European Union Aviation Safety Agency

Certification Memorandum

Certification of Elastomeric Components on Rotorcraft

EASA CM No.: CM-S-016 Issue 01 issued 31 January 2025

Regulatory requirement(s): CS--27, CS--29

In accordance with the EASA Certification Memorandum procedural guideline, the European Union Aviation Safety Agency proposes to issue an EASA Certification Memorandum (CM) on the subject identified above. All interested persons may send their comments, referencing the EASA Proposed CM Number above, to the e-mail address specified in the "Remarks" section, prior to the indicated closing date for consultation.

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EASA Certification Memoranda are living documents into which either additional criteria or additional issues can be incorporated as soon as a need is identified by EASA.

Log of issues

Issue	Issue date	Change description
001	09.04.2024	First issue.

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1. Introduction

1.1. Purpose and scope

The purpose of this Certification Memorandum is to provide specific guidance for CS-27 or CS-29 rotorcraft elastomeric component certification in the absence of a dedicated requirement and guidance material.

This CM addresses compliance demonstration for elastomeric components made of metals and elastomers.

1.2. References

It is intended that the following reference materials be used in conjunction with this Certification Memorandum:

Reference	Title	Code	Issue	Date
CS-27	Certification Specifications and Acceptable Means of Compliance for Small Rotorcraft CS-27	CS-27	Initial Issue and all subsequent amendments	14 Nov. 2003
CS-29	Certification Specifications and Acceptable Means of Compliance for Large Rotorcraft CS-29	CS-29	Initial Issue and all subsequent amendments	14 Nov. 2003
AMC 20-29	Composite Aircraft Structure	CS-27 & CS-29	Initial Issue	19 Jul. 2010
FAA AC 27	Certification of Normal Category Rotorcraft (Changes 1 - 7 incorporated)	CS-27	Issue 1B and subsequent amendments	4 Feb. 2016
FAA AC 29	Certification of Transport Category Rotorcraft (Changes 1 - 7 incorporated)	CS-29	Issue 2C and subsequent amendments	4 Feb. 2016
AC 21-26A	Quality system for the manufacture of composite structures	AC 21	Issue A	23 Jul. 2010

1.3. Abbreviations

AC	Advisory Circular
ALS	Airworthiness Limitation Section
AMC	Acceptable Means of Compliance
AVCS	Active Vibration Control System
CAT	Catastrophic
CM	Certification Memorandum

CS	Certification Specification
DT	Damage Tolerance
EASA	European Union Aviation Safety Agency
F&DT	Fatigue and Damage Tolerance
FAA	Federal Aviation Administration
FMEA	Failure Mode and Effects Analysis
~~FMECA~~	~~Failure Mode, Effect & Criticality Analysis~~
HAZ	Hazardous
LL	Limit Load
MGB	Main Gearbox
MoC	Means of Compliance
PSE	Principal Structural Element
STCH	Supplement Type Certificate Holder
TCH	Type Certificate Holder
UL	Ultimate Load

1.4. Definitions

Elastomeric Component	Describes components consisting of one or more elastomeric elements bonded to one or more metallic (*) elements. These components are ~~designed to accommodate axial, shear and/or rotational forces~~ designed to react to loads and accommodate motions and are used for their hyper-elasticity and/or visco-elasticity, allowing high deformation spring-like behaviour which may be combined with a damping capability through energy dissipation, vibration reduction and/or introduction of degree(s) of freedom.
Elastomeric Element	Describes the part of the elastomeric component that consists of an elastomeric material
Elastomer material	Describes a natural or synthetic "highly polymeric, organic networks capable of reversibly absorbing large deformations" (ASTM D1566)
Metallic Element (*)	Describes the part of an elastomeric component that consists of metallic material (e.g metallic shims and armature).

Shim	Describes internal metallic* elements, used for example as layers inside the elastomeric laminate
Metallic armature (*)	Describing fittings connected by elastomer laminate or elastomer material.
Elastomer laminate	Describes a succession of metallic shims and elastomer material layers bonded together and onto the armature

* This CM describes guidance for compliance demonstration for Elastomeric Components~~ made including~~ consisting of elastomeric material and metallic elements. Any future development with non-metallic elements should require complementary investigation.

