

Elastomeric Components on Rotorcraft

CM-S-016

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Content

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- Definitions
- Approach for Certification
- Damage Tolerance Substantiation
- Maintenance Concept
- Conclusion

Scope and Background

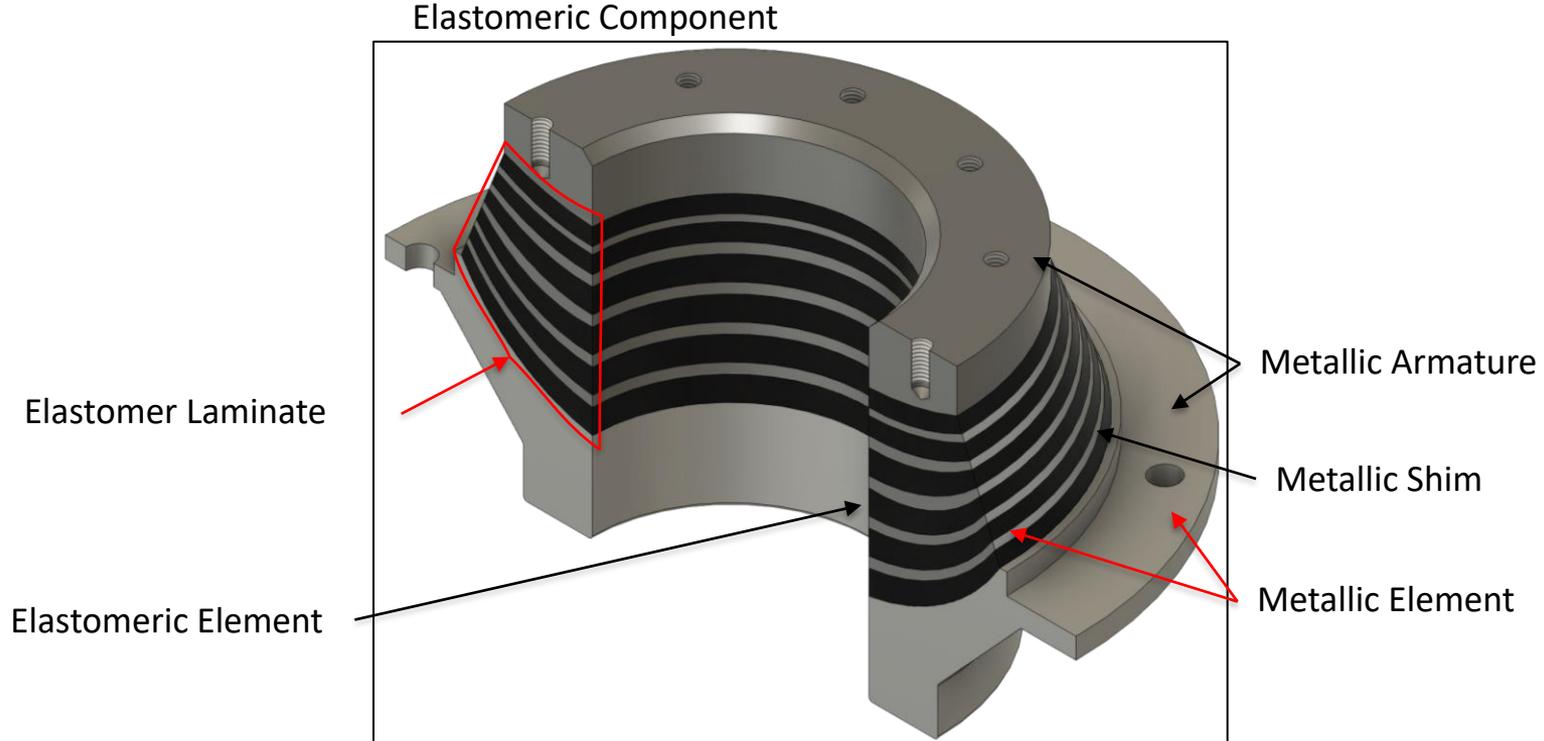
- Publishing EASA's expectations
- Providing guidance for consistency, harmonisation, etc.
 - Acknowledging Elastomeric Components are around for a while already
- Taking into account lessons learned and good practices
- Public Consultation Phase

Scope and Background

- Covering all kinds of elastomeric components
- Spherical bearings, suspension bearings, pitch rod ends, dampers, etc.
- non-structural applications are out of scope, e.g. seals



Definitions



CM considers components consisting of elastomeric material and metallic elements only

Lol and change classifications

Level of Involvement:



Novelty

- **Maybe novel**, if the technology or application is novel to the applicant



Complexity

- **Maybe complex**, e.g. dynamic analysis, inspection techniques in areas difficult to access,



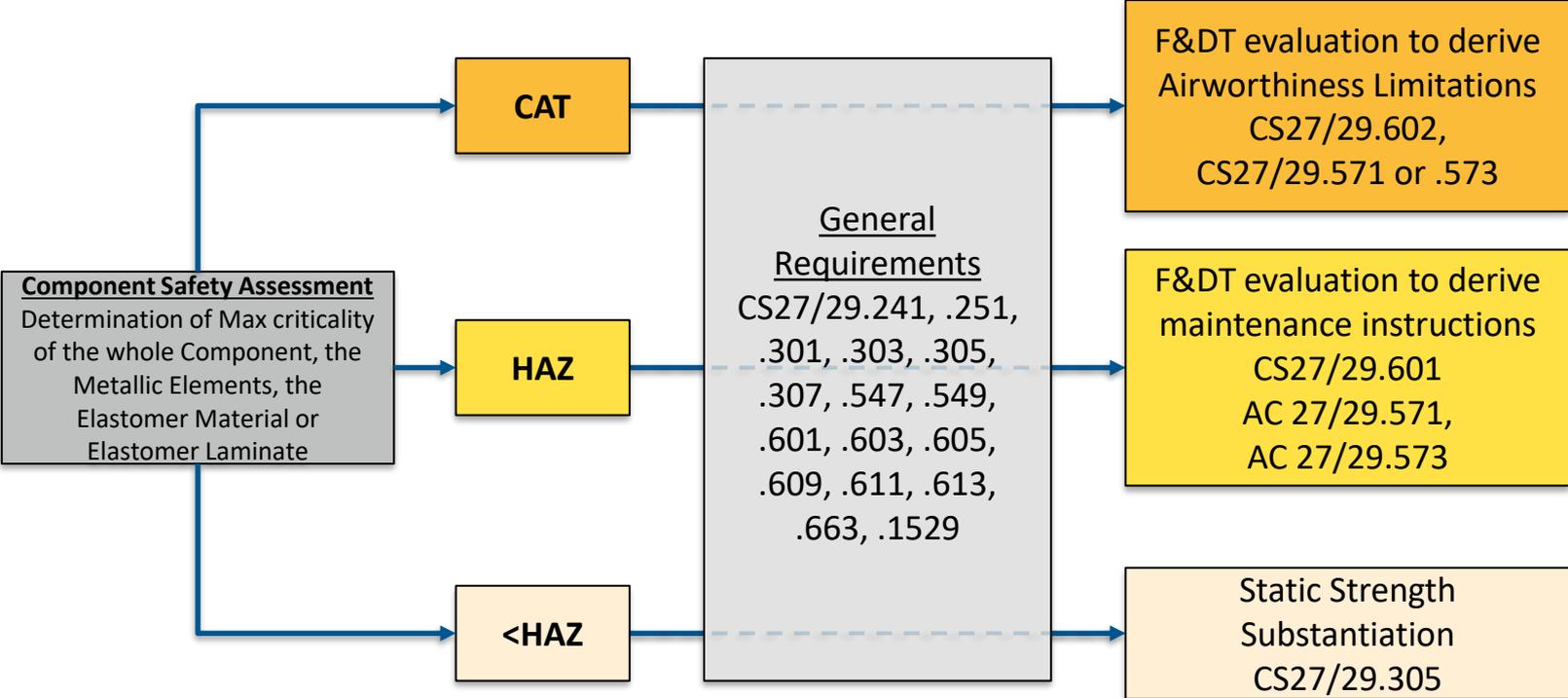
Criticality

- **Maybe critical**, e.g. a failure of the affected structure being potentially catastrophic

Change classification:

Major? Changes affecting elastomeric components identified as **critical parts** (for critical characteristics) and/or **PSEs** and/or having **hazardous or catastrophic failure consequences** as per design assessments (when applicable), e.g. changes affecting F&DT, life limits, changes to the ALS.

Approach for Certification



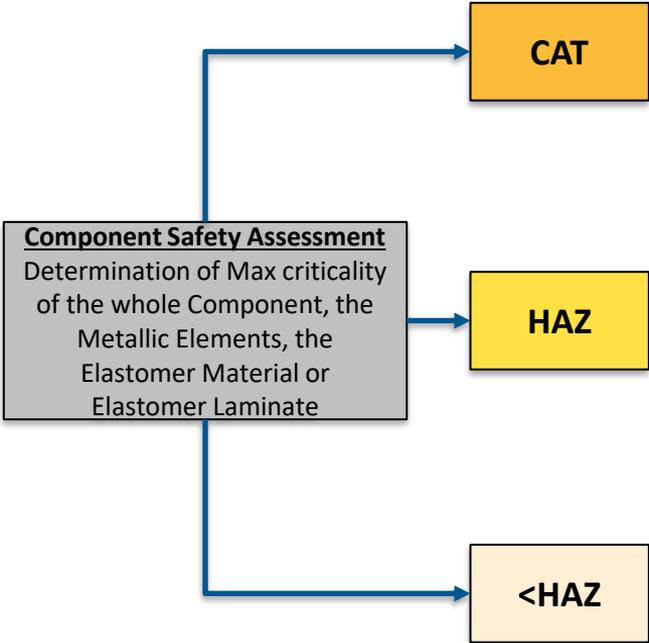
Criticality Classification

Component Safety Assessment
Determination of Max criticality
of the whole Component, the
Metallic Elements, the
Elastomer Material or
Elastomer Laminate

- Design Assessment
 - follow the principles stated under 29.547(b) and 29.917(b)
 - FMEA is one accepted method
- Classification based on most critical sub-component
 - Strong interaction between sub-components

Classification Categories

Definitions concerning structures



“failure conditions which would prevent safe landing”
[AC 29.547/29.917]

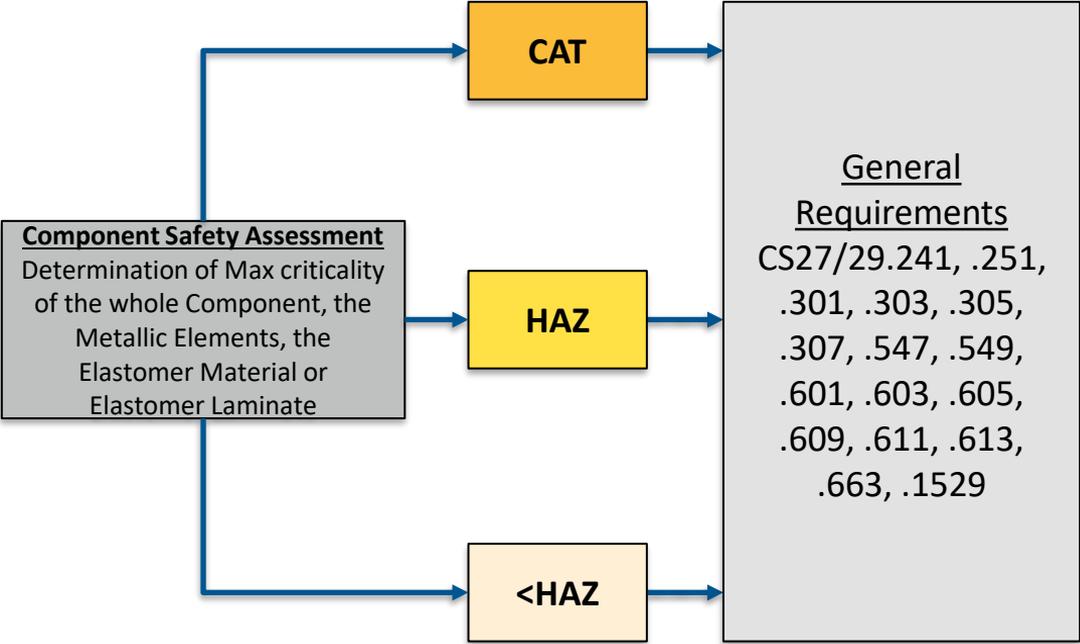
“Failure conditions which would reduce the capability of the rotorcraft [...] to the extent that there would be:

- (i) A large reduction in safety margins or functional capabilities.
- (iv) Loss of ability to continue safe flight to a suitable landing site”

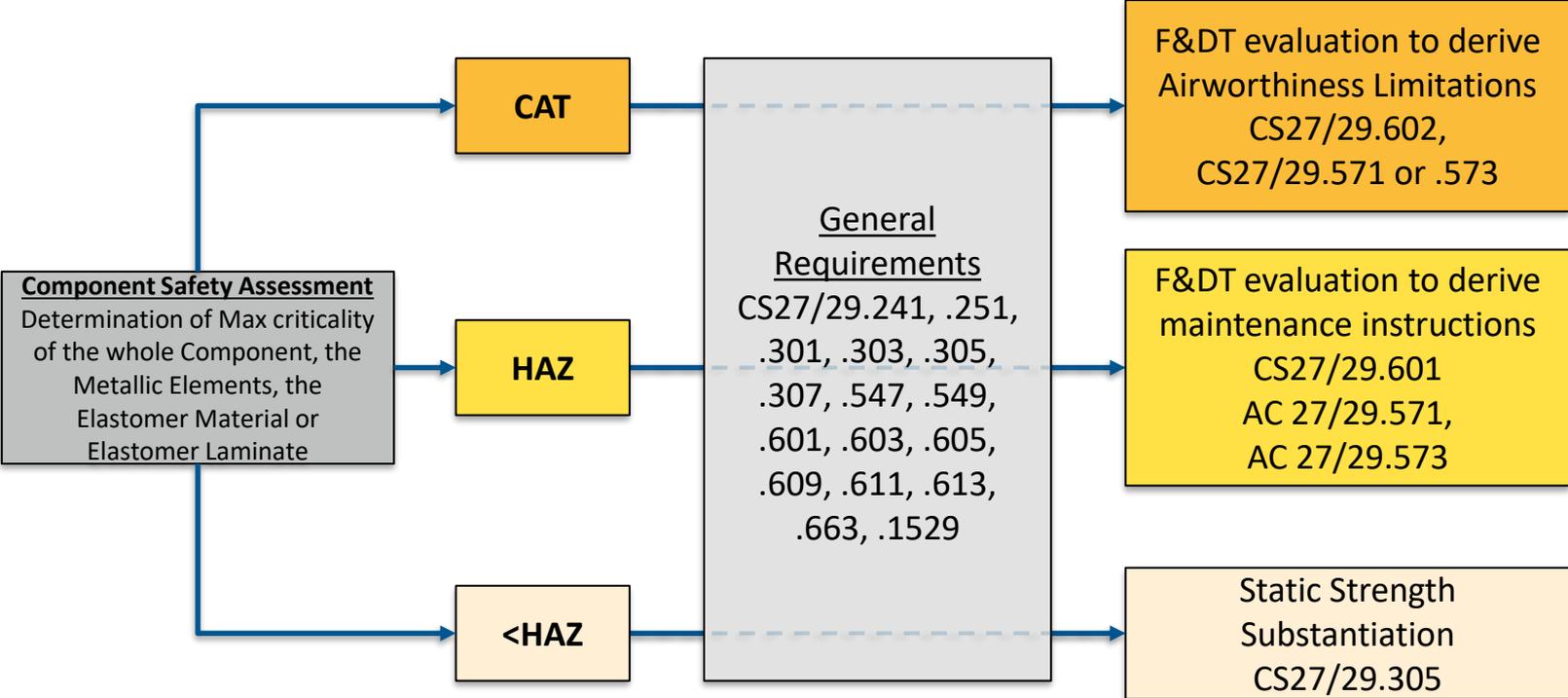
[AC 29.547/29.917]

Anything not CAT or HAZ

General Requirements applicable to all structures



Requirements specific to criticality



Requirements specific to criticality

F&DT evaluation to derive
Airworthiness Limitations
CS27/29.602,
CS27/29.571 or .573

F&DT evaluation to derive
maintenance instructions
CS27/29.601
AC 27/29.571,
AC 27/29.573

Static Strength
Substantiation
CS27/29.305

Approach for <HAZ

F&DT evaluation to derive
Airworthiness Limitations
CS27/29.602,
CS27/29.571 or .573

F&DT evaluation to derive
maintenance instructions
CS27/29.601
AC 27/29.571,
AC 27/29.573

Static Strength
Substantiation
CS27/29.305

- Expected minimum regardless of classification: static strength substantiation
- Considering special factors and environmental conditions

Approach for HAZ

F&DT evaluation to derive
Airworthiness Limitations
CS27/29.602,
CS27/29.571 or .573

F&DT evaluation to derive
maintenance instructions
CS27/29.601
AC 27/29.571,
AC 27/29.573

Static Strength
Substantiation
CS27/29.305

In addition to static strength:

- Fatigue and Damage Tolerance evaluation to
 - Address the design assessment requested for compliance demonstration by CS29.547(b) and CS29.917(b)
 - F&DT evaluation as common practice to identify compensating provisions for CAT/HAZ parts
 - show reliability per CS27/29.601 to evidence that: „no design features or details that experience has shown to be hazardous or unreliable” exists
 - derive maintenance instructions

Approach for CAT

F&DT evaluation to derive
Airworthiness Limitations
CS27/29.602,
CS27/29.571 or .573

F&DT evaluation to derive
maintenance instructions
CS27/29.601
AC 27/29.571,
AC 27/29.573

Static Strength
Substantiation
CS27/29.305

In addition for catastrophic:

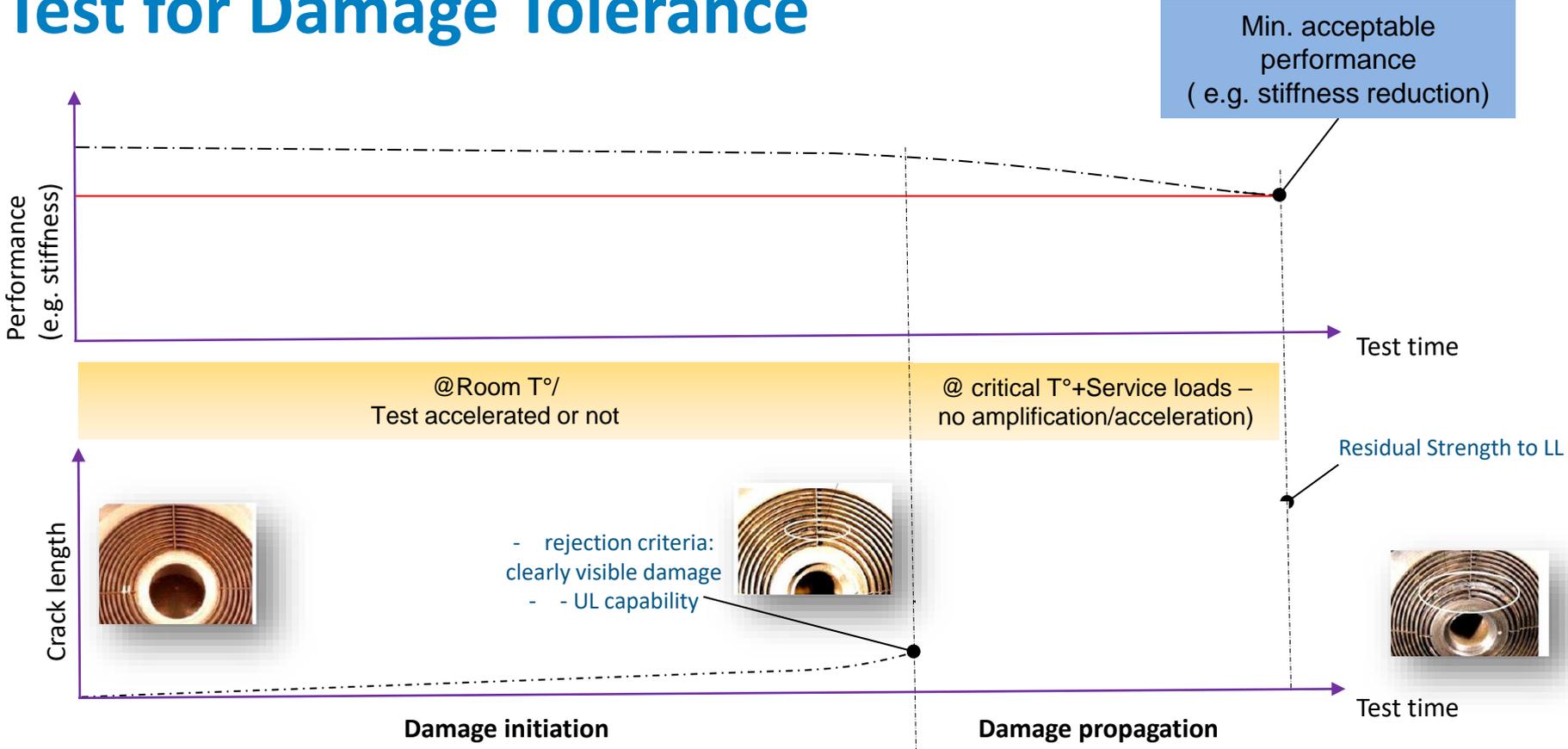
→ F&DT evaluation in accordance with
27/29.571/.573 to derive Airworthiness
Limitations to be recorded in the ALS

→ identified critical characteristics lead to a
critical part

Objectives of F&DT evaluation

- Demonstrate durability
- To ensure UL capability with a clearly detectable damage
- Safety by Inspection principle (On-Condition)
 - Defining a rejection criteria linked to inspection
 - Establish an inspection interval derived from test with a safety factor
 - Ensuring that damages are detected
 - before reaching critical size (demonstrate LL as min. acceptable residual strength)
 - with no detrimental effect on functionality
 - while accounting for effects of environmental conditions

Test for Damage Tolerance



Maintenance concept / Inspection Interval

- The inspection method needs to be in line with the damage detectability identified after damage initiation
- Inspection intervals
 - In maintenance manual
 - For CAT in ALS
- Calendar Life*
 - Due to sensitivity to ageing
 - Unless shown not prone to ageing

Conclusion

- Level of substantiation is based on the classification
- Max criticality for classification of whole component
- F&DT evaluation necessary for HAZ/CAT (to different levels)
- Safety by inspection (on- condition)
- Focus on damage detectability and damage propagation phase
- Inspection method in line with demonstrated rejection criteria
- Calendar Life



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