Understanding CQI-15

Welding System Assessments

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CQI-15

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Course Objectives

- Understand the scope of the welding system assessment
- Prepare to assess a welding system and subsequent jobs in order to ensure it provides for continual improvement, emphasizing defect prevention and reduction of variation and waste in the supply chain

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Agenda

- Introduction and Overview
- Assessor Requirements
- Weld System Assessment Scope
- Weld System Assessment Procedure
- Weld System Assessment Summary Information
- Job Audit Process Tables
  - Gas Metal Arc Welding
  - Resistance Welding
  - Laser Beam Welding
  - Drawn Arc Welding
  - Friction Welding
  - Induction/High Frequency Tube Welding
  - Fastener Projection Welding
  - Magnetically Impelled Arc Butt (MIAB) Welding
- Welding Sustainability Health Chart
- Glossary

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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.

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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).

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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.

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- Omnex Global Head Quarters (Michigan, USA)
  West Coast Operations (San Jose, CA)
- Asia Pacific HQ (Chennai, Pune, Delhi, Bangalore)
- China (Shanghai, Guangzhou, Wuhan, Chengdu)
- Canada (Mississauga)
- Europe (Berlin, Germany)
- Middle East (Dubai, Saudi Arabia, Bahrain)
- Thailand (Bangkok)
- Mexico (Monterrey)
- Singapore
- Malaysia (Kuala Lumpur)

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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
- ✓ 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

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Icebreaker

- Instructor Information:
  - Name
  - Background
- Student Introductions:
  - Name
  - Position / Responsibilities
  - What is your involvement in welding system assessments?
  - What are your experiences with CQI-15?
  - Please share something unique and/or interesting about yourself.

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Introduction and Overview

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

Special Note on WSA Terminology
Shall = requirement for the purpose of the self assessment
Should = recommendation
Such as = suggestions provided for guidance only

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Introduction and Overview

- The previous version showed the categories of:
  - **Not Satisfactory**
  - **Needs Immediate Action (which requires immediate containment actions)**

- CQI 15 Version 2 has changed this slightly per the chart below:

Red	**Any Red Element**	**Does NOT meet the requirements, needs immediate action.** Process review indicates that there is a risk of non-conforming product.
Yellow	**<100% Green -0- Red**	**Does NOT meet the requirements, containment is in place.** Process review indicates that there is enough containment of non-conforming product.
Green	**100% Green**	**Meets all requirements.**

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Introduction and Overview

Welding System Assessment Goals

- Develop a welding 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 welding management systems when coupled with an internationally recognized QMS and applicable customer-specific requirements.
- Provide a common approach to a welding management system for automotive production and service part organizations.

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Introduction and Overview

Assessment Process

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

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Assessor Requirements

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

- Experienced QMS internal auditor (for example the latest edition of ISO 9001 or IATF 16949).
- Possess welding knowledge:
  - Evidence shall include a minimum of 5 years experience in welding or a combination of formal education in welding and welding 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).

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

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Welding System Assessment Scope

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

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Welding System Assessment Scope

Eight Job Audit Process Tables have been developed and the appropriate Job Audit(s) is to be completed during the assessment. The Job Audit Process Tables are specific to welding process and contain the requirements for:

1. Part Print
2. Control Plan
3. Destructive and Nondestructive Test Data
4. Weld Quality Inspection & Reports
5. Rework Procedure and Reports
6. Parameter Documentation
7. Maintenance Records
8. Sustainability
9. Equipment & Robotic Processing Requirements
10. Other

The Process Tables specify the tolerances of process parameters and the frequencies for checking process control parameters and parts.

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Job Audit Welding System Assessment Scope

Gas Metal Arc Welding
- Flux-Cored Arc Welding
- Gas Metal Arc Welding
- Shielded Metal Arc Welding
- Plasma Arc Welding
- Gas Tungsten Arc Welding
- Gas Metal Arc Braze Welding

Resistance Welding
- Resistance Spot Welding
- Projection Welding
- Resistance Seam Welding
- Mash Seam Welding
- Flash Welding

Laser Beam Welding
- Laser Beam Welding

Drawn Arc Welding
- Arc Stud/Fastener Welding

Friction Welding
- Flash Butt Welding
- Resistance Butt Welding
- Ultrasonic Welding
- Inertia Friction Welding
- Direct Drive Friction Welding

Does not include: Friction Stir Welding

Induction/High Frequency Tube Welding
- High-Frequency Seam Welding
- Induction Seam Welding

Fastener Projection Welding
- Projection Welding

Magnetically Impelled Arc Butt (MIAB) Welding

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Welding System Assessment Procedure

- Each WSA shall include a review of the organization's system using the WSA and Job Audit Process Table located in the Excel file.
- Successive assessment shall sample parts from different automotive component manufactures that require compliance to the WSA.
- The organization shall keep records as evidence of compliance per the following method:
  1. Download and save the Excel file that contains the CQI-15 Welding System Assessment by following the steps below:
     - Go to www.aiag.org
     - Enter your username and password
     - Go to *My Account*
       - *Either download an eDocument or print a hard copy*
  2. Save the Excel file that contain the WSA as:
     - **Supplier Name_Site Code_Country_State_City_Year_Month_Day_Weld Assessment.xlsx**
- Each section of the assessment has its own specific tab within the Excel file, we will review each as applicable during this training.

NOTE: This is where CQI version 2 significantly changes methodology from the previous version

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Welding System Assessment

- The assessment form has been designed to standardize the assessment of special processes such as welding so that it can be applied consistently and can be utilized as a benchmark against other similar welding operations.
- Weld System Assessment (required regardless of weld method) contains five sections consisting of questions with requirements and guidance for each question to determine compliance:
  - **SECTION 1: Weld System Process Assessment**
  - **SECTION 2: Documentation**
  - **SECTION 3: Preplanning / Quality Documentation**
  - **SECTION 4: Production Monitoring / Documentation**
  - **SECTION 5: Rework or Scrap Procedure and Reports**

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Welding System Assessment

- If the observed evidence is in compliance, the assessor will note the evidence in the "**Evidence/Gap Identified**" column and select green in the "**Initial Rating**". The current status column will self-populate.
- Same is to be completed where gaps are identified. The assessor will classify as either Yellow or Red.
  - Yellow: Items do not meet the requirement but there is sufficient containment.
  - Red: Items do not meet the requirement and containment is required.
- If the question is not applicable the assessor shall place N/A in the Evidence/Gap Identified column.
- Remember, assessments shall be conducted annually unless otherwise specified by the customer.

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Welding System Assessment Summary Information

Since the CQI 15 Version 2 is driven by the required Excel file we will review the Summary Information Sheet directly.

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Welding System Assessment Standard Questions

- The Weld Assessment still has some standard questions that are applicable regardless of the type of weld system utilized.
  - Excel file has a specific tab for the Weld System assessment

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Process Table(s) CQI-15 Version 1 Replaced

1.0	Arc Welding specific essential variables which shall be addressed in the FMEA, Control Plan and welding procedures (Related to WSA Questions 1.7 and 1.8)								
ITEM #	Category/Process Steps	Arc Stud / Fastener Welding (SW)	Flux-cored Arc Welding (FCAW)	Gas Metal Arc Welding (GMAW)	Submerged Arc Welding (SAW)	Shielded Metal Arc Welding (SMAW)	Plasma Arc Welding (PAW)	Gas Tungsten Arc Welding (GTAW)	Gas Metal Arc Braze Welding
A1.1	Arc voltage		x	x	x		x	x	x
A1.2	Amperage	x	x	x	x	x	x	x	x
A1.3	Current type (AC/DCEN/DCEP)	x	x	x	x	x	x	x	x
A1.4	Wire feed speed		x	x	x		x[1]	x[1]	x
A1.5	Pulse setting variables specific to the OEM of the welding equipment must be documented and controlled			x			x	x	x
A1.6	Stud gun/torch position work angle, travel angle	x	x	x	x	x	x	x	x
A1.7	Contact tip-to-work distance		x	x	x				x
A1.8	Electrode-to-work distance					✓	x	x	
A1.9	Lift height of stud	x							
A1.10	Fastener coating (determines current type)	x							
A1.11	Plunge control mode force or position	x							
A1.12	Flux classification and depth				x				
A1.13	Flux removal and reclaimation plan				x				

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Job Audit Welding System Methods

Gas Metal Arc Welding
- Flux-Cored Arc Welding
- Gas Metal Arc Welding
- Shielded Metal Arc Welding
- Plasma Arc Welding
- Gas Tungsten Arc Welding
- Gas Metal Arc Braze Welding

Resistance Welding
- Resistance Spot Welding
- Projection Welding
- Resistance Seam Welding
- Mash Seam Welding
- Flash Welding

Laser Beam Welding
- Laser Beam Welding

Drawn Arc Welding
- Arc Stud/Fastener Welding

Friction Welding
- Flash Butt Welding
- Resistance Butt Welding
- Ultrasonic Welding
- Inertia Friction Welding
- Direct Drive Friction Welding

Does not include: Friction Stir Welding

Induction/High Frequency Tube Welding
- High-Frequency Seam Welding
- Induction Seam Welding

Fastener Projection Welding
- Projection Welding

Magnetically Impelled Arc Butt (MIAB) Welding

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Gas Metal Arc Welding

CQI-15 Welding System Assessment

- Flux-Cored Arc Welding
- Gas Metal Arc Welding
- Shielded Metal Arc Welding
- Plasma Arc Welding
- Gas Tungsten Arc Welding
- Gas Metal Arc Braze Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

Resistance Welding

CQI-15 Welding System Assessment

- Resistance Spot Welding
- Projection Welding
- Resistance Seam Welding
- Mash Seam Welding
- Flash Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

Laser Beam Welding

- Laser Beam Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

Drawn Arc Welding

- Arc Stud/Fastener Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

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Friction Welding

- Flash Butt Welding
- Resistance Butt Welding
- Ultrasonic Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

Induction/High Frequency Tube Welding

- High-Frequency Seam Welding
- Induction Seam Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

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Fastener Projection Welding

- Projection Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

Magnetically Impelled Arc Butt (MIAB) Welding

All control of variables given in this table are subordinate to applicable customer/OEM specific requirements.

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

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Welding Sustainability Health Chart

- The purpose of the Welding Health Chart:
  - High level look at weld quality history using pass/fail attribute data
  - Used to show failure mode
  - Used to identify which weld or welds need to be further evaluated
  - A tool to show sustainability information
    - **Sustainability:** being the ability to meet all cut and etch attributes of the weld qualification for a period of time without making parameter changes

- The last tab of the Excel file is a Open Item list used for any unsatisfactory (Yellow or Red) findings during the WSA.

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Thank You!

Questions?

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Glossary

Definitions and Acronyms

Definitions and Acronyms

- **Capability:** The total range of inherent variation in a stable process.
- **Control Plans:** Written descriptions of the system for controlling processes for production of parts or bulk materials. Control Plans are written by organizations to address the important characteristics and engineering requirements of the product. Each part must have a Control Plan, but in many cases, “family” Control Plans can apply to a number of parts produced using a common process.
- **Critical Spare Parts List:** A list of service parts critical for the operation of equipment. Extended delay in obtaining spare parts would result in unacceptable delays in the welding operation.
- **Cross-Functional Team:** A team of employees that represent the different functions within an organization. The team will typically consist of an operator, line supervision, process engineer, metallurgist, and quality personnel.
- **Customer:** The recipient of the organization’s or supplier’s product or service.
- **Customer Requirements:** Requirements or specifications from the original equipment manufacturer (typically the automobile company). These may be identified in the contract or purchase order, in engineering standards, part specifications, etc.

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Definitions and Acronyms

- **Inter-Lock:** A method of preventing missed steps within the operations by putting controls on how an operation can be performed in order to force the correct completion of the operation.
- **Nonconforming Product:** Product that does not conform to the customer requirements.
- **Reprocessing:** Any process that is performed on nonconforming product so that it will meet the specified requirements.
- **Responsibility Matrix:** A responsibility matrix defines the designated personnel for all key functions. This matrix includes the primary and secondary designees.
- **Robust:** A stable predictive outcome regardless of variation within operating window; able to withstand its environment, not prone to failure.
- **Shop Traveler:** A document usually created in the receiving department for each batch or lot of parts received. The document defines the process routing of parts.
- **Special Characteristics:** Product characteristics or manufacturing process parameters which can affect safety or compliance with regulations, fit, function, performance or subsequent processing of product. Refer to customer-specific requirements.

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