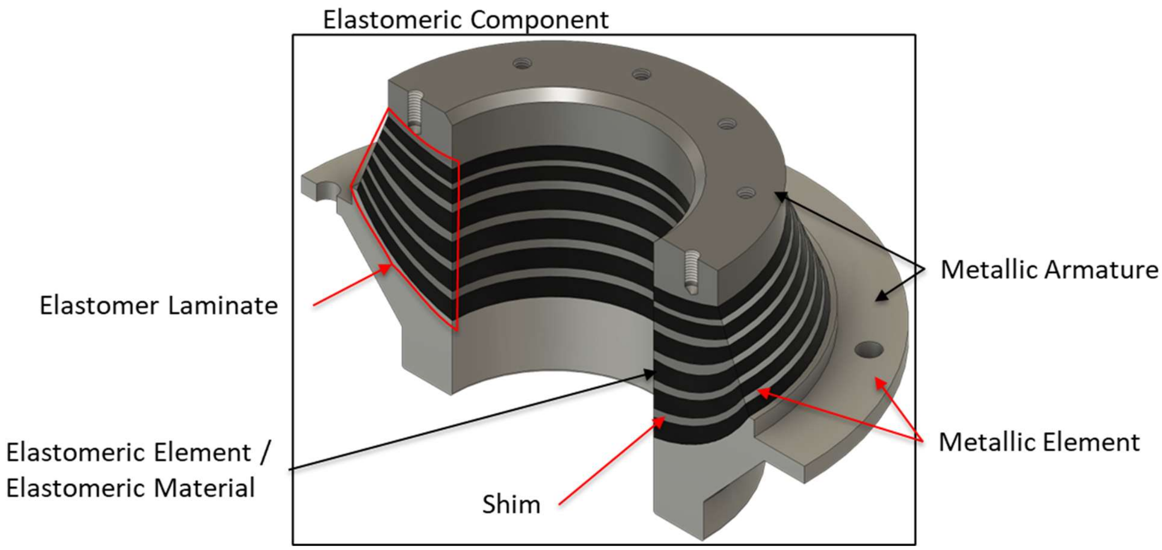

Figure 1: Example of the element-definitions of an Elastomeric Component. Picture showing a spherical bearing.

2. Background

Elastomeric components have been certified on rotorcraft since the 1940s and an increasing ~~the~~ number of those components are introduced ~~entering~~ in the designs of modern rotorcraft~~ has increased over time~~. They are often part of ~~helicopter~~ the rotor design (Spherical bearing, pitch control ends, damper rod end, damper body...) or interact with the fuselage design for suspension function (MGB coupling, engine mount, AVCS…).

The major benefit ~~introduced by~~ of this technology is ~~to have~~ an efficient and simplified system design~~ed~~ to react and accommodate loads and motions (angle and displacement). For example, the laminate design involved in spherical bearings eliminates the sliding and/or rolling between surfaces that usually takes place in conventional bearings when accommodating the required motions. The functions of several conventional bearings can frequently be combined into a single elastomeric bearing with a damage tolerance evaluation leading to simple inspection.

So far, no airworthiness requirement is specifically dedicated to elastomeric components.

This CM addresses structural elastomer applications. Non-Structural applications (e.g. seals such as O-rings) are excluded from this CM.

3. EASA Certification Policy

The ~~current~~ certification memorandum's objective is to share guidance and common good practices for the certification of elastomeric components involved in structural applications of rotorcraft design.

This certification memorandum provides guidance on:

- The general principles for elastomeric component classification and criticality
- The requirements ~~guidance~~ commonly used for elastomeric component substantiation
- The usually accepted certification approach including the parameters influencing elastomeric component performances.

3.1. Requirement Considerations for Elastomeric Components ~~Applicable Requirements for Elastomeric Components~~

The following non-exhaustive list~~ing~~ outlines the requirements to be considered for elastomeric components. The specific set of requirements for each certification project will depend on the ~~specific~~particular application.

