EPPAP

EMBRAER PRODUCTION PART APPROVAL PROCESS

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CHANGES IN THIS REVISION

General
✓ Inclusion of eligibility criteria based on AS9145. ✓ Overall improvement of EPPAP requirements' content (deliverables, due dates and guidelines). ✓ Exclusion of the deliverables LAYOUT, WORKFORCE QUALIFICATION and MANUFACTURING READINESS ASSESSMENT from EPPAP list.

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I. SCOPE

This document defines the requirements for preparing, submitting and approving parts according to EMBRAER Production Part Approval Process (EPPAP).

II. DEFINITIONS

- ✓ ALT (Accelerated Life Test) – A test methodology that utilizes rapid cycling or stress levels higher than those the products are subjected to during field service, in order to identify failures in a compressed period of time. A proper accelerated test reveals the failure modes that could occur in the field under normal use conditions and does not introduce failure modes that would never occur under such conditions. Examples: HALT, enhanced endurance, acoustic, ballistic, ambient, etc.
- ✓ ATP (Acceptance Test Procedure) – the procedure conducted in a product to determine if the requirements of a specification or contract are met.
- ✓ CIs (Critical Items) – items (and all their breakdown levels) which have a significant impact on product realization and subsequently its use impacting safety, performance, fit, form, function, manufacturability, service life, etc.
- ✓ COTS (Commercial off-the-shelf) – commercial item available and sold in substantial quantities intended by design to be procured and utilized without modification as it is sold in the marketplace.
- ✓ Dummy – the exact mechanical equivalent of fully functional, electronically active component.
- ✓ HASS (Highly Accelerated Stress Screening) – a production screening method applied in 100 % of produced products in order to detect infant mortality failures caused by deviations in the manufacturing process or issues with electronic components.
- ✓ KCs (Key Characteristics) – the attributes or features of a material, process or part whose variation has a significant impact on the CI and/or product (Reference: AS9103 - Variation Management of Key Characteristics).
- ✓ LAI (Last Article Inspection) – Is required when production source is to change. LAI is the same as FAI but conducted on a product prior to the end of production in the existing source.
- ✓ Program phases:
    - JDP – Joint Definition Phase
    - DDP –Detail and Design Definition Phase
    - VER – Verification Phase
    - POP – Pre Operation Phase
    - SE – Series Phase
- ✓ Standard part – A part manufactured in complete compliance with an established industry specification that contains design, manufacturing, and uniform identification requirements. The specification must include all information necessary to produce and conform the part and must be published so any person/organization may manufacture the part. Examples include, but are not limited to, National Aerospace Standard (NAS), Aerospace Standard (AS), Military Standard (MS).

III. APPLICATION

EMBRAER Production Part Approval Process (EPPAP) is an output of Advanced Product Quality Planning (APQP) governed by AS9145 and applicable to:

- Product Development
    - New hardware designs including hardware with embedded software
        - Final Product or
        - Selected levels of parts (parts with an assembly as defined by the organization or customer)
    - Design Changes to a previously approved product
- Manufacturing Process Development
    - New Processes
    - Process Changes to a previously approved process
- Work Transfers
    - Change of site
    - Change of source

The scope of application shall be negotiated with Embraer Quality Engineering and registered in the EPPAP Scope Matrix.

The following types of product are not eligible to EPPAP:

a. Dummy parts, testing or engineering units out of manufacturer's configuration control and not supposed to be installed in prototype or production aircraft.
b. COTS and standard parts.
c. Standard raw material.

EPPAP may not be applicable to products already developed and/or approved, including reuse Part Numbers (EMBRAER's or other platforms) with representative in-service life (availability of field data under similar operational conditions of the proposed application). In this case, supplier is encouraged to provide technical substantiation and argumentation for EPPAP exemption however the final decision will be made by EMBRAER Quality Engineering at its sole discretion. In case during the development phases a modification is required in a product declared as developed and/or approved, EMBRAER reserves the right to evaluate the modification magnitude and the associated risks and revise the EPPAP scope previously agreed as needed.

