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SPECIAL PROCESSES GUIDEBOOK



LEONARDO UK LTD –
ELECTRONICS DIVISION



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1 INTRODUCTION

1.1 Purpose

This purpose of this document is to increase knowledge and understanding of Special Processes within Leonardo UK (LEUK) and within the Supply Chain.

1.2 Scope

When we refer to a 'Special Process' this is a reference to processes that are executed in Aerospace, Space & Defence sectors. Special Processes are identified by the LEUK Engineering Organisation and referenced on assembly or part drawings and specifications (i.e. specified finishes for surface treatments, soldering, etc.).

2 WHAT DEFINES ASPECIAL PROCESS

2.1 ISO9000 & ISO9001 Definitions

ISO9000 section: 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**'.

"**ISO9001** section: 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."

2.2 AS9100-- Requirement

AS9100 section 8.5.1.2 Validation and Control of Special Processes; 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;

requirements for documented information to be retained

2.3 Leonardo Definitions

LEUK expand on the AS9100 definition as a manufacturing process controlled by specification where:

- The product undergoes a physical, chemical or metallurgical transformation or special examination, where conformance to the specification cannot be readily verified by normal inspection methods.
- The quality of the product depends on use of specific equipment operated in a specific manner, under controlled conditions, by trained personnel with instructions, procedures and standards.

The product must be destroyed to fully verify compliance to the controlling specification.

3 PROCESS VALIDATION

3.1 Verifiable Processes (Non-Special Process)

For any Non-Special Process, the output of the manufacturing process is verifiable through various traditional testing methods, usually conducted during production verification or inspection.

For example, measurement of dimensions on a produced part using callipers & gauges to verify compliance to LEUK requirements. This verification can be part of First Article Inspection or ongoing product output inspection.

For verifiable processes, the process is verified by product validation via testing.

4 SPECIAL PROCESS VALIDATION

4.1 Process Control

Special Processes cannot be easily verified and validated to ensure process control.

When compared to a verifiable process, a different method is required to validate the process.

For special processes, the product is verified by process validation via testing.

For Special Processes, it is the process itself that must be verified and validated. This is usually conducted by performing audits or periodic testing of key process parameters.

Operators will perform the process in accordance with the required process specification.

Special Processes are controlled by a defined set of characteristics / parameters that are documented and controlled throughout the manufacturing processes to ensure repeatability

The following are methods to validate special processes:

- Validation of the process parameters/Process Control Plan
- Periodic destructive testing of sample test pieces, processed under manufacturing conditions.
- Qualified operators are audited or re-qualified over set periods.
- Monitoring, testing and system accuracy is also tested, including the process equipment and measurement instrumentation.

The processes are periodically re-assessed for re-validation to ensure continuous control by LEUK or a third-party e.g. Nadcap.

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.

There are certain Special Processes that require staff/operators to be qualified to a set standard to be allowed to execute the required process. For example, personnel working in non-destructive testing must

be certified to NAS410, with a level 2 and level 3 required on site. This does not negate the need to validate the process.

Suppliers or sub-contractors must hold a LEUK Approval Certificate or Nadcap Certificate (including any relevant LEUK specifications in their Nadcap scope) to provide work to LEUK. LEUK Preference is for Suppliers and sub-contractors to hold Nadcap as far as is reasonably practicable.

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.

The risk is minimised if we ensure the correct process, operator and materials are used when conducting special processes. If the process is followed to the same method as how it has been previously validated, risk is reduced to a minimum.

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.

For Special Processes LEUK require:

- Process Approval / Certification
- Process Specification referenced in the technical documentation

In addition, when a special process is referenced in the applicable drawing/technical documentation, the following requirements shall be met:

- Definition of the special processes,
- Identification of the characteristics to ensure its repeatability under controlled conditions.
- Description of the types of control to ensure the output meets specification.

7 SPECIAL PROCESS COMMODITIES

The below table contains special process categories and specific processes within each category. Each of the below specific processes will have or produce one or more characteristics that can be only tested or verified by destructive methods.

