



# Comment-Response Document 2015-11

## Regular update of CS-25

CRD TO NPA 2015-11 — RMT.0673 — 22.6.2016

Related Decision 2016/010/R

### EXECUTIVE SUMMARY

This Comment-Response Document (CRD) contains the comments received on NPA 2015-11 (published on 13 August 2015) and the responses, or a summary thereof, provided thereto by the Agency.

11 comments were received from 7 organisations.

A few clarifications and improvements were made to the regulatory text proposal.

The most substantial comments addressed the topic ‘respecting brake energy qualification Limits’ and the related AMC 25.735 amendment.

Based on the comments and responses received on the NPA, Decision 2016/010/R was developed.

Applicability		Process map	
Affected regulations and decisions:	CS-25 (ED Decision No. 2003/2/RM)	Concept Paper:	No
Affected stakeholders:	Large aeroplane manufacturers and other design organisations dealing with Supplemental Type Certificates (STCs), repairs or changes to large aeroplanes.	Terms of Reference:	27.04.2015
Driver/origin:	Safety, efficiency/EASA MB Decision 01-2012 (Article 3.5. on ‘systematic tasks’).	Rulemaking group:	No
Reference:	N/A	RIA type:	None
		Technical consultation during NPA drafting:	No
		Publication date of the NPA:	13.08.2015
		Duration of NPA consultation:	2 months
		Review group:	No
		Focussed consultation:	No
		Publication date of the Opinion:	N/A
		Publication date of the Decision:	2016/Q2



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## 1. Procedural information

### 1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed this Comment-Response Document (CRD) in line with Regulation (EC) No 216/2008<sup>1</sup> (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure<sup>2</sup>.

This rulemaking activity is included in the Agency's [5-year Rulemaking Programme](#), under RMT.0673. The scope and timescale of the task were defined in the related Terms of Reference (see process map on the title page and the ToRs webpage).

The draft CS has been developed by the Agency. All interested parties were consulted through NPA 2015-11<sup>3</sup>, which was published on 13 August 2015. During the NPA consultation 11 comments were received from interested parties, including industry, national aviation authorities, international organisations.

The text of this CRD has been developed by the Agency.

The process map on the title page contains the major milestones of this rulemaking activity.

### 1.2. The structure of this CRD and related documents

This CRD provides a summary of comments and responses as well as the full set of individual comments (and responses thereto) received to NPA 2015-11. The resulting rule text is provided together with ED Decision 2016/010/R on 'CS-25 — Amendment 18'.

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<sup>1</sup> Regulation (EC) No 216/2008 of the European Parliament and the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

<sup>2</sup> The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See Management Board Decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications, acceptable means of compliance and guidance material ('Rulemaking Procedure'), EASA MB Decision No 18-2015 of 15 December 2015..

<sup>3</sup> <https://www.easa.europa.eu/document-library/notices-of-proposed-amendment>



## 2. Summary of comments and responses

11 comments were received from 7 organisations (Airbus, Boeing, DGAC France, Embraer, Eurocontrol, FAA and LBA).

The comments were distributed as follows (note that some posted comments address several topics):

Topic	General	Emergency egress assisting means	References to Flight Test Guide	Electronic flight control systems	Limit pilot forces for aeroplanes equipped with side stick controls	Respecting Brake Energy Qualification Limits	Retracting mechanism	Missing or wrong cross references in the CSs (Book 1) to specific AMCs (Book 2)
Number of comments	4	1	0	1	1	5	0	0

A summary of the comments and responses is provided here below:

### Emergency egress assisting means:

The term 'close proximity' in the proposed AMC 25.810(a)(1)(iv) has been clarified further to a comment from the FAA.

### Electronic flight control systems:

One commentator requested a change to the core text of CS 25.143(l), which was not in the scope of this NPA. Therefore, the comment has not been accepted.