IV. PART APPROVAL REQUIREMENTS

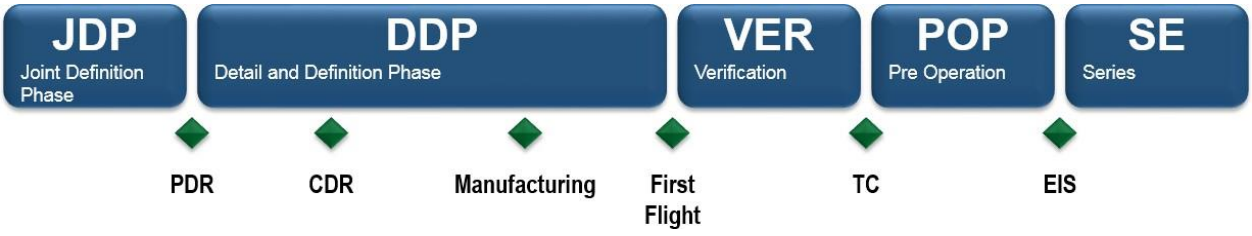
Supplier shall detail scope for each EPPAP requirement in the EPPAP scope matrix (X.1).
Supplier shall complete the following deliverables.

1. Design Risk Analysis (DRA).
2. Process Flow Diagram.
3. Process Failure Mode Effect Analysis (PFMEA).
4. Control Plan.
5. Measurement System Analysis.
6. Process Capability Studies.
7. Tooling, Checking Aids and Fixture Approval.
8. Visual Aspect Criteria.
9. GD&T Inspection.
10. First Article Inspection (FAI).
11. Special Process.
12. Sub Tiers Management.
13. First Part Qualification (FPQ).
14. Accelerated Life Tests (ALT).
15. High Accelerated Stress Screening (HASS).
16. Acceptance Test Procedure (ATP).
17. Packing.

V. EPPAP PLAN

Supplier shall elaborate an EPPAP Plan according to the Table 1 and based on the scope of application (Scope Matrix) negotiated with Embraer Quality Engineering.
Figure 1 is a reference for development programs only and shows the integration of the EPPAP deliverables in the development process.

FIGURE 1 – PROGRAM PHASES, FOR REFERENCE



When the phases of figure 1 are not applicable (for programs in series production or even in development phase), the delivery due dates shall be jointly agreed between supplier and Embraer Quality Engineering.
EPPAP Plan shall be defined considering the necessary cycle to comply with the requirements without affecting the delivery schedule of products.

VI. EPPAP DELIVERABLES

Supplier shall perform the deliverables in accordance with table 1, in agreement with the EPPAP plan and the scope of EPPAP matrix.

In the context of Table 1, due dates 'Before Manufacturing' and 'Before first shipset delivery' are related to the first units to be provided for prototype aircraft (subjected to certification test campaign) or production aircraft, whichever occurs first.

Note: In case the production strategy foresees the manufacturing of a given number of units in an experimental environment (e.g., laboratory) and/or with non-definitive production means, this information must be declared in the EPPAP Plan followed by the proposed due dates for each requirement/deliverable affected by this scenario. It must be clear that some requirements can be normally met according to the original due dates (e.g., DRA, ALT, and Control Plan).

TABLE 1: EMBRAER PRODUCTION PART APPROVAL PROCESS

TOPIC	DELIVERABLE	DUE DATE	GUIDELINES
1. DESIGN RISK ANALYSIS	DRA Plan: ▪ 100% of scope defined. ▪ Schedule (execution dates and assignees).	PDR	Potential failure modes related to product performance (e.g., fit, form, function), durability, service life, reliability, manufacturability, maintainability, and cost shall be identified, considered and addressed by the design of the product. CIs and Product KCs shall be defined as potential inputs for other EPPAP deliverables. The scope definition shall consider final products (end items) and critical components. Note: Design Failure Modes and Effects Analysis (DFMEA) methodology can be used as a record of this activity (reference SAE J1739).
	DRA Report: ▪ Documented design risks, mitigations needed, actions taken and results obtained. ▪ CIs and Product KCs.	CDR	
2. PROCESS FLOW DIAGRAM	▪ Preliminary version of plant floor and process flow diagram.	PDR	Plant floor shall indicate all steps from receiving to shipping. Process flow diagram shall present all operations of manufacturing, testing and inspections sequentially up to finished product. Machine, equipment, and tooling description must be indicated on process flow as applicable.
	▪ Final version of plant floor and process flow diagram.	CDR	
3. PROCESS FAILURE MODE EFFECT ANALYSIS	PFMEA with RPN calculated, risks identified and actions implemented.	Before Manufacturing	Applicable to final product (end item) and CIs. For any potential failure mode and effect with severity 9 or 10, a design evaluation action is also recommended. Actions shall be implemented for at least the 30% highest RPN The SAE AS13004 standard can be used as reference for PFMEA elaboration.
4. CONTROL PLAN	Preliminary version.	CDR	Control plan shall consider final product (end item), CIs and KCs. The SAE AS13004 standard can be used as reference.
	Final version.	Before Manufacturing	

