

Proposed Equivalent Safety Finding on CS-E 820 – Over-torque

Consultation Paper

1 Introductory Note

The hereby presented Equivalent Safety Finding (ESF) request shall be subject to public consultation, in accordance with EASA Management Board Decision No 7-2004 as amended by EASA Management Board [Decision No 12-2007](#) products certification procedure dated 11th September 2007, Article 3 (2.) of which states:

“2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency.”

2 Deviation Request

Summary of Deviation

Statement of Issue

An applicant requesting approval for a new derivative model with an approved Maximum Engine Over-torque is seeking an Equivalent Safety Finding against CS-E 820 (over-torque) at initial issue.

The Certification Specifications for Engines CS-E 820 specifies as follows:

(a) If approval of a Maximum Engine Over-torque is sought for an Engine incorporating a free power turbine, compliance with this paragraph must be demonstrated by test.

(1) The test may be run, if desired, as part of the endurance test of CS-E 740. Alternatively, evidence may be provided from tests of a complete Engine or equivalent testing of individual groups of components.

(2) On conclusion of such tests, the stripped condition of the Engine or individual groups of components must be satisfactory for continued running.

(b) The test conditions must be as follows:

(1) A total of 15 minutes run at the Maximum Engine Over-torque to be approved. This may be done in separate runs, each being of at least 2½-minutes duration.



(2) A power turbine rotational speed equal to the highest speed at which the Maximum Engine Over-torque can occur in service, but not more than the limit speed of Take-off or OEI ratings of a duration longer than 2 minutes.

(3) For Engines incorporating a reduction gearbox, a gearbox oil temperature equal to the max temp at which the Max Engine Over-torque could occur in service; for other Engines, an oil temp within the normal operating range.

(4) A turbine entry gas temperature equal to the maximum steady state temperature to be approved for use during periods longer than 20 seconds when operating at conditions not associated with 30- Second or 2-Minute OEI Power Ratings, unless it can be shown that other testing provides substantiation of the temperature effects when considered in combination with the other parameters identified in CS-E 820 (b)(1), (b)(2) and (b)(3).

The applicant has requested approval of a maximum engine over-torque for an engine incorporating a free power turbine, however the test as performed was not ran at a rotational speed equal to the highest speed at which the maximum engine over-torque can occur in service as required per CS-E 820 (b)(2).

The test performed by the applicant was conducted during the two-hour torque demonstration portion of the endurance test. Other than the deviation in test speed, all other requirements of CS-E 820 were achieved, furthermore post-test inspections found that the power turbine shaft assembly and discs conformed to the type design and were eligible for incorporation into an engine and continued operation.

Applicant's Proposal

The Applicant proposes to justify that with consideration of certain compensating factors an equivalent safety level, in accordance with 21.A.103 (a)(ii), to the requirement of CS-E 820 (b)(2) may be demonstrated for the engine. It is proposed that this equivalent safety level may be demonstrated through a comparative analysis of part attributes and characteristics at the tested conditions and for those requested by CS-E 820.

Applicants Safety Equivalency Demonstration

The Applicants analysis shows that the stresses in the as-tested condition are equivalent to those that the shaft would be subjected to if it ran at the speed required by CS-E 820.

Analysis of the test conditions has shown that the stresses of any relevant part subject to stresses under over-torque conditions as required by CS-E 820 would be achieved. Namely the von Mises stress or equivalent stress, spline tooth crushing stress and shear capability in the power turbine shaft under the conditions requested by CS-E 820 would be achieved in the as-tested condition, and are also within the material capability of the part. It is therefore considered that the outcome of the

test would be unaffected by differences in the as-tested operating conditions when compared with those specified in CS-E 820 (b)(2).

EASA Position

EASA is prepared to agree to the proposal of the applicant subject however to the inputs from this public consultation which will be taken into consideration.