### Limit pilot forces for aeroplanes equipped with side stick controls:

One commentator explained that the proposed CS 25.397(d) table simplification (presentation on one row-two columns, i.e. not specifying distinct values for pitch up and for pitch down, and roll left and roll right) may cause confusion and lead to misapplication of the requirement. The two tables have, therefore, been updated to retain the two rows-two columns presentation.

### Respecting brake energy qualification limits:

One manufacturer commented that the proposed amendment to AMC 25.735 created a new requirement which could lead to new aeroplane flight manual (AFM) limitations. The Agency disagrees and clarifies that the AMC text merely emphasises that any limits established during qualification testing should not be exceeded during normal service. The wording of the AMC text has nevertheless been updated to use the term 'should ensure' instead of 'it is necessary to ensure'.

Based on the comments from two manufacturers, some changes to paragraph 4.f(2)(d) of AMC 25.735 have been made to clarify that the applicant may decide to demonstrate a temperature limit above the ETSO C135a test temperature. It is not a new requirement rather an option available for the applicant.

Furthermore, based on comments from the FAA, paragraph 4.a(2)(b) of AMC 25.735 has been improved to clarify the statement on KE absorption capability vs. the initial brake temperature, and to replace the term 'respected' which could be misunderstood.



### 3. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest the Agency's position. This terminology is as follows:

- (a) **Accepted** — The Agency agrees with the comment and any proposed amendment is wholly transferred to the revised text.
- (b) **Partially accepted** — The Agency either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.
- (c) **Noted** — The Agency acknowledges the comment but no change to the existing text is considered necessary.
- (d) **Not accepted** — The comment or proposed amendment is not shared by the Agency.

#### (General Comments)

-

comment	8	comment by: <i>Luftfahrt-Bundesamt</i>
	The LBA has no comments on NPA 2015-11.	
response	Noted.	
comment	9	comment by: <i>EUROCONTROL</i>
	The EUROCONTROL Agency does not have comments on NPA 2015 - 11.	
response	Noted.	
comment	10	comment by: <i>DGAC France</i>
	DGAC France has no specific comment on this NPA	
response	Noted.	
comment	11	comment by: <i>DGAC France</i>
	DGAC France has no specific comment on this NPA.	
response	Noted.	

#### 2. Explanatory Note

p. 4-6

comment	2	comment by: <i>FAA</i>
	<p><b>Comment:</b> "Respecting Brake Energy Qualification Limits:"          What does the word respecting mean? Use of a different word than "Respecting" is suggested.</p>	



response

**Suggested Resolution:** Ensure brake energy qualification limits are not exceeded

Noted.

Although this proposal appears to be acceptable, the title provided in the explanatory note is the one used in the EASA Certification Memorandum (CM). For keeping a clear reference related to this background, it is preferred to keep the original terminology.

However, please note that in the text of AMC 25.735, the term ‘are to be respected’ has been replaced by ‘will not be exceeded’.

comment

6

comment by: Boeing

#### GENERAL COMMENT

But specifically at:

· -- Page: 5; Paragraph: 2.4 [Overview of the proposed amendments] -- and elsewhere in the document.

-- Page: 33; Paragraph: 4. [Regulatory Impact Assessment (RIA)]

#### The proposed text in paragraph 2.4 states:

*“Respecting Brake Energy Qualification Limits: A Certification Memorandum (EASA CM-HS-001, Issue 1, 24.8.2010) has been applied on several projects through Interpretative Material Certification Review Items (IM CRIs) and is considered mature enough to be introduced into AMC 25.735... **It is necessary** to ensure that the demonstrated brake KE absorption capability is not exceeded when the brake is installed on the aeroplane. **Applicants must demonstrate** how the threshold temperatures are to be respected. .. It is proposed to amend AMC 25.735 to reflect this certification policy.” [Highlighting added.]*

#### The proposed text in paragraph 4 states:

*“This NPA does not create new requirements for applicants. Some clarifications of existing certification specifications are proposed, as well as new or updated AMCs based on common certification practices agreed with applicants. There is no need to develop a RIA.”*

**REQUESTED CHANGE:** We recommend that this aspect of the proposal described in paragraph 2.4 be revised and reissued as an amendment to CS-25 (i.e., CS 25.735) itself, not the indicated AMC. In doing that, EASA should undertake the development of a full RIA.