5. MEASUREMENT SYSTEM ANALYSIS	MSA Plan.	CDR	Applicable for KCs and CIs. The MSA Plan shall be updated with new measurement systems as needed. When gages or methods are defined to be not appropriate after MSA, the investigation and actions must be taken for correction or replacement.
	MSA Results.	Before Manufacturing	
6. PROCESS CAPABILITY STUDIES	List of eligible process and product characteristics.	CDR	Evaluation of applicability for CIs and KCs.
	Implementation Plan.	Before Manufacturing	
7. TOOLING, CHECKING AIDS AND FIXTURE APPROVAL	List of tooling, checking aids and fixtures.	CDR	Tooling, checking aids and fixtures used for product manufacturing, inspection and testing. Besides tooling identification, the list shall contain its classification (e.g., drilling, assembly, inspection) and the affected product. Tooling approval data shall be available for Embraer upon request.
	Updated list of tooling, checking aids and fixtures with approval status.	Before Manufacturing	
8. VISUAL ACCEPTANCE CRITERIA	Preliminary visual acceptance standard.	CDR	CIs with direct exposure to the Final Customer or items that may present subjectivity for visual acceptance.
	Final visual acceptance standard.	Before first shipset delivery	
9. GD&T INSPECTION	GD&T Inspection Plan.	CDR	Applicable to final products and/or CIs. GD&T Inspection Plan shall contain: ▪ Identification of critical dimensions. ▪ Measurement procedure ▪ Equipment (including targeting accessories, extensions, auxiliary devices such as pins and bushings or others). ▪ Fixtures or tooling used for product inspection. ▪ Definition of Software for metrology and analysis. GD&T Inspection Report shall contain: ▪ Demonstration of Datum alignment. ▪ All GD&T features according to drawing/3D model Note: Raw data (point clouds) collected by 3D measurement equipment shall be available for Embraer upon request.
	GD&T Inspection Report.	Before first shipset delivery	
10. FIRST ARTICLE INSPECTION	FAI Report (FAIR).	Before first shipset delivery	FAI and according to AS9102 requirements. Note: In case the current production source changes the LAI (also based on AS9102) shall be conducted and a report issued before last shipset delivery.

11. SPECIAL PROCESS	Preliminary special processes list.	CDR	Applicable for in-house and outsourced special processes. The special processes list shall include location and qualification responsibility (supplier or third party, including scope of NADCAP accreditation) Special processes shall be qualified prior to production start. Reference: EQRS – EMBRAER Quality Requirements for Suppliers, OPRs (010.2018 & 011.2018).
	Qualification documents for special process approval according to "GUIDELINES FOR SPECIAL PROCESS APPRAISAL".	Before Manufacturing	
	Updated special processes list.	Before EIS	
12. SUB TIERS MANAGEMENT	Sub tiers management plan.	PDR	The sub tiers management plan shall comprise but not limited to the following aspects: ▪ List of procedures for supply chain management. ▪ Procurement and selection process (new suppliers). ▪ Criteria for supplier's classification/ categorization. ▪ Control and monitoring process (e.g., KPIs, audits planning, corrective actions, source inspection, and flow down of customer requirements). ▪ Risk analysis process.
	Supply chain risk analysis report.	Before EIS	Supply chain risks of EMBRAER products shall be identified and managed to ensure the expected quality and delivery performance throughout the product lifecycle.
13. FIRST PART QUALIFICATION	FPQ Schedule.	PDR	Applicable for composite parts only. FPQ according to NE40-251. FPQ schedule shall contain the milestones of FPQ plan, execution and report. FPQ must be approved by Embraer prior to first ship set delivery.
	FPQ Report.	Before first shipset delivery	
14. ACCELERATED LIFE TEST	ALT Plan.	CDR	All test stages, such as planning, preparation, execution and reporting shall be in accordance with the latest version of NE07-044. Based on the applicability rules defined by NE07-044, the products shall undergo HALT and/or ENHANCED ENDURANCE. The design improvements required from the maturity test shall be implemented in the configuration of the first shipset to be delivered for: - Prototype aircraft, when HALT applies. - Production aircraft, when ENHANCED ENDURANCE applies.
	ALT Procedure.	30 days prior to test start	
	ALT Report.	30 days after test conclusion	