Requirement	Title
CS 27/29.241	Ground Resonance
CS 27/29.251	Vibration
CS 27/29.301	Loads
CS 27/29.303	Factor of Safety
CS 27/29.305	Strength and Deformation
CS 27/29.307	Proof of structure
CS 27/29.361	Engine torque
CS 27/29.471	Ground Loads General
CS 27/29.473	Ground loading conditions and assumptions
CS 27/29.547 (b), (c), (d), (e)	Main and Tail Rotor Structure
CS 27/29.549	Fuselage and rotor pylon structures
CS 27/29.571	Fatigue Tolerance Evaluation of Metallic Structure
CS 27/29.573	Damage Tolerance and Fatigue Evaluation of Composite Rotorcraft Structures
CS 27/29.601	Design (Design and Construction)
CS 27/29.602	Critical parts
CS 27/29.603	Materials
CS 27/29.605	Fabrication Methods
CS 27/29.607	Fasteners
CS 27/29.609	Protection of Structure
CS 27/29.610	Lightning and static electricity protection
CS 27/29.611	Inspection Provisions
CS 27/29.613	Material Strength Properties and design values
CS 27/29.619	Special factors
CS 27/29.629	Flutter and Divergence
CS 27/29.663	Ground resonance prevention means
CS 27/29.861	Fire protection of structure, controls, and other parts
CS 27/29.907 (a)	Engine Vibration
CS 27/29.917	Design (Rotor Drive System)
CS 27/29.1509	Rotor Speed
CS 27/29.1529	Instructions for Continued Airworthiness

3.2. Approach for Certification

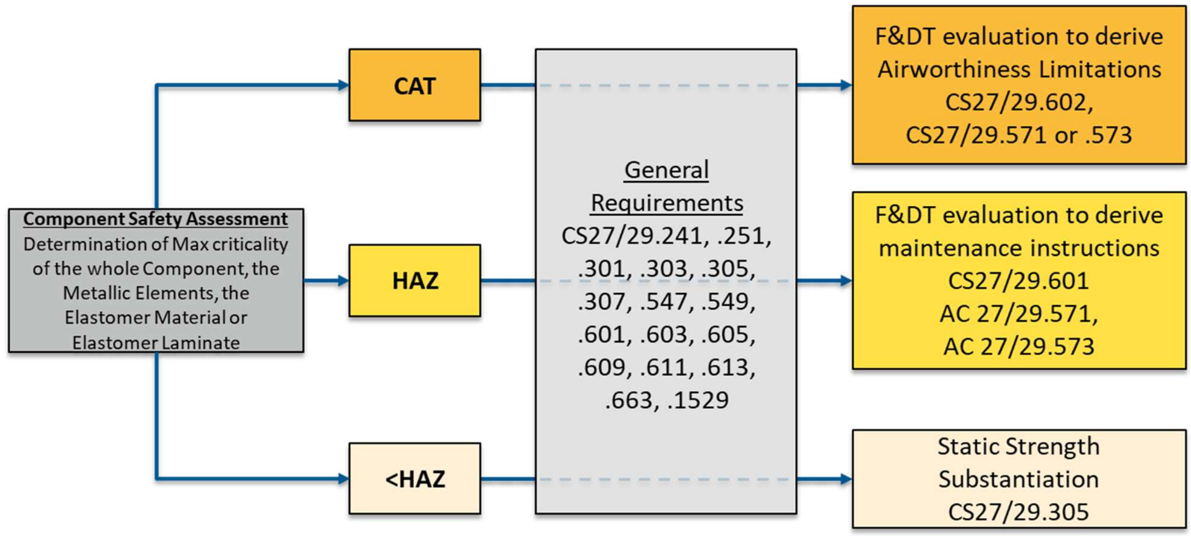

Figure 2: Substantiation principle based on criticality classification

The applicant should~~is asked to~~:

- Perform Fatigue and Damage Tolerance evaluation to derive Airworthiness Limitations for components with catastrophic (CAT) failure consequences
- ~~to perform a damage tolerance (DT) and fatigue evaluation for an elastomeric component with hazardous (HAZ) / catastrophic (CAT) failure consequences.~~
- Perform Fatigue and Damage Tolerance evaluation to derive maintenance instructions for components with hazardous (HAZ) failure consequences (see note).
- ~~to~~ Determine an operating limit based on reliability for non-catastrophic and ~~/~~non-hazardous elastomeric components with failure consequences < HAZ
- Record the Airworthiness Limitations in the ALS and the operating limits in the maintenance manual.

