

Manufacturing Management Program

IMPLEMENTATION OF SAE AS6500

25 SEPT 2019


AS6500 Training

- In-person Instruction
- One day course that covers:
 - The background and history of why the standard was created
 - How AS6500 relates to other SAE standards
 - In-depth coverage of AS6500 definitions, requirements, and implementation
 - How to implement the standard within your organization
 - The benefits of adopting the standard
- By participating in this course, you will be able to:
 - Understand the benefits of implementing AS6500
 - Apply the AS6500 standard to your organization

Course Purpose and Objective

- The standard, SAE AS6500, Manufacturing Management Program was developed to promote the timely development, production, modification, fielding, and sustainment of affordable products by addressing manufacturing throughout the program life cycle
- The course objective is to provide an understanding of this commercial aerospace standard, and how to implement within your organization

Course Outline


- Background
- Overview
- Definitions 
- Requirements
- Implementation & Conformance
- Benefits
- Summary

In Depth Coverage and Discussion of All Definitions and Requirements

Sample: Inspection, Verification, and PPV Definitions and Requirements

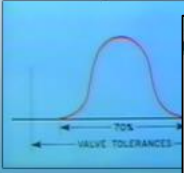
Inspections and Verification

- First Article Inspection (FAI) (§4.10)
 - A complete, independent, and documented **physical and functional** inspection of product to conform to contract, planning specifications, design and inspection requirements being performed prior to the initial stage of production.




Inspections and Verification

- Production Process Verification (PPV) (§6.56)
 - The organization shall conduct PPVs to verify that manufacturing processes, documentation, and tooling are statistically capable of producing parts and assemblies that meet requirements



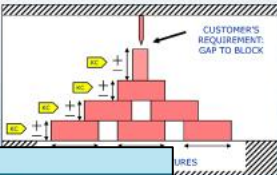
Inspections and Verification (cont.)

- First Article Testing (FAT) (§4.11)
 - Testing and evaluating the first article for conformance with specified contract requirements before or in the initial stage of production.



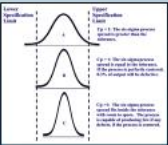

PPVs

- Applies across the factory floor
- Verifies that processes, documentation, and tooling are statistically capable of



PPV ≠ FAI & FAT

- A PPV verifies that manufacturing processes, documentation, and tooling are **statistically capable** of producing parts and assemblies that meet requirements
- FAI/FATs verify that prescribed production methods have **produced a conforming item** as specified by contract, engineering drawings, planning, purchase order, engineering specifications, and/or other applicable design documents

How does your organization perform these?

First Article Inspections/First Article Tests

- First Article Inspections (FAIs)/First Article Tests (FATs) (§6.5.7)
 - At the start of production the organization shall conduct FAIs/FATs
 - **Shall** only be performed on production parts and with production processes, documentation, and tooling that have undergone a PPV
 - **Shall** be performed on parts that:
 - Have not previously been manufactured
 - Have a change in the design affecting fit, form or function of the part
 - Have a change in manufacturing source(s), process(es), inspection method(s), location of manufacture, tooling or materials that can potentially affect fit, form or function
 - Have a change in numerical control program or translation to another media that can potentially affect fit, form or function
 - Experienced a natural or man-made event which may adversely affect the manufacturing process
 - Have had a lapse in production for two years or as specified by the customer

First failures
cause analysis

Sample: Process Capability Definitions and Requirements

Process Capability

- **Process Capability (Cp)** (not defined in AS6500)
 - A means of establishing the extent a process is likely to produce items acceptable to the design
 - Cp measures process spread
- **Process Capability Index (Cpk)** (§ 4.24)
 - A statistical measure of the ability of a process to produce output within specification limits
 - Cpk measures process location
- Both are useful for:
 - Measuring continual improvement
 - Prioritizing processes to improve

Process Capabilities

Process Capabilities (§6.5.5)

- The organization **shall** analyze process capabilities for each critical manufacturing process
 - **Should** use statistical tools to minimize variability and calculate the Process Capability Index (Cpk)

Example: Calculation of Cp

- Cp is simply a measure of how the variation of the process compares with the total tolerance

• Cp measures process spread

Process Capability Levels

- Cpk's relate directly to sigma levels and defects per million opportunities
- AS6500 intent is to optimize trades between cost, quality, and performance

Interpretation of Indices				
Cpk	Sigma Level	Yield %	Defects (ppm)	Evaluation
0.33	1	30.85%	691462	Not Capable
0.67	2	69.15%	308538	Not Capable
1.00	3	93.32%	66807	Barely Capable • Part of process outside of specification
1.33				
1.67				
2.00				

Example: Calculation of Cpk

- Cpk is a measure of how the variation and average of the process compares with each side of the tolerance.

- Cpk measures process location and spread
- It is the smaller value of the "upper" and "lower" calculations

$$Cpk_U = \frac{\text{Available Tolerance}}{3 \times \sigma} = \frac{USL - Avg}{3 \times \sigma} = \frac{131 - 128.4mm}{4.5mm} = 0.58$$

$$Cpk_L = \frac{\text{Available Tolerance}}{3 \times \sigma} = \frac{Avg - LSL}{3 \times \sigma} = \frac{128.4 - 125mm}{4.5mm} = 0.75$$

Process Capabilities Cost Impact

- AS6500 requires SPC only for critical manufacturing processes
- AS6500 intent is to optimize trades between cost, quality, and performance

Critical Manufacturing Process

- 4.5 Critical Manufacturing Process (CMP)
- A process that creates or substantially affects a key or critical characteristic

AS6500 Training Summary

- One day training with in-person instruction

APT
Advanced Product Transitions Corp.

Summary

- DoD and Industry developed AS6500 to focus on manufacturing management in DoD programs to improve product and program performance
- AS6500 promotes the timely development, production, modification, fielding, and sustainment of affordable products addressing manufacturing throughout the life cycle

If an organization continues to do what it has always done, it will not see any improvement – David Karr, 2019

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Advanced Product Transitions Corp.

- **APT Corp.** provides consulting, training, and engineering services to federal, state, and local governments and commercial industry
- Our staff is highly experienced in program management, systems engineering, technology development and transition, manufacturing and quality assurance, supply chain management, and lean enterprise techniques
- Active members of MRL Working Group
 - Key contributor to MRL Deskbook, User Guide, Criteria, and Metrics
 - Working multiple initiatives
 - Recognized MRL training provider
- Active members of AS6500 Standards Committee (G-23)
 - Key contributor to the development of the standard
 - Developing AS6500 implementation training course

Contact Us

- **To Learn More**

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