15. HIGHLY ACCELERATED STRESS SCREENING	HASS Plan.	CDR	All test stages, such as planning, preparation, proof of screen execution and reporting shall be in accordance with the latest version of NE07-044. The proof of screen shall only be performed once the HASS procedure is approved by EMBRAER. The test shall be incorporated to the manufacturing process of the first shipset to be delivered for serial production aircraft.
	HASS Procedure.	30 days prior to proof of screen test start	
	Proof of Screen Report.	30 days after proof of screen test conclusion	
16. ACCEPTANCE TEST PROCEDURE	Test Procedure.	Before Manufacturing	Applicable to end items and critical components. The ATP shall contain: ▪ Product functionalities. ▪ Target values and tolerances. ▪ Benches and measurement devices. Note: Supporting documentation (e.g., calibration certificates, benches design and validation reports) shall be available for Embraer upon request.
17. PACKING	Packing Plan.	CDR	Packing Plan shall contain drawings and/or pictures to evidence the compliance with EMBRAER Package Manual, available at: https://www.embraersuppliers.com/esuppliers/#/en-US/supplier-requirements Packing proposal shall be approved by Embraer prior to first delivery.

VII. SUBMISSION

Supplier shall complete elements of an EPPAP and provide evidence of the deliverables as agreed in the EPPAP scope matrix and according to the EPPAP plan.
Deliverables' evidence as well as any other document related to EPPAP shall be submitted via Embraer System (PLM or any other tool to be defined by Embraer).
EMBRAER reserves the right to require the revision of EPPAP deliverables and application whenever appropriate.

VIII. EPPAP CERTIFICATE

After approval of deliverables by EMBRAER Quality Engineer, supplier shall release the EPPAP certificate for EMBRAER approval. The certificate shall include revision level and date of approval for all deliverables.
For development programs the limit date to have the EPPAP Certificate is EIS.

IX. PART SUBMISSION STATUS

The conclusion of EPPAP is the certificate approval and the status will be according to the following:

1. APPROVED – Indicates that part meets all EMBRAER´s requirements and specifications and therefore supplier is authorized to ship parts to EMBRAER without any restriction.
2. INTERIM APPROVED – Indicates that part does not meet all EMBRAER's requirements and specifications, but deviations are considered acceptable for an interim period. However, this approval will be just granted to supplier if the following restricted conditions are established:

a. Problem root cause is clearly identified for each deviation.
b. Containment actions are in place.
c. Action plan is agreed and approved by EMBRAER to solve all deviations. EPPAP re-submission is mandatory to obtain approval status.

EMBRAER notifies supplier of the submission final disposition.
NOTE: Any approval by EMBRAER of any documents, drawings, reports or the like provided by supplier shall not exclude nor transfer to EMBRAER the liabilities and responsibilities of supplier in relation to EMBRAER on the items eventually approved.

X. TEMPLATES

X.1 EPPAP Scope Matrix


EPPAP Scope Matrix Rev F.xlsx

X.2 EPPAP Certificate


EPPAP Certificate Rev F.xlsx

X.3 EPPAP Forms


EPPAP Forms Rev F.xlsx