Note: The purpose of performing a Fatigue and Damage Tolerance evaluation for components with HAZ failure consequences is:

- To address reliability per CS27/29.601 to evidence that “no design features or details that experience has shown to be hazardous or unreliable” exists.
- To address the design assessments requested for compliance demonstration to CS29.547(b) “Main and tail rotor structure” and CS 29.917(b) “Rotor drive system”. The applicant should identify appropriate compensating provisions for parts the failure of which is CAT or HAZ. The common practice is to identify “fatigue and damage tolerance evaluation” as a compensating provision for identified elastomeric components.

~~It is noted that DT evaluation is requested for elastomeric components with HAZ failure consequence, however different safety factors (a reduced SF based on a statistical approach) may be proposed compared to those applied to the analysis of components with CAT failure consequences.~~

3.2.1. Design Assessment

For main and tail rotor structures and rotor drive systems, CS 29.547(b) and CS 29.917 (b) request a design assessment including "a detailed failure analysis to identify all failures that will prevent continued safe flight or safe landing and must identify the means to minimise the likelihood of their occurrence".

This is usually evaluated through:

- A hazard assessment performed at rotorcraft level,
- A detailed analysis of functional failures classified as catastrophic and hazardous,
- A failure analysis performed for each of those components of the system,
- The establishment of the consequence of each component failure and their associated severity,
- Identification and evaluation of compensating provisions or risk reduction measures.

FMEA~~/FMECA~~ is one failure analysis method of the design assessment currently accepted to identify the components failure severity and define the part classification (see 3.2.2), although alternative methods are also acceptable.
It is important to consider both the functional and structural aspects of the component for the classification. Compensating provisions should not be considered when determining the consequence of the failure of the component.

~~TCH/STCHs should not consider compensating provisions when proceeding to the component classification.~~
In general, an elastomeric component is composed of single or multiple layers of elastomer and metal shims, bonded and vulcanised to metallic armatures, in order to accommodate static and/or dynamic inputs of motion and loads. The failure analysis should be detailed enough, taking into consideration the consequences and dormant aspect of failure of each element or sub-component of the elastomeric component, to properly determine the failure criticality of each element or sub-component. The elastomeric component classification should be based on the maximum failure severity level of all elements.

This failure analysis principle of a design assessment should be extended to any elastomeric component installed on the rotorcraft in order to identify its failure severity.
This logic ~~can~~ may also be adopted for CS 27 category B rotorcraft, although design assessment is not a requirement for this category of rotorcraft.

3.2.2. Part Classification

3.2.2.1. PSE (Principal Structural Element)

Each elastomeric component that contributes significantly to the carrying of flight and ground loads and the failure of which could result in catastrophic failure of the rotorcraft, must be identified and classified as a PSE.

The existing guidance provided on part classification in AC 29-2C (Change 7~~9~~) and AC 27-1B (Change 7~~9~~) (MG 8 and MG 11) are considered appropriate for the classification of elastomeric components.

3.2.2.2. Critical Part

For an elastomeric component, the failure of which could have a catastrophic effect upon the rotorcraft, and for which critical characteristics have been identified, compliance to CS 27/29.602 must be demonstrated. Elastomeric components ~~are considered to~~ may have critical characteristics that must be clearly identified in the TCH/STCH critical part plan. Any processes having an influence on either the elastomeric or the metallic element performance or the performance of the component must be strictly controlled according to the requirements defined in the TCH/STCH critical parts plan.

Evidence should be provided to EASA that the TCH/STCH has identified, together with the elastomeric component supplier, the critical characteristics and developed a quality plan, including quality control associated with this elastomeric component. Further information can be found in chapter 3.2.8.1.

3.2.3. Loads

Elastomeric components may be subject to complex loading conditions, that dependent on frequencies, phases, angles, motions and environmental conditions. The loading conditions should be validated by flight load measurement unless the methods for determining the loading conditions are shown to be reliable. The effect of altitude and air density on loads must be accounted for.

3.2.4. Static Substantiation

Elastomeric components should be substantiated against limit and ultimate loads, in accordance with CS 27/29.305.

