

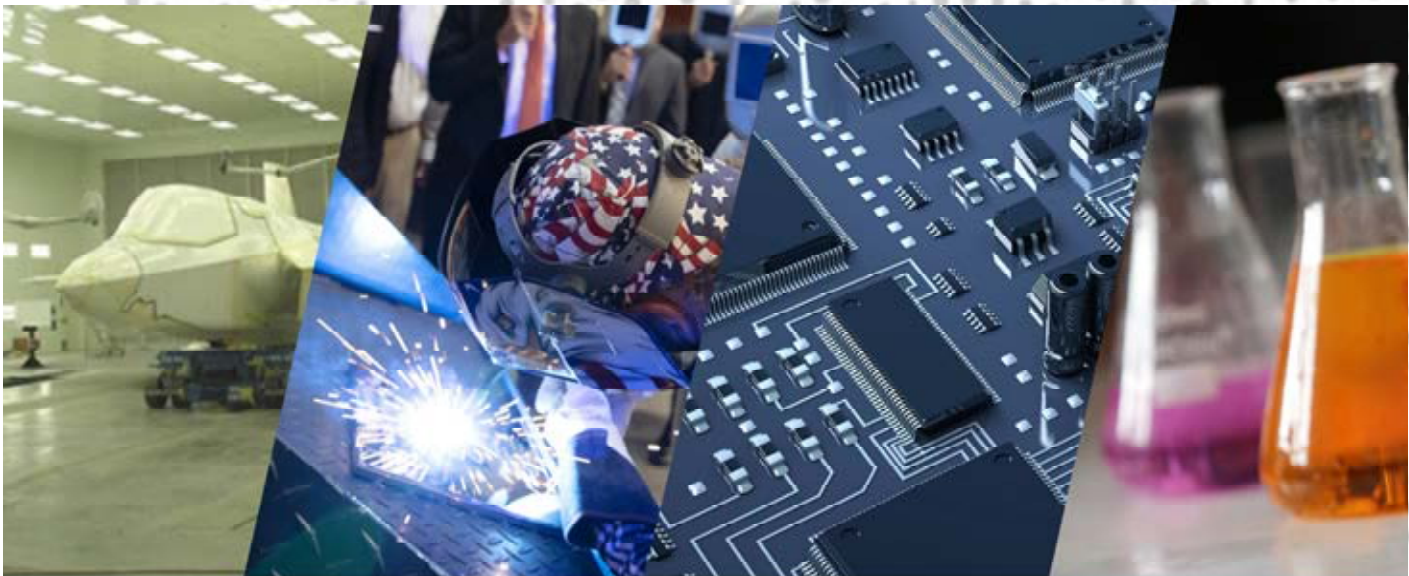
SPG01

Special Processes Guidebook

Issue 1

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Lockheed Martin UK Ampt Hill Ltd



Contents

- 1. Introduction3
 - 1.1. Intent3
 - 1.2. Scope.....3
- 2. What Are Special Processes?3
 - 2.1. ISO9000 Fundamentals and Vocabulary3
 - 2.2. ISO9001 Requirements3
 - 2.3. AS9100 Requirements for Aviation, Space and Defence3
 - 2.4. Summary.....3
- 3. Production Process Verification3
 - 3.1. Verifiable (Non Special) Process3
- 4. Special Process Validation.....3
 - 4.1. Process Control3
 - 4.2. Periodic Testing (Re-Validation)3
 - 4.3. Qualification4
 - 4.4. Monitoring & System Accuracy Testing.....4
- 5. Risks.....4
 - 5.1. Process Failure Mode Effect Analysis (PFMEA)4
- 6. Standards & Specifications4
 - 6.1. External Sources of Special Processes.....4
- 7. Aerospace, Space & Defence Special Processes4
- 8. Nadcap4

1. Introduction

1.1. Intent

The intent of this document is to increase knowledge and understanding of special processes.

1.2. Scope

The term special processes within this document refer to some of the processes undertaken in aerospace, space and defence production processes.

2. What Are Special Processes?

2.1. ISO9000 Fundamentals and Vocabulary

In accordance with ISO9000:2015(E) 3.4.1 Process, Note 5: A process where the conformity of the resulting output cannot be readily or economically validated is frequently referred to as a "special process".

2.2. ISO9001 Requirements

Special Processes are reference in ISO9001 8.5.1 f "the validation, and periodic revalidation, of the ability to achieve planned results of the processes for production and service provision, where the resulting output cannot be verified by subsequent monitoring or measurement"

2.3. AS9100 Requirements for Aviation, Space and Defence

Specific requirements are listed in AS9100 8.5.1.2 Validation and Control of Special Processes as; For processes where the resulting output cannot be verified by subsequent monitoring or measurement, the organization shall establish arrangements for these processes including, as applicable:

- a. definition of criteria for the review and approval of the processes;
- b. determination of conditions to maintain the approval;
- c. approval of facilities and equipment;
- d. qualification of persons;
- e. use of specific methods and procedures for implementation and monitoring the processes;
- f. requirements for documented information to be retained.

2.4. Summary

So, a special process is when the output of a process cannot be verified without destruction of the product. Generally, if you cannot measure or confirm the output of a process (the resulting product or service) with calibrated tools or instruments and know whether it conforms to specifications, the process is likely a special process that requires validation.

3. Production Process Verification

3.1. Verifiable (Non Special) Process

To further understand, an output of a process that can be verified is usually done during the production process verification or inspection. For example, where a machined part is manufactured to design data that includes dimensional tolerances is inspected. In this case, the output can be verified by the use of a calibrated tool or measuring instrumentation. The 'inspection' or production process verification activity ensures the production process is able to produce product that meet requirements. This activity can be referred to as first article inspection. In other words, the product (output) inspection can verify the process.

4. Special Process Validation

4.1. Process Control

Special processes require a different approach to control. Instead of the output being directly measured for conformity, the process itself is 'measured' (validated). This validation process takes the form of periodic testing and qualification of the process and / or operators performing the process against criteria detailed in specifications.

One or more of the following activities are used to validate a special process: -

- Test pieces processed and destructively tested and results evaluated on a periodic basis
- Qualified Operators are periodically evaluated or re-qualified
- Periodic monitoring, testing and system accuracy tests are performed on the process, equipment and measurement instrumentation

4.2. Periodic Testing (Re-Validation)

All special processes must be validated and re-validated (periodically tested) to verify that the process is capable of producing product that repeatedly meets requirements. Usually validation consists of processing a test piece or test standard made of the same material with known properties through the special process and then destructively testing the test piece. For example for surface treatment such as chemical conversion coating, electroplating, anodising or application of paint the validation includes the periodic adhesion testing and salt spray (corrosion) testing of test coupons that are processed on a monthly or batch basis etc.

4.3. Qualification

Some special processes require processing staff to be formally qualified and periodically re-qualified as part of the validation process. For Example, coded welder and weld inspection, Non-destructive Testing (NDT) Level II & III qualification etc.

4.4. Monitoring & System Accuracy Testing

Some special processes require periodic monitoring of the system accuracy. For example, heat treatment system accuracy test and temperature uniformity survey (AMS2750 Pyrometry SAT & TUS) or NDT penetrant flaw detect TAM panel processing and evaluation to verify the NDT system is functioning correctly etc.

5. Risks

If special processes are not validated or periodically tested (re-validated) then, as a consequence, deficiencies can become apparent only after the product is in use or the service has been delivered. For example where parts are coated (plated or painted), lack of process control can result in poor adhesion and the coating may crack, blister, flake or peel after delivery or in service etc.

5.1. Process Failure Mode Effect Analysis (PFMEA)

All processes including special processes can benefit from a failure mode effect analysis activity to anticipate risks and the output of the PFMEA should input into process control documentation. For further guidance see AS13004 Process Failure Mode and Effects Analysis and Control Plans.

6. Standards & Specifications

All special processes have a related standard or specification that defines the validation method, frequency and criteria to be applied. For example AMS2750 for heat treatment or MIL-DTL-5541 for chemical conversion coatings etc.

6.1. External Sources of Special Processes

When outsourcing special processes from external providers the standard / specification including specific requirements for process control and validation must be included in the design data or purchase order.

7. Aerospace, Space & Defence Special Processes

Aerospace, Space & Defence Special Processes Incorporated in Manufacturing		
Welding	Surface Engineering & Chemical Processing	Electronics
Rotational Friction / Inertia Welding, Torch / Induction Brazing, Flash Welding & Laser Welding, Electron Beam Welding, Resistance Welding, Fusion Welding & Evaluation of Welds	Electroplating, Electroless Plating, Anodising, Chemical Conversion Coatings, Passivation, Painting & Dry-Film, Surface Enhancement, Etching & Chemical Cleaning	Printed Circuit Board (PCB) Manufacture, PCB Assembly (Incl. Soldering), Cable and Harness Assemblies, Conformal Coating, Cell Manufacture & Battery Array Assemblies
Composites	Elastomer Seals	Heat Treatment
Prepreg, Adhesive Bonding, Resin Film Infusion (RFI), Metal Bonding, Core Processing, Liquid Resin Processing & Compression Moulding	Plate Seals, Fabric / Textile Reinforced Seals, O-Rings & Moulded Shapes	Brazing, Aluminium Heat Treating, Carburizing, Nitriding, Hot Isostatic Pressing, Induction Hardening & Sintering
Materials Testing & Inspection	Nonconventional Machining	Non-destructive Testing
Chemical Analysis, Mechanical Testing, Metallography, Micro Indentation Hardness Testing, Corrosion Testing, Fastener Testing, Mechanical Testing, Physical Testing, Thermal Testing & Coordinate Measuring Machines (CMM)	Electrochemical Machining, Electrochemical Grinding, Electrical Discharge Machining, Laser Beam Machining, Laser Part Marking & Spark Erosion Grinding	Penetrant Flaw Detect, Anodise Flaw Detect, Magnetic Particle Inspection, Ultrasonic Testing, Radiographic Inspection Testing & Eddy Current Inspection Testing

8. Nadcap

[Nadcap](#) is an industry-managed approach to conformity assessment that brings together technical experts from both Industry and Government to establish requirements for accreditation, accredit Suppliers and define operational program requirements for special processes. Organisations that hold Nadcap accreditation for a particular special process can demonstrate that validation and re-validation activities are performed to industry best practices.

SPG01 Issue Control

Date	Iss	Clause	Changes	By
5 Sep 2022	1	All	Special Processes Guidebook established	Konrad Burgoyne

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