
- **Electropolishing :** (EP) Electrochemical polishing primarily stainless steel to passivate and/or create a bright finish.
- **Embrittlement:** Reduction in the normal ductility of a metal due to a physical or chemical change.
- **EN :** Electroless Nickel Plating
- **Hydrogen Embrittlement:** A condition of low ductility (brittleness) in metals resulting from the absorption of hydrogen.

Definitions and Acronyms

- **Manual Operation:** Employing a person rather than mechanical controls.
- **Nonconforming Product:** Product that does not conform to the customer requirements.
- **Passivate:** Conversion coating applied by dipping after plating to enhance corrosion protection.
- **Pickling:** Removing surface oxides from metals by chemical or electrochemical reaction.
- **Porosity:** Measure of void spaces in a material.
- **POTW (Public Owned Treatment Works):** Treated water typically supplied by local government.
- **Process Sheet:** A complete list of process parameters and frequency of checks and analysis for a plating line. Sometimes this is the same as the Control Plan.
- **PSA:** Plating system assessment.

Definitions and Acronyms

- **Rack, Plating:** A frame for suspending or holding articles during plating and related operations.
- **Rectifier:** A unit which converts alternating current into direct current.
- **RO (Reverse Osmosis):** Membrane technical filtration method that removes many types of large molecules and ions from solutions by applying pressure to the solution when it is on one side of a selective membrane.
- **Specialty Electroless Nickel Alloys and Composites:** Standard electroless nickel processes contain co-deposits of phosphorus. Specialty electroless nickel contains additional co-deposited materials such as the following: Nickel-Boron, Nickel-PTFE, Nickel-Silicon carbide, etc.
- **Supplemental Treatments (Topcoat, Sealants, and Friction modifiers):** A post-passivation coating to enhance corrosion protection and/or regulate friction properties.

Definitions and Acronyms

- **STEP Test:** Simultaneous Thickness and Electrode Potential Determination of Individual Layers in Multilayer Nickel Deposit.
- **Thermal Cycling Test:** A test for plated materials which is designated to determine the ability of the composite to withstand temperature changes such as for an adhesion test.
- **Timer:** A device that is used for measuring an interval of time and may activate another mechanism at fixed intervals.
- **Trap Points:** Areas in containers (baskets, fixtures, shipping boxes, etc.) or any equipment that may inadvertently retain parts, allowing the potential for parts to be mixed between batches.
- **Verification:** Confirmation, through the provision of objective evidence that specified requirements have been fulfilled.