Static substantiation should consider:

- CS 27/29.307 Proof of sStructure; the guidance of AMC1 27/29.307 may be used.
- CS 27/29.603 environmental conditions (Further information on environmental conditions under chapter 3.2.8.2.)
- Special factors as deemed applicable in accordance with CS 27/29.619
- Material properties and their variability in accordance with CS 27/29.613

In accordance with CS 27/29.603 environmental conditions and the effect of altitude and air density on loads must be accounted for.
In accordance with CS 27/29.619 static loads must consider any special factors that are deemed applicable.

Considerations for static substantiation under fire conditions for parts located in a fire zone are developed in the proposed CM-S-015 – "Required material properties and structural residual strength for fireproof / fire-resistance compliance demonstration".

For Ultimate Load Conditions a 1,5 factor of safety applies to the external loads, unless application on internal stress leads to more realistic loading conditions of the elastomeric component.

For Ultimate Load Conditions a 1,5 factor is applied to the maximum internal stress or strain (corresponding to limit loads).

3.2.5. Damage Tolerance and Fatigue Evaluation

Historically, EASA has requested that all components the failure of which could be catastrophic (e.g. PSE) must undergo a fatigue and/or damage tolerance evaluation, resulting in with the end result being the establishment of replacement/retirement time, inspection or other approved means to avoid catastrophic failure during the normal life of the rotorcraft.

In the absence of a dedicated requirement for hybrid components using both metallic and elastomeric portions, applicants are requested to show a level of compliance similar to the requirement contained under the CS 27/29.571 and CS 27/29.573 for HAZ and CAT. The applicant should use the CS 27/29.571 and CS CS 27/29.573 as appropriate and their related ACs as a guide and propose derived substantiation methodologies for the certification of elastomeric components.

Attention should be paid to designs where the use of multiple materials in complex configurations can result in many different failure consequences, damage modes, failure sequences, failure durations, etc. The various combinations of materials, processes and fabrication methods can produce competing damage modes, some of which might not be readily detectable. It is therefore important to select a representative configuration in the test and analysis pyramid to correctly characterise and support the F&DT aspects of the certification.

Comparison between CS--27 and CS--29 fatigue and damage tolerance requirements are summarized below.

- CS 27.571 (metallic structure) requires Safe-Life, Fail-Safe or a combination of both philosophies.
- CS 29.571 (metallic structure) requires a fatigue and damage tolerance evaluation
- CS 27.573 does not differ to 29.573, and damage tolerance and fatigue evaluation should be considered.

Table 1: Guidance on compliance

Metallic CS 27.571	Metallic CS 29.571	CS 27/29.573
Safe Life	Fatigue and Damage Tolerance Evaluation	
Fail Safe		
Combination of the above		

3.2.5.1. Fatigue Loads

The loads for fatigue evaluation are addressed under CS 27/29.571, CS 27/29.573 and are a combination of:

- Flight loads derived from direct flight loads measurement,
- Ground loads and ground operations (pre-flight checks…).

Angles and displacements of the elastomeric component are in some cases derived from flight tests and in other cases defined by conservative geometrical analyses.

The loads and motion spectra introduced in the elastomeric component (including frequencies and phases) should be considered for its design and substantiation.

3.2.5.2. Threat Assessment

Both CS 29.571 and CS 27/29.573 request the applicant to perform a threat assessment for fatigue and damage tolerance evaluation. The threat assessment has to be conducted for both metallic and elastomeric material/laminate and the failure or partial failure of the elastomeric material with the changes in its performance parameters (e.g. stiffness/damping reduction or increase) has to be considered.

3.2.6. Inspection Interval substantiation-principle

For components the failure of which could be catastrophic, (i.e. PSE) or hazardous the selected damage tolerance fatigue/ fail-safe philosophy should be applied when testing and qualifying the elastomeric components. The major metallic armatures are generally subject to an independent fatigue and damage tolerance/fail safe evaluation driven by the CS 27/29.571 requirement. The elastomeric element or elastomer laminate (if shims are included)~~including shims if part of the definition)~~ is tested with the metallic armature. Indeed, laboratory fatigue testing (~~MOC~~ MC4) under simulated operational loads, displacement and frequency in simulated environments, has proven to be extremely valuable in demonstrating actual reliability and inspection interval of elastomeric parts.~~. However, the metallic shims should also be fatigue evaluated by analysis.~~

~~So far, certification by pure analysis is not accepted by Airworthiness Authorities.~~
Justification by test is requested.
However, as detailed in AMC1 27/29.307, evaluation by analysis supported by test may be performed for static strength demonstration. This might be the case for single elements like metallic shims.

Changes in the key performance parameters ~~stiffness~~ of the elastomeric component, like stiffness, and its effect on the metallic armature and surrounding rotorcraft structure should be addressed. A limitation, inspection interval or safe life, with relevant safety coefficients should be derived.

3.2.6.1. Relevant testing phases for components with HAZ or CAT failure consequence

While designing and testing the elastomeric component, a TCH/STCH should take into account several factors such as:

- Realistic load and motion spectrum (linked to the part configuration, including frequencies, phase, angles, …)
- Operation and environmental conditions (operational temperatures, contaminants);
- Objective Service Life (flight hours, calendar time)

Relevant testing phases are summarised in the following picture:

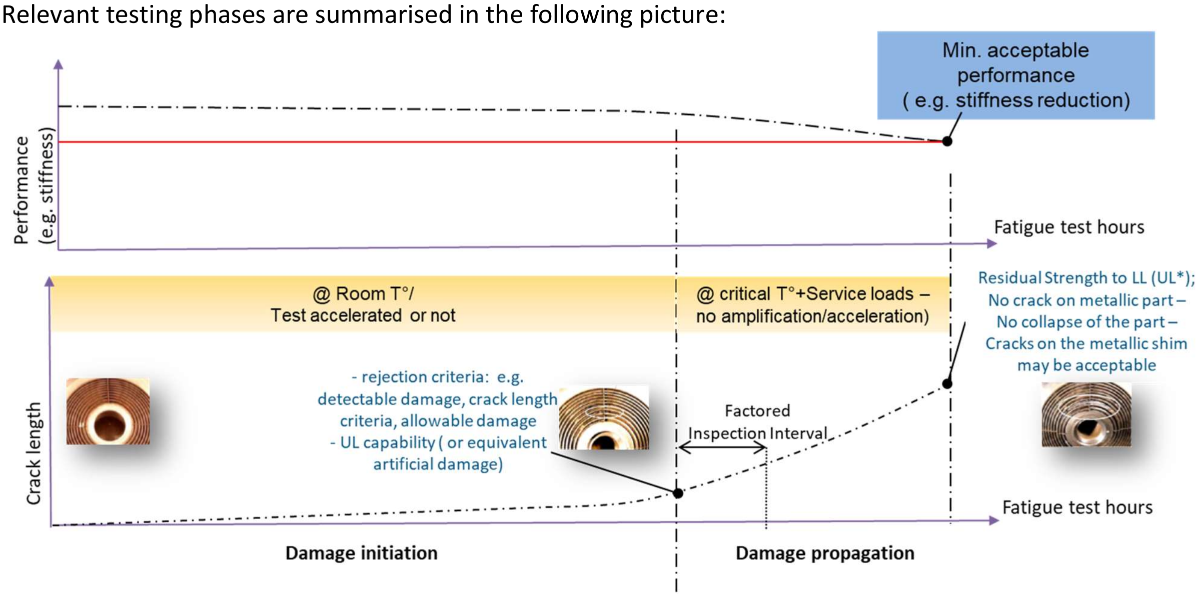

Figure 3: Test for Damage Tolerance

** Alternatively, UL can be more conservatively demonstrated at the end of the propagation phase (instead of LL), providing the possibility to not perform the UL demonstration at the end of the initiation phase*

The test articles should conform to a typical part representative of the production process.
The first step of the qualification test has the objective to obtain a clearly visible damage which:

- Ensures a high probability of detection during inspection, typically detailed visual, ~~a general visual inspection (GVI)~~ of the component, following the prescribed inspection techniques and tools
- Ensures an acceptable level of performance for the part (non-detrimental stiffness loss).

The inspection method proposed in service should be compatible with the damage occurring during the test. Particular care should be paid to the validation of the proposed inspection method, taking into account the level of accessibility to the component and the level of damage detectability. On ground, some elastomer damages (e.g. separation between shim and elastomer ~~shim delamination~~) might be not visible without specific equipment or procedures.

