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1.0 Purpose

This handbook's purpose is to ensure Smith & Co.'s employees and its external providers are aware of and understand the requirements of special processes.

2.0 Scope

This handbook applies to all special processes conducted throughout all manufacturing activities within scope of the QMS.

3.0 Users

Purchasing, Subcontracts, Engineering, Manufacturing, and *Quality* are responsible for conforming with this handbook to the extent specified herein.

4.0 General

A special process is any process where conformity of the resulting output cannot be readily verified.

4.1 Manufacturing Process Verification (Non-special)

Process outputs are verified during manufacturing process verifications or inspections such as the inspection of machined or fabricated part against an engineering drawing and bill of material (BOM) using calibrated inspection, measuring, and test equipment (IM&TE). These inspection activities verify the manufacturing process can produce products and processes that meet defined requirements. Initial verification is referred to as a first article inspection (FAI), which is further addressed in First Article Inspection Handbook (HBK 8.5).

4.2 Manufacturing Process Verification (Special)

4.2.1 Process Control

Special processes take a different control approach to that of a non-special process. Instead of monitoring and measuring output 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 product including destructive testing with results evaluated at defined intervals.
- Evaluating and re-qualifying qualified operators at specified intervals.
- Performing monitoring and testing periodically on the special process, material validity, and its IM&ET.

For a list of special processes along with examples, refer to Appendix A – Special Process and Example.

4.2.2 Periodic Testing

Special processes are validated and re-validated (periodically, randomly tested) to verify process capability of producing products repeatedly while 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 a UUT coupon for each lot/batch through a salt spray test.

4.2.3 Qualification

Some special processes require manufacturing and quality personnel to receive formal training followed by re-qualification as part of the manufacturing validation process. Personnel will maintain certification as proof of successfully completing the initial and re-qualification training.

Examples of meeting these requirements include:
- Certified welder inspector (CWI) through the American Weld Society
- Non-destructive testing (NDT) Level II and III through National Aerospace Standard 410.

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4.2.4 System Accuracy

Periodically monitoring system accuracy is required for processes such as surveying temperature uniformity for heat treating or detecting a known flaw on a test panel prior to performing NDT. This monitoring verifies the system is accurate and functions properly.

4.3 Deficiency Risk

Not validating or periodically testing a special process can result in detection of deficiencies after a product or service delivered or in use. To predict and mitigate these risks, a Process Failure Mode Effect Analysis (PFMEA) should be completed.

4.4 Standards and Specifications

Each special process has an associated standard or specification that defines the validation method, frequency, and criteria. Special process standards and specifications include but are not limited to:

- ASTM G85 A4, Sulphur Dioxide (SO2) 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 an industry-managed program that evaluates and accredits external providers of processes like:

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

5.0 References

- HBK 8.5, First Article Inspection Handbook
- Appendix A – Manufacturing Special Processes

6.0 Records

- First article inspection records
- Special process records
- Technical data package

7.0 Appendix A – Special Process and Example

Special Process	Examples
Chemical Processing	Electroless plating, Chemical conversion coatings, Passivation, Anodic coatings, Etching
Welding	Inertia, Fusion, Brazing, Laser, Electron Beam, and Friction Stir
Heat Treatment	Brazing, Aluminum Heat Treating, Induction Hardening
Material Testing and Inspection	Hardness testing, Corrosion testing, Adhesive testing, Fastener testing, Thermal testing, Material analysis
NDT	Magnetic particle inspection, Ultrasonic testing, Vibration testing, Radiographic inspection, Eddy current inspection
Non-Conventional Machining	Electrical discharge machining, Laser part marking, Electrochemical machining, 3D printing

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