**JUSTIFICATION:** The proposed text defines a requirement where it states: “... *It is necessary...*”; and “... *Applicants must demonstrate...*” EASA states that Certification Memo EASA CM-HS-001, from where this action has been drawn, has been applied to certification projects through CRIs that require compliance with the Certification Memo. Since EASA is applying this action as a requirement and not just as “voluntary” action, the requirement should be included in the certification standards at CS 25.735, rather than only in the advisory material, AMC 25.735.

In its description of CMs, EASA states: *“Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation.”*



However, if EASA intends to continue to require applicants to demonstrate compliance in accordance with the CM, then we maintain that the CM is no longer merely a means to comply; it is, instead THE means to comply.

As a new requirement, we expect the new AFM limitations to have an adverse economic impact on airlines operating under EASA-approved AFMs, in that it would introduce operational delays. We also expect the new requirement to reduce capacity at airports served by these airlines as a result of such delays. An RIA should be developed to capture these issues.

Further, as it is now, the NPA is “unharmonized” with the latest FAA rulemaking at Amdt. 25-107 re: 14 CFR §25.735. We urge EASA to ensure their requirements are harmonized with those of the FAA. . Harmonization of regulations and standards results in lower costs, fewer inefficiencies, and less confusion for operators, manufacturers, and suppliers when complying with the requirements.

response

Not accepted.

It is not unusual to emphasise a particular aspect of compliance in the AMC. Indeed the phrase ‘it is necessary’ or ‘it is also necessary’ appears four more times in AMC 25.735.

The CM (and the AMC) do not introduce any new requirements, they merely emphasise that any limits established during qualification testing should not be exceeded – by design – during normal service. The brake temperature limits are established by the applicant and the AMC reminds that the applicant should show how these limits are not exceeded – by design. Nevertheless, the AMC text has been updated to use the term ‘should ensure’ instead of ‘it is necessary to ensure’.

CS 25.735 is unchanged and remains harmonised with FAR 25.735.

**3. Proposed amendments, 3.1. Draft Certification Specifications (Draft EASA Decision), BOOK 1, SUBPART B—FLIGHT**

p. 7-11

comment

5

comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

Section 25.143(l)(4)(ii)

Proposal: From level flight, 0 g is readily achievable, or, at least, a trajectory change of 5 degrees per second or, **alternatively, a satisfactory trajectory change is readily achievable at operational speeds.** Operational speed interval should be proposed by the applicant and agreed by EASA, but should start in the lower end of the normal flight envelope. Higher limit shall be Max speed – 10 kt, where Max speed is VFE or VMO/MMO. Ten knots is intended to cover typical margin from VMO/MMO to cruise speeds and typical margin from VFE to standard speed in high lift configurations.

Rationale: Embraer does not agree with strictly requiring a minimum capability of producing either 5 deg/s of change in flight path response pitch down or 0.0g at operational speeds. None of these requirements has ever been applied to conventional flight control system aeroplanes, which are generally limited by elevator control power. Current conventional aircraft designs may not be capable of producing 0.0g due to elevator control power at low operational speeds, like landing approach speed (VREF). At high altitudes and low speeds, they may also be unable to produce 5 deg/s of change in flight path response due to the same reason. Therefore, if elevator control power already limits the current conventional



aircraft designs, Embraer sees no reason for requiring aeroplanes with electronic flight control systems to produce such negative load factors or flight path responses at low operational speeds.