The demonstrated time period until a detectable damage is identifiable as a rejection criterion is important for the TCH/STCH, to ensure acceptable reliability. ~~This time period may be used to derive a limitation for the elastomer laminate, which should not exceed the service life limits of the shims.~~

The damage initiation phase, not directly linked to the compliance demonstration, is usually completed at room temperature and can be accelerated to reduce the test duration. Acceleration methodologies can be proposed to, and accepted by, EASA. When acceleration methodologies are used, care should be taken to ensure the degradation mode has not been modified and remains representative.

The testing activity certified by EASA is the damage propagation phase, used to substantiate a safe inspection interval and sufficient margin to UL capability for the elastomer having reached the detectable damage. Environmental effects need to be considered for the damage propagation phase (see chapter 3.2.8.2).

The detectable damage is considered as a Category 2 damage according to the AMC 20-29. This damage could be considered severe enough to cover impact damages, scratches, manufacturing defects and some level of delamination or debonding (to be justified by the applicant). This type of damage should grow slowly enough to define a safe inspection interval and residual strength capability sufficiently above LL until the end of the propagation phase. The damage growth rate should be shown to be slow, stable, and predictable.

As highlighted in AMC 20-29, "Adhesion failures, which indicate the lack of chemical bonding between substrate and adhesive materials, are considered an unacceptable failure mode in all test types." Similar principles should generally be considered for elastomeric components, and design and process changes should be considered in case of adhesion failure occurring on the test article.

~~adhesion failures between elastomer and metallic shims are considered an unacceptable failure mode for elastomer components, under any design environment. Changes in the design and/or processes are required in case adhesion failures occur during the test.~~

Residual Strength Criteria:

- UL should be demonstrated at the end of the damage initiation phase if the defined rejection criteria was obtained, considering environmental conditions (temperature / contaminants)
- LL should be demonstrated at the end of the damage propagation phase

Alternatively, UL can be more conservatively demonstrated at the end of the damage propagation phase (instead of LL), providing the possibility to not perform the UL demonstration at the end of the initiation phase.
Note: UL and LL may be demonstrated with two distinct samples since the UL demonstration on one sample might distort the damage propagation phase.

At the end of the fatigue and damage tolerance test it should also be shown that the performance and functionality of the component has not changed beyond acceptable limits (e.g. changes in stiffness, damping, etc.). ~~stiffness properties have not changed beyond acceptable limits.~~
Contrary to the composite parts the elastomer material/laminate cannot be repaired. Once the component is found damaged beyond the rejection criterion (size of the damage), it is removed from service unless another alternative approach is justified and approved by the airworthiness authorities.

It is generally expected to perform the propagation and residual strength tests at high, standard, and low temperatures unless a critical temperature or other substantiation methodologies can be identified and justified to the airworthiness authorities. Justification can be provided through lower levels of the test pyramid or through in-service experience of similar elastomeric components.
For this test phase, it is not recommended to use accelerated and/or amplified spectrum due to the risk of thermal degradation of the elastomer or disbonding generated by excessive local heating unless otherwise justified and accepted by EASA.

The detrimental effect of the most critical contaminant shall be evaluated during the qualification testing and validated by LL (contamination during at least one inspection interval is usually considered as acceptable). The selection of the most critical contaminant should be done consistently with relevant design drivers (e.g. modulus for stiffness, shear strength, etc.).
If lower-level pyramid tests demonstrate no detrimental effect of contaminants on the elastomeric material, component level testing with contaminants is not necessary.

Other fatigue approaches (e.g. flaw tolerance safe life) may be proposed by the applicant for acceptance by the authority and should include a threat assessment.

3.2.6.2. Scatter Factor for inspection interval

Variability of the elastomeric material/laminate behaviour in repeated load cases should be covered by appropriate life scatter factors applied to the propagation phase duration. The selected factor should take into account the number of specimens tested. The factors used in component tests should be consistent with the fatigue and damage tolerance behaviour characterised for the materials, processes, and other design details of the structure in building block tests (AMC 20-29). The scatter factor shall be also dependent on the elastomeric component criticality classification.
Alternative approaches can be evaluated by the AgencyAirworthiness authorities.

3.2.6.3. Maintenance concept

The maintenance concept will be adapted to the substantiation approach selected. The definition of a rejection criteria will be associated to a safe inspection interval, generally recorded in the maintenance manual.the ALS.
Inspection intervals for components with CAT failure consequences should be recorded in the ALS of the maintenance manual.
A calendar limit life should be defined for each elastomeric material/laminate due to the sensitivity to ageing. unless An alternative substantiation approach can may be provided proposed if it is demonstrated that inspections would detect any degradation or that the used elastomeric material/laminate is not prone to ageing.
The service life limit of the elastomeric component is generally driven by the metallic armature substantiation, whereas the inspection interval is generally driven by the elastomer laminate.

Maintenance linked to elastomer laminate substantiation is generally recorded in the normal maintenance program for HAZ components.

3.2.7. Dynamic Behaviour Characterisation

The malfunction or degradation of an elastomeric component should not create cause any ground resonance or excessive vibration.
AC 27/29.663, AC 27/29.241, and AC 27/29.251, AC 29.547 and AC 29.917 can be used as guidance.

3.2.8. Elastomeric Component and Process Qualification

3.2.8.1. Process Qualification

As per AMC 20-29 and AC21-26A guidance, a quality system should be established for manufacturing of elastomer materials and components. Complementary aspects of the quality control can be found in AC21-26A. Key material and processing parameters should be defined in the materials and process specifications approved under CS27/29.603 and CS27/29.605. These specifications should also identify which key characteristics and parameters are to be monitored for in-process quality control. The material and process

specifications should form the reference for the qualification of an elastomeric component. If stricter control of processing parameters is required for the elastomeric components to achieve the intended reliability and meet the objectives of the damage tolerance and fatigue evaluation (e.g. the safe inspection interval), those controls should be detailed in the process specification. Once established, these processes should only be changed with further qualification and engineering approval. Changes to qualified bonding systems (substrate, surface preparation or processing) should be validated by test. The applicant should have a defined process for the serialisation/traceability, quality control, and handling of elastomeric components. In addition, this process should be invoked in the type design data.
EASA is recognisesing that elastomeric formulations and processes are highly proprietary to all suppliers. For certification the applicant has the responsibility to show evidence of a reliable qualification control. For this reason the applicant needs to be informed if any changes are made to the material and process specifications and evaluate the effect upon the component.

3.2.8.2. Environmental conditions for material qualification

An elastomeric material/laminate should encompass an environmental survey to investigate the effect of contamination (i.e. exposure to aggressive fluids)(CS 27/29.609), the effect of temperature on the mechanical properties (CS 27/29.61309) and the impact of lightning (CS 27/29.610). Testing has to be conducted on elastomeric coupons and full components as appropriate. The qualification test can be subcontracted to the elastomer supplier. The supplier conducts testing on elastomeric coupons and full components as appropriate.

There are a number of environmental conditions that affect elastomer performance in terms of its spring rate and resistance to degradation. The following conditions typically have a significant impact on the elastomer performance:

- Temperature
  The complete temperature range of operation and the internal effect should be investigated.
  High and Low temperature effects (e.g. on stiffness or degradation rate of the elastomeric component) can impact loads and should be evaluated.
- Contamination
  Some maintenance liquid and lubricant contamination can significantly affect the elastomer strength due to their absorption. A threat assessment should identify the relevant contaminants. Their impact on both, static and fatigue behaviour, has to be evaluated.
- Ageing
  The effect of elastomer ageing should be evaluated and a calendar limit, starting from the manufacturing date, is to be defined to address risks on components stored or not used for long durations.,

This does not exempt the applicant from a detailed evaluation of other environmental threats deriving from the threat assessment such as:
- Salt fog
- Pressure variation
- Damp heat and rain
- Icing conditions, snow, hail and impact icing
- Sand and dust
- Solar radiations / sunlight exposure
- Ozone
- Fungus

- Humidity
- Waterproofness
- Fluid susceptibility (e.g. hydraulic fluids, lubricating oil, fuel, solvents)
- Lightning
- Shocks
- Temperature (e.g. storage temperature)

3.2.9. Certification Design Validation:

The CM S-007 on Post Certification Actions to Verify the Continued Integrity of Rotorcraft Critical Parts applies.

4. Remarks

1. For any question concerning the technical content of this EASA Certification Memorandum, please contact:
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