Special Process Handbook

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Change History

Effective Date	Revision	Created By	Description of Change
5/14/2024	A	Rich Welch	Initial release.

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1. Purpose, Scope, and Users

1.1. Purpose

The purpose of this handbook is to ensure CFD Research Corporation's employees and suppliers are aware of and understand special processes.

1.2. Scope

This handbook is applicable to special processes carried out during manufacturing activities to the extent specified herein.

1.3. Users

Purchasing/Subcontracts, Engineering, Manufacturing, and Quality Assurance (QA) are responsible for complying with this handbook to the extent specified herein.

2. Definitions

Term	Definition
Special process	A process where conformity of the resulting output cannot be readily or economically validated.

3. Process

3.1. Manufacturing Process Verification (Non-special)

Process outputs are verified during manufacturing process verification or inspections such as the inspection of a machined part against its engineering drawing using a calibrated monitoring and measuring equipment. This type of inspection activity verifies the manufacturing process is capable of producing product that meets defined requirements. The initial verification is referred to as a first article inspection (FAI). For additional information, refer to *QSP-QA-0008, First Article Inspection.*

3.2. Manufacturing Process Validation (Special)

3.2.1. Process Control

Special processes take a different control approach to that of non-special processes. Rather than monitoring and measuring an output's conformity, the actual process is measured (validated). This validation takes the form of periodic testing and qualification of the process and its operators against the specification (requirement) criteria.

Special process validation occurs using one or more activities as follows:

- Testing of parts processed including destructive testing with results evaluated at defined intervals.
- Evaluating and re-qualifying of a qualified operator at defined intervals.
- Performing monitoring and testing periodically on the special process and its measuring equipment.

Refer to Appendix A – Manufacturing Special Processes for special process examples.

3.2.2. Periodic Testing

Special processes are validated and re-validated (tested periodically) to verify a process' capability of producing product repeatedly meeting defined requirements. Validation consists of processing a unit under test (UUT) or standard manufactured from the same material with known properties through special process followed by destructively testing the UUT.

For example, surface treatment like chemical conversion coating, anodizing, and powder coating validation is accomplished on an UUT coupon for each lot/batch through an adhesion test or salt spray.

3.2.3. Qualification

Various special processes require manufacturing and quality personnel to receive formal training followed by re-qualification as part of the manufacturing validation process. Personnel will hold and maintain certication as proof of successfully completing the initial and re-qualification (follow-up) training.

Examples of meeting such requirements include as follows:

- Certified welder inspector (CWI) through the American Weld Society (AWS)
- Non-destructive testing (NDT) Level II and III through National Aerospace Standard (NAS) 410.

3.2.4. System Accuracy

Periodic monitoring of system accuracy is required for various special processes such as surveying temperature uniformity for heat treating or detecting a known flaw on a test panel prior to performing non-destructive testing (NDT). This monioring verifies the system being used is accurate and properly functions.

3.3. Risks of Deficiencies

Not validating or periodically testing (re-validating) special processes may result in detection of deficiences after product or service delivery or is in use. To better predict and mitigate these risks, a Process Failure Mode Effect Analysis (PFMEA) is performed.

3.4. Standards and Specifications

Each special process has a related standard or specification that defines the validation method, frequency, and criteria to be applied.

Special process standards and specifications include but are not limited to:

- ASTM G85 A4, Sulphur Dioxide (SO_2) salt spray test, cyclic
- MIL-A-8625, Anodic Coatings for Aluminum And Aluminum Alloys
- MIL-DTL-5002, Surface Treatments and Inorganic Coatings
- MIL-DTL-5541, Chemical Conversion Coatings of Aluminum and Aluminum Alloys
- NAS410, NAS Certification and Qualification of Non-Destructive Test Personnel

Nadcap is a unique industry-managed program that evaluates and accredits external providers of specific processes such as:

- Coatings
- Conventional machining
- Heat treating
- Chemical processing
- Welding
- NDT

4. References

- QSP-QA-0008, First Article Inspection
- Appendix A – Manufacturing Special Processes

5. Quality Records

- None noted.

6. Appendix A – Manufacturing Special Processes

Special Process	Examples
Chemical Processing	Electroless plating, Chemical conversion coatings, Passivation, Anodic coatings, Etching
Welding	Inertia welding, Fusion welding, Brazing, Laser Welding, Electron Beam welding, Friction Stir welding
Electronics	Printed Circuit Board (PCB) assembly, Cable and Harness assembly, Conformal coating, Soldering
Composites	Pre-preg, Core processing, Resin film, Adhesive bonding
Elastomer Seals	O-rings, Seals
Heat Treatment	Brazing, Aluminum Heat Treating, Induction Hardening
Materials Testing and Inspection	Hardness testing, Corrosion testing, Adhesive testing, Fastener testing, Thermal testing, Material analysis
Non-Destructive Testing	Magnetic particle inspection, Ultrasonic testing, Vibration testing, Radiographic inspection, Eddy current inspection
Coatings	Primer, Painting, and Powder Coat
Non-Conventional Machining	Electrical discharge machining, Laser part marking, Electrochemical machining