Embraer considers that an alternative criteria to demonstrate “that a satisfactory trajectory change is readily achievable at operational speeds” could be added to show that aeroplanes with electronic flight control systems produce flight path variation and load factor responses similar to a conventional aeroplane. Embraer also does not agree with the demonstration at VLS, since this speed is below the minimum operational speeds, where normal pilot procedures should not allow the aeroplane to fly. Furthermore, current controllability requirements do not require demonstrations below the minimum operational speeds.

response

Not accepted.

CS 25.143(l) has been introduced at Amendment 13 of CS-25 following the usual consultation process. NPA 2015-11 did not propose to change the core text of this subparagraph; the objective is only to clarify the structure of the subparagraph.

**BOOK 1, SUBPART C — STRUCTURE**

p. 11-13

comment

3

comment by: FAA

**Comment** CS 25.397(d): EASA proposes to change CS 25.397(d) to specify a single control force value for pitch and a single value for roll, rather than specifying distinct values for pitch up and for pitch down, and for roll left and roll right. Since the numbers are the same either direction (up and down are the same, and left and right are the same), EASA does not believe that it’s necessary to repeat them.

By not specifying distinct values for pitch up and for pitch down, and roll left and roll right, this change may cause confusion and lead to misapplication of the requirement.

**Suggested Resolution:** Retain the specified control force values for both pitch up and for pitch down, and separately roll left and roll right. This will make the rule more clear that the side stick control system must be evaluated in both directions under the application of the specified control forces.

response

Accepted.

**BOOK 2, AMC SUBPART D**

p. 28-30

comment

1

comment by: AIRBUS

AMC 25.735, section 4. DISCUSSION

Airbus recalls that the discussions during a recent TC (which resulted in CRI IM D-29) were that the revised AMC material was related to 25.735(a) and 25.735(f). Airbus’ comments are:

- Shouldn’t the AMC wording be applicable for 25.735(f)? If not, Airbus considers that there are two conflicting AMC points between 25.735(a) and 25.735(f) as the AMC for 25.735(f) is con-sistent with the ETSO C135 (i.e. “typical temperature” Vs “threshold temperature”).



- If the revised AMC wording from NPA 2015-11 is made applicable to 25.735(a) only, Airbus considers that this constitutes an additional qualification test to the tests identified currently in the ETSO C135.
- Is the AMC proposed in NPA 2015-11 going to be harmonized with the FAA?

Airbus considers that this revised AMC constitutes a change in the advisory material whereby a “typical” (or average) has become a “threshold” (or limit). This seems to contradict section 4 of the NPA 2015-11 which states “This NPA does not create new requirements for applicants”.

Airbus is concerned that the revised wording gives rise to a contradiction in the required brake temperature at the start of the qualification tests and moreover requires additional qualification tests to those already required by the regulations.

response

Partially accepted.

It is agreed to bring a clarification to AMC 25.735 paragraph 4.f(2)(d) which is amended as follows:

‘The brake temperature at the commencement of the braking manoeuvre should be determined using the rational analysis method. However, in the absence of such analysis, an arbitrary heat sink temperature should be used equal to the normal ambient temperature, increased by the amount that would result from a 10 % maximum kinetic energy accelerate stop for the accelerate stop case and from a 5 % maximum kinetic energy accelerate stop for landing cases. The temperature determined for the beginning of the test becomes the highest allowable temperature at commencement of the take-off run unless another test is performed at a higher temperature.’

With this clarification, the applicant may decide to demonstrate a temperature limit above the ETSO C135a test temperature. It is not a new requirement rather an option available for the applicant.

Concerning the question about harmonisation with FAA, CS 25.735 remains harmonised with FAR 25.735. It is not known yet whether FAA will amend their Advisory Material to harmonise with EASA. However, FAA has contributed to the revised wording of the proposed AMC.

comment

4

comment by: FAA

Comment: It is, therefore, necessary to ensure that the demonstrated brake KE absorption capability is not exceeded when the brake is installed on the aeroplane.”

The demonstrated brake KE absorption capability should be based on brake temperatures that at typical in-service condition (threshold temperature). The use of the threshold temperature as a temperature limitation is very conservative since the ‘Accelerate-Stop Test’ and a ‘Most Severe Landing Stop Test’ are conducted with 100% worn brakes, 100% kinetic energy, and no credit for application of the thrust reversers.

Suggested Resolution: Provide an explanation for the statement, “It is, necessary to ensure that the demonstrated brake KE absorption capability is not exceeded when the brake is installed on the airplane.” Is this statement based on a regulatory requirement, service history, or some other factors? In other words state why it is necessary.

Comment: “It is assumed that if the brake were to be used in-service with an initial



temperature higher than the threshold temperature, then its KE absorption capability during a subsequent stop would be reduced.”

Why is it an assumption that a brake with an initial temperature higher than the threshold temperature would have less KE absorption capability than the same brake has at the threshold temperature?

Suggested Resolution: A brake with an initial temperature higher than the threshold temperature will have less KE absorption capability than it has at the threshold temperature.

Comment: “It should be demonstrated how the temperature thresholds, determined for the brake qualification testing, are to be respected.”

What is meant by “respected” in the above paragraph? If this is intended to mean that the threshold temperature established during the qualification test will be used as an in-service temperature limitation.

Suggested Resolution: It should be demonstrated how the temperature thresholds, determined from the brake qualification testing, will not be exceeded.

Comment AMC 25.810(a)(1)(iv): The term ‘close proximity’ may imply a specific distance, whereas the issue is related to the influence of the engine, which is a function of the engine.

Suggested Resolution: Suggest: “... running at ground idle should be only to escape slides positioned forward of the engine(s) and in such proximity to the engine air intake(s) that the deployment of the escape slide could be influenced.”

response

Partially accepted.

Comment 1: Before the publication of the EASA Certification Memorandum, on which this update to the AMC is based, there was no systematic regulatory check that the boundary conditions defined by the aircraft OEMs for their brake qualification tests were not being exceeded in service. This is especially true for aircraft which perform many flight cycles each day, during which the brakes do not fully cool down. Additionally, although the ETSO qualification test conditions are severe, they are within the permitted operational conditions.

Comment 2: The capability of a brake to exert the required retardation torque is proportional to the heat sink temperature. If the heat sink temperature at the commencement of a stop is elevated, then the kinetic energy absorption capability during that stop is reduced. During qualification the brake is shown to be capable of absorbing a certain amount of energy (derived from the mass and velocity of the aircraft) having started at a certain (elevated) temperature. Any increase from these baseline values would mean that the brake is being operated outside its proven capabilities. The suggested resolution is agreed.

Comment 3: The proposed clarification is accepted.

Comment 4 on AMC 25.810(a)(1)(iv) about the term ‘close proximity’: Accepted, the text has been revised.

comment

7

comment by: Boeing



Page: 30

Paragraph: Book 2, AMC Subpart D, AMC 25.735, 4. [Discussion]

**THE PROPOSED TEXT STATES:**

*"It is assumed that if the brake were to be used in-service with an initial temperature higher than the threshold temperature, then its KE absorption capability during a subsequent stop would be reduced. This could lead to the brake being unable to generate the required torque to stop the aeroplane in the available distance, or being unable to safely dissipate the additional thermal energy generated during the stop (hence, a risk of fire). It is, therefore, necessary to ensure that the demonstrated brake KE absorption capability is not exceeded when the brake is installed on the aeroplane.*

*It should be demonstrated 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.*

*Appropriate limitations have to be specified in the Aeroplane Flight Manual (AFM)."*

**REQUESTED CHANGE:** Boeing recommends that this text be withdrawn. However, if is not withdrawn, then it should go forward as an amendment to CS 25.735 in a separate NPA action with a full RIA, rather than as AMC 25.735.

**JUSTIFICATION:** Existing standards, guