

EASA	CERTIFICATION MEMORANDUM
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Subject

Respecting Brake Energy Qualification Limits

Log of Issues

Issue	Issue date	Change description
1	24/08/2010	Initial Issue

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1. INTRODUCTION

1.1. PURPOSE AND SCOPE

The purpose of **this** Certification Memorandum is to provide specific guidance to ensure that the demonstrated brake kinetic energy (KE) absorption capability is not exceeded when installed on the aircraft.

This Certification Memorandum describes how applicants should demonstrate that the Kinetic Energy (KE) absorption capability demonstrated during brake qualification is not exceeded when the brake is installed on the aircraft.

1.2. REGULATORY REFERENCES & REQUIREMENTS

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

Reference	Title	Code	Issue	Date

1.3. ABBREVIATIONS & DEFINITIONS

The following abbreviations and definitions are used in this Certification Memorandum:

Abbreviation	Meaning
KE	Kinetic Energy
ETSO	European Technical Standard Order
CS	Certification Specification
TC	Type Certificate
STC	Supplemental Type Certificate

Definition	Meaning

2. BACKGROUND

Brake assemblies are qualified against the minimum performance standard ETSO C-135. This is an acceptable means of compliance with the requirement of CS 25.735(a) (“Each assembly consisting of a wheel(s) and brake(s) must be approved”).

Part of this ETSO is an “Accelerate Stop Test” and a “Most Severe Landing Stop Test” (if applicable), which establish the KE absorption capability of the brake assembly. The ETSO tests prove the KE absorption capability of the brake with that brake at a pre-determined (threshold) start temperature. Both of these tests are required to be performed on (new and worn) brakes with threshold temperatures that are “as closely as practicable, be representative of a typical in-service condition”.

Two methods are permitted to calculate the energy required to bring the heat pack to this representative thermal condition, either by a rational analysis or by the addition of a percentage of the KE_{RT} - Wheel/Brake Rated Accelerate-Stop Energy (see note 1), 10% for Accelerate-Stop Test, or 5% for Most Severe Landing Stop Test.

It is assumed that if the brake were to be used in-service with an initial temperature higher than the threshold temperature then it’s KE absorption capability during a subsequent stop would be reduced (ref. note 2),. This could lead to the brake being unable to generate the required torque to stop the aircraft in the available distance, or being unable to safely dissipate the additional thermal energy generated during the stop (fire risk). As this capability of the brakes is finite, appropriate limitations must be specified in the Airplane Flight Manual (AFM) to ensure operations are permitted only within the demonstrated capability of the brakes.

The following policy has been developed to enable applicants to provide adequate substantiation and/or mitigation factors, when complying with CS-25 applicable requirements.

3. EASA CERTIFICATION POLICY

3.1. EASA POLICY

EASA wish to ensure that the demonstrated brake KE absorption capability is not exceeded when the brake is installed on the aircraft.

EASA has no preference for either of the two methods permitted by ETSO C-135 for calculating the energy required to bring the brake heat pack to the representative threshold thermal condition.

In all EASA CS25 certification and validation projects, applicants shall demonstrate how the temperature thresholds, determined for the brake qualification testing, are to be respected.

Acceptable methods of demonstrating this include, but are not limited to, the following:

- (a) Use of Brake Temperature Monitoring. By allowing the crew to check the brake temperature prior to a take off it can be ensured that that the brake temperature does not exceed the temperature threshold of the demonstrated brake qualification testing, or

(b) Use of Brake Cool Down Charts. By establishing the cool down rate of the brake heat sink, an estimate can be made that relates the energy absorbed by the brake to its temperature and also to the appropriate cool down time.

Note 1.

These temperatures must be based on a rational analysis of a braking cycle, taking into account a typical brake temperature at which an aeroplane may be dispatched from the ramp, plus a conservative estimate of heat sink temperature change during subsequent taxiing and takeoff acceleration, as appropriate.

Alternatively, in the absence of a rational analysis, the starting heat sink temperature must be that resulting from the application of 10 percent KERT to the tyre, wheel and brake assembly, initially at not less than normal ambient temperature (59°F/15°C).

(Appendix 1 ETSO C135 paras 3.3.3.3 & 3.3.4.3)

Note 2.

The possible exceedance of the demonstrated KE absorption capability results from pre-heating of the brakes during the previous landing and taxi out, which may be in excess of the pre-heating used during the brake qualification tests.

3.2. WHO THIS CERTIFICATION MEMORANDUM AFFECTS

EASA has prepared this Certification Memo for the TC, STC and ETSO applications.

For TC and STC, the applicant should take into account the Interpretative Material contained herein if applicable.

For ETSO, the applicant may decide to take into account the complete or part of this Interpretative Material contained herein, and may substantiate the detailed compliance in specific documentation (Declaration of Design and Performance, Software Accomplishment Summary, Hardware Accomplishment Summary or equivalent). Caution should be taken as Certification Memo content may have changed at the time of the equipment installation. The installed equipment should finally comply with the Aircraft Certification Basis (including Certification Review Items).

4. REMARKS

1. Suggestions for amendment(s) to this Certification Memorandum are invited and should be submitted by email to the Certification Policy and Planning Department, Certification Directorate, EASA. E-mail CMs@easa.europa.eu.
2. For any question concerning the technical content of this Certification Memorandum, please contact:

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