

Critical Parts

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Rotorcraft Structures Workshop
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27/29.602 Requirement

Objective:

- Ensure critical parts are controlled during design, manufacture, and throughout their service life
 - to minimise the risk of failure by ensuring the critical characteristics are maintained.

Applicability:

- Structural Components, rotor drive systems, rotors and mechanical control systems

Procedure:

- Identify Critical Parts → Critical Parts List
- Establish a Critical Parts Plan → to identify and control the critical characteristics



CIVP may be applicable (see dedicated presentation)

Background of 27/29.602

→ Critical Part requirement is applicable to Rotorcraft only:



Rotorcraft have parts the single failure of which could be catastrophic!

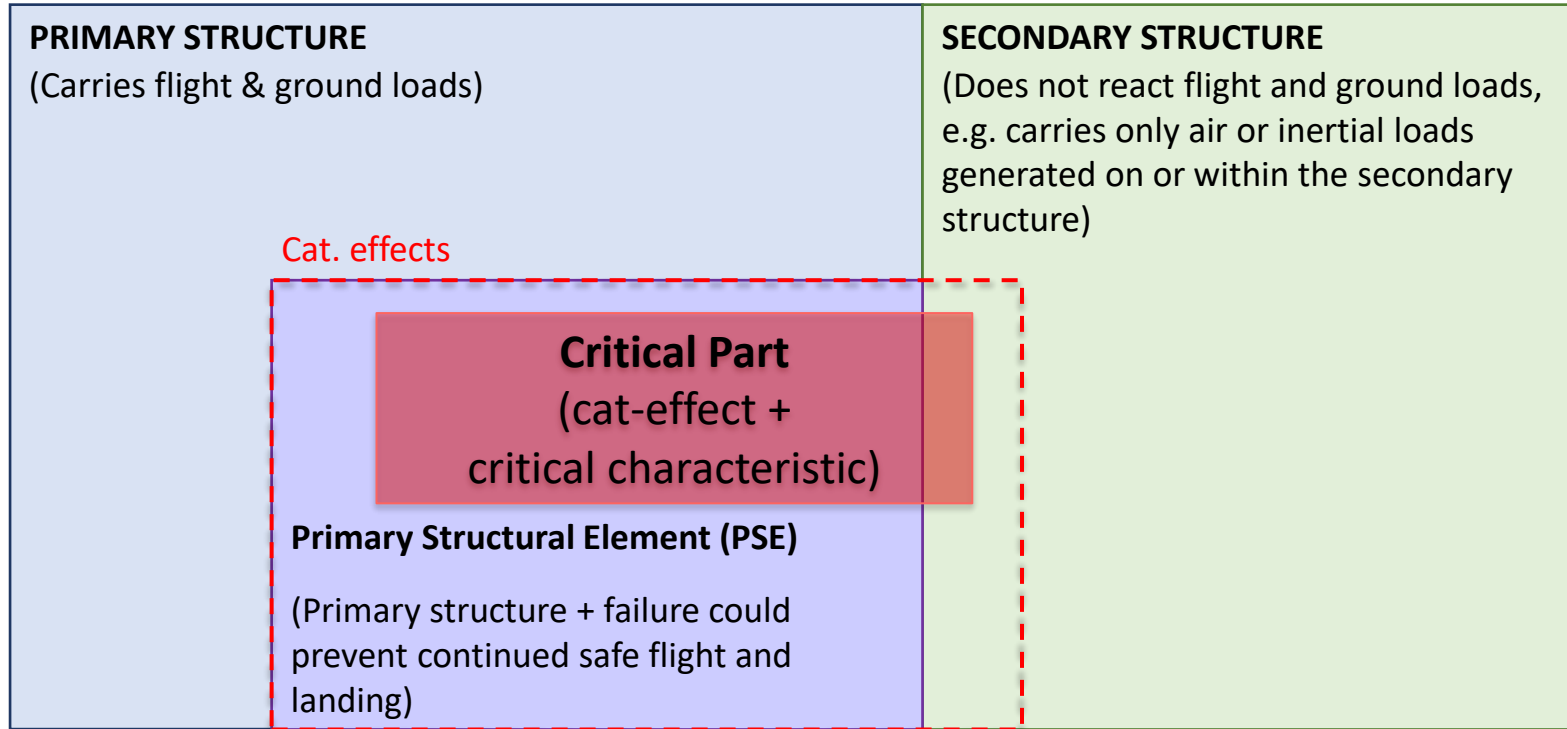
→ Rule introduced in 1999, requiring control processes of critical parts to be formalised and submitted as part of TC process.

→ Critical Parts selection should focus on specific parts and their specific critical characteristics that need to be maintained to prevent catastrophic failure.



Note: Engines also have critical parts in accordance with CS-E. Critical Parts for Engines have a dedicated definition.

Part Classification – Critical Parts



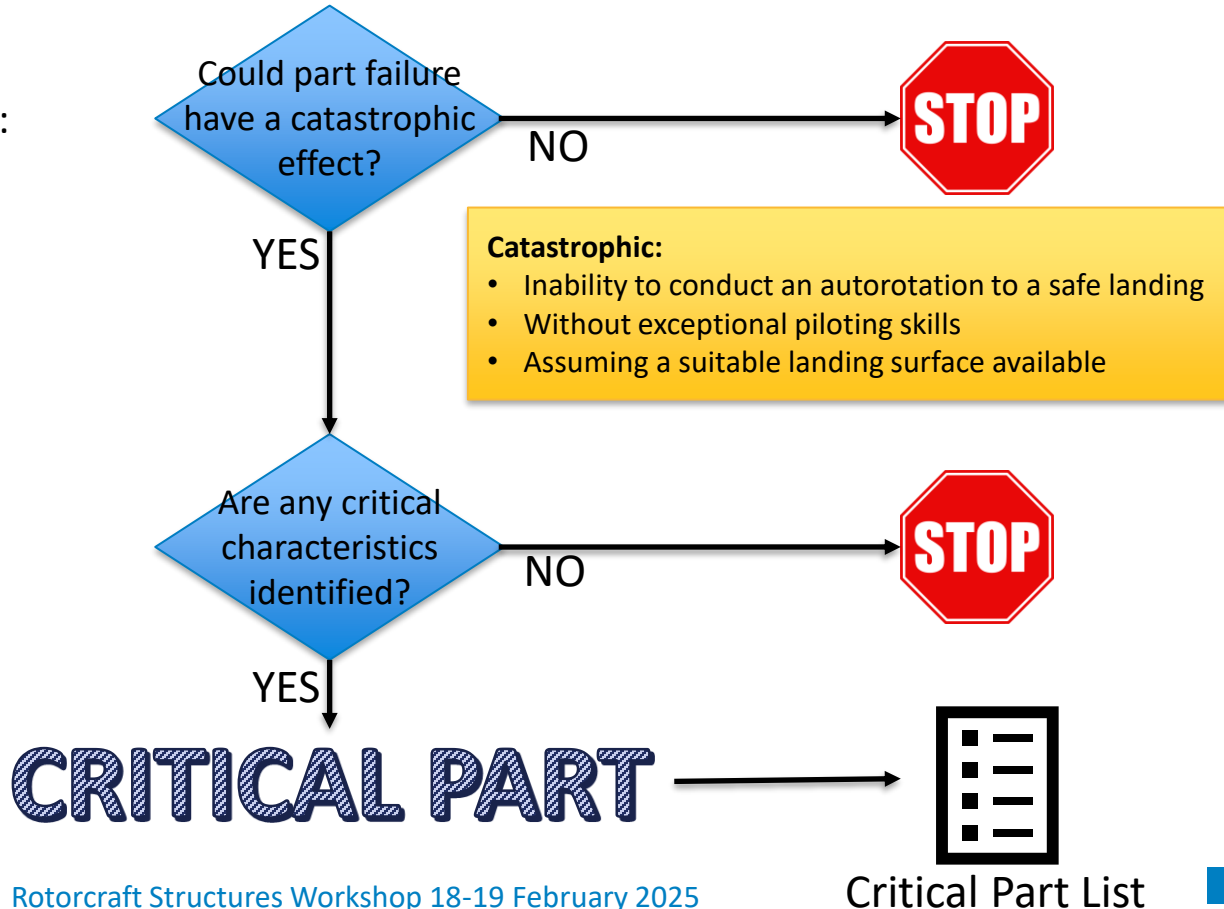
Identification of Critical Parts

Identification of candidate parts:

FAILURE ASSESSMENT

Identification of critical parts:

Hoists: Critical Parts may also be defined for Hoists (see ETSO-2C208)



Critical Characteristics

→ Critical characteristics need to be identified and controlled.

Examples of critical characteristics:

Flaws / anomalies size

Grain direction / grain size

Residual stresses

Surface roughness

Hardness

Examples of processes that may need additional controls (i.e. frozen process):

Casting

Forging

Titanium processes

Shot peening

Welding

Bonding

Machining

Thermo-mechanical treatments

NOTE: The critical characteristics depend on the part and specific locations on the part

Critical Part Plan



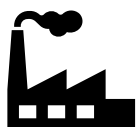
Critical Part List established and reported in the ICA



Classification as Critical Part and the critical characteristics stated in technical documentation, i.e. drawings, reports, work instructions, inspection documents



Procedures established for identify and controlling critical characteristics



Procedures for changing manufacturing procedures to be established (including change of manufacturing facility, change of tool or any item which could have an effect on critical characteristics)

XX-XXXX Parts must be Serialized

Critical Part Plan



Comprehensive **instructions for maintenance, inspection and overhaul**



Detailed **handling instructions** may be necessary (e.g. for transportation, etc.)



Traceability of manufacturing steps from material to final product



Record keeping and archiving



Critical characteristics of critical parts from **suppliers** need also to be maintained:
(TCH/STCH should be aware of any change that could impact the critical characteristics.)



Continued Integrity Verification Programme (**CIVP**) may be required

Part 21: Change Classification

Appendix A to GM 21.A.91 Examples of Major Changes per discipline

1. Structure

(ii) changes to materials, processes or methods of manufacture of primary structural elements, such as spars, frames and **critical parts**

Proposed new text (NPA 2024-04):

*(ii) changes to materials, processes or methods of manufacture of **critical parts** that **impact the critical characteristics***

Part 21: Certain Major Changes

AMC No 1 to 21.A.263(c)(5), (8) and (9) Scope and criteria

ED Decision 2019/018/R

2. Definition of ‘certain major changes’ and ‘certain supplemental type certificates’

2.1 Criteria for limitations on eligibility

2.1 Criteria for limitations on eligibility

The following types of changes are not eligible:

- (i) “changes that affect a part or system, a single failure of which may have a catastrophic effect upon the product, and for which critical characteristics have been identified, which should be controlled to ensure the required level of integrity;”

Part 21: Repairs

GM 21.A.435(a) Classification of repairs

ED Decision 2012/020/R

3. Examples of 'Major' repairs

(ii) A repair to life limited or critical parts.

AMC 21.A.433(b) and 21.A.5 Repair design and record-keeping *[applicable from 18 May 2022 — ED Decision 2021/007/R]*

ED Decision 2019/018/R

4. Special consideration should also be given to life-limited parts and critical parts, notably with the involvement of the TC or STC holder, when deemed necessary under 21.A.433(a)(4).

Part 21: Part Identification

21.A.805 Identification of critical parts

Regulation (EU) No 748/2012

In addition to the requirement of point 21.A.804, each manufacturer of a part to be fitted on a type-certificated product which has been identified as a critical part shall permanently and legibly mark that part with a part number and a serial number.

Part 21: POA

21.A.143 Exposition

Regulation (EU) 2015/1039

- (a) The organisation shall submit to the competent authority a production organisation exposition providing the following information:

- (11) a description of the quality system and the procedures as required by point 21.A.139(b)(1);

21.A.139 Quality System

Regulation (EU) No 748/2012

- (b) The quality system shall contain:

- The control procedures need to include specific provisions for any **critical parts**.

Part 21: Level of Involvement

AMC 21.B.100(a) and 21.A.15(b)(6) Level of involvement (LoI) in a certification project for a type certificate (TC), a major change to a TC, a supplemental type certificate (STC), a major repair design or European technical standard order (ETSO) authorisation for an auxiliary power unit (APU)

ED Decision 2019/018/R

3.3. Criticality

The potential impact of a non-compliance within a CDI should be classified as critical if, for example:

- a CDI affects parts that are classified as **critical as per CS 27.602/29.602**, CS-E 515, or that have a hazardous or catastrophic failure consequence (e.g. a principal structural element as per CS 25.571).

Conclusion

- Critical Part Plan must be established and Critical Part List must be defined
- Critical Characteristics must be identified and controlled during design, manufacture, and throughout their service life
- CIVP may be applicable (see dedicated presentation)
- Part 21 regulations and guidance for Critical Parts:

Section	Notes
Major change definition	Critical Parts are Major Changes (<i>if critical characteristics affected</i>)
Certain major changes	Critical Parts are excluded from certain major changes
Repairs	Major Repair Classification
Part identification	Serialization of critical part obliged
Lol	CDI is critical
POA	Specific POA provisions for critical parts



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