Additive Manufacturing	Aero Structure Assembly	Chemical Processing
Vat Photopolymerisation, Material Extrusion, Material Jetting, Binder Jetting, Laser/Electron Beam Powder Bed Fusion, Sheet Lamination, Directed Energy Deposition	Rivets, Bolt Installation, Installation of Bonded Inserts, Sealing of Nut Plates, Electrical Bonding, Bush and Bearing Installation	Anodising, Chemical Conversion Coatings, Electroplating, Electroless Plating, Passivation, Painting & Dry-Film, Etching & Chemical Cleaning
Coatings	Composites	Elastomer Seals
Thermal Spray, Vapour Deposited Coatings, Diffusion Coating Processes, Coating Evaluation, Plating of Coated Parts	Adhesive Bonding, Core Processing, Liquid Resin Processing, Metal Bonding, Prepreg, Resin Film Infusion (RFI)	Molded Rings, Molded Compression Seals and Molded O-Ring Cord, Molded-In-Place Gaskets & Plate Seals, Fabric/Textile Reinforced Seals, Elastomer Seals for Compounding
Electronics	Heat Treating	Materials Testing & Inspection
Printed Circuit Board (PCB) Manufacture, PCB Assembly (inc. Soldering), Cable & Harness Assemblies, Conformal Coating	Aluminium Heat Treating, Brazing, Carburizing, Gas/Ion/Plasma, Hot Isostatic Pressing, Induction Hardening, Sintering, Stress Relief for AM	Chemical Analysis, Mechanical Testing, Metallography, Micro Indentation Hardness Testing, Corrosion Testing, Fastener Testing, Physical Testing & Thermal Testing
Metallic Materials Manufacturing	Non-Conventional Machining	Non-Destructive Testing
Forging, Casting, Metallic Powder Manufacture	Electrochemical Machining, Electrochemical Grinding, Electrical Discharge Machining, Laser Beam Machining, Laser Part Marking, Spark Erosion Grinding, Abrasive Water Jet Machining	Anodise Flaw Detect, Eddy Current Inspection Testing, Magnetic Particle Inspection, Penetrant Flaw Detection, Radiographic Inspection Testing, Ultrasonic Testing
Non Metallic Materials Manufacturing	Surface Enhancement	Welding
Adhesive Films, Core, Fibres, Prepreg, Resin	Surface Enhancement Peening, Automated Peening, Flapper Peening, Manual Peening, Pneumatic Needle Peening	Electronic Beam Welding, Flash Welding & Laser Welding, Fusion Welding & Evaluation of Welds, Resistance Welding, Rotational Friction/Inertia Welding

8 PERFORMANCE REVIEW INSTITUTE (PRI)

PRI (Performance Review Institute) is a non-for-profit organisation that have offices in USA, UK, China and Japan.

It provides supply chain oversight programs, quality management systems approvals and professional development for various industries including the aerospace and defence sector.

PRI administer the Nadcap program, arranging the meetings and co-ordinating actions within the various hierarchies of the program.

8.1 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.

Nadcap assessments are process-specific and very detailed. They are far more stringent than quality system audits such as AS9100. Nadcap process accreditation is a mandatory requirement for suppliers to Lockheed, Northrop Grumman, SAAB, Raytheon, Navair and others.

As of 7-Nov-25, LEUK currently accept Nadcap certification for the following critical process commodities:

AM	Additive Manufacturing	MI	Measurement & Inspection
AQS	Aerospace Quality System	MMM	Metallic Materials Manufacture
CM	Counterfeit Mitigation	MTL	Material Testing Laboratories
COMP	Composites	NDT	Non-Destructive Testing
CP	Chemical Processing	NMMM	Non-Metallic Material Manufacture
CT	Coatings	NMMT	Non-Metallic Material Test
ETGCHA	Electronics – Cable Harness Assemblies	SEAL	Elastomer Seals
ETGPB	Electronics – Printed Boards	SLT	Sealants
ETGPBA	Electronics – Printed Board Assemblies	WLD	Welding
HT	Heat Treatment		

8.2 EAN

EAN (formally EAuditNet) is web-based software that supports and improves efficiency in the auditing and accreditation systems of industry-managed programs administered by the Performance Review Institute. EAN is developed and maintained by PRI for the benefit of industries where safety and quality are shared values, implementing a standardized approach to quality assurance.

Suppliers should have access to the database to validate their sub-contractors Nadcap approval status and source sub-contractors that are compliant to LEUK General Conditions of Purchase. If the Supplier has any concerns/queries regarding the scope of their sub-contractor, or for potential sub-contractors who aren't Nadcap approved, they should contact the sub-contractor in the first instance before contacting the LEUK Special Process Mailbox for clarification.

9 GEA

GEA (Global Electronics Association), formerly IPC (Institute of Printed Circuits), is a global non-profit, member-driven organization and leading source for industry standards, training, industry intelligence and public policy advocacy.

GEA administer the suite of IPC standards offering a framework to harmonise industry practises across the global electronics sector. GEA represent all facets of the electronics industry, including design, printed board manufacturing, electronics assembly, and test.

GEA's IPC certification is used in conjunction with LEUK/Nadcap for certification to electronics special processes. IPC certification is only applicable for demonstrating employee competence to perform the process and not the infrastructure surrounding the process. IPC certification should be considered as a pre-requisite prior to considering approval of any potential suppliers.

10 RELATED DOCUMENTATION AND TOOLS

10.1 Documentation

Doc Code	Title
SAE AS9100D	Quality Management Systems - Aerospace - requirements
Nadcap AC7000 Series	Nadcap Audit Criterion for all Special Processes
IPC Series of Documents	The Global Association for Electronics manufacturing

10.2 Resources

Doc Code	Title
Leonardo Special Process Site	https://uk.leonardo.com/en/suppliers/special-processes
Special Process Mailbox	special.process@leonardo.com
EAN Database	https://www.eauditnet.com/eauditnet/ean/user/login.htm
PRI Webpage	https://p-r-i.org/nadcap/
IPC Website	https://www.ipc.org