# CS 31GB.44 Protection of envelope against tearing

*ED Decision 2011/012/R*

The design of the envelope must be such that, while supporting limit load, local damage will not grow to an extent that results in uncontrolled flight or landing.

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Demonstration of sufficient rip-stopping capability of the envelope material.

The objective of this demonstration is to show that the envelope material is sufficiently damage resistant. It therefore needs to be determined at what tear size the envelope material would continue to tear under the maximum tension and conditions (temperature) experienced in normal operation.

In this AMC this tear size is called the critical damage.

In order to establish that the determined damage resistance is sufficient, the critical damage should be reviewed in relation to local damage foreseeable in normal operation.

The local damages to be considered are:

- existing damage that may be undetected during pre-flight inspection, and
- limited damage, inflicted during flight where the size of the damage in itself would not result in

a catastrophic failure (e.g. a limited damage caused by hitting a branch or other basket during take off).

The resistance of envelope fabric to damage propagation should be determined by a test.

Determine the critical damage to the envelope fabric at the maximum tension experienced in service. Critical damage is the maximum damage at which growth does not occur.

Damages to be considered are:

- a slit in the most unfavourable direction;
- a crosswise slit in the most unfavourable directions.

Test requirements

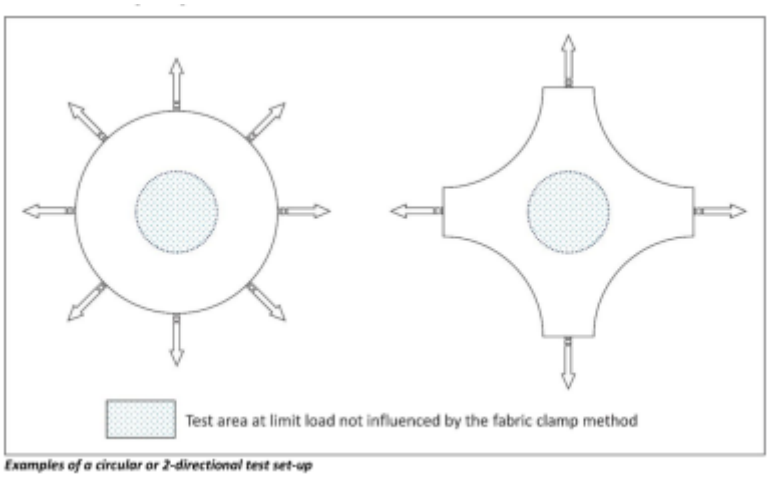
The envelope fabric should be tested at maximum tension experienced in service. The effects of temperature on the material properties must be taken into account.

The tension in the test area of the specimen of the fabric should be equal to the maximum tension experienced in service and the test method should not create unacceptable tension re-distributions in the test area when the test is conducted.

A step-wise increase of the damage (e.g. a cut with a sharp knife) should be used to determine the critical damage size.

Between the step-wise increase of the damage, enough time should be permitted for the tension redistribution at the damage location.

The critical damage length of the material should be recorded.




*Examples of a circular or 2-directional test set-up*

Pre-flight inspection requirements

The design of the envelope and pre-flight inspection method should be such that a damage length considerably smaller than the critical damage length will be discovered during a pre-flight inspection. The impact of aging and operating circumstances should be considered when establishing the margin between critical damage and detectable damage. (Refer to CS 31GB.27(g) )

Design features that could possibly hinder discovery of damage during a pre-flight inspection should be avoided or taken into consideration when the detectable damage size is determined.

Note 1: It is assumed that an envelope damage exceeding 5 cm will be detected before flight due to the loss of gas.

Note 2: The critical damage is a design property that should not be confused with acceptable damage as provided in the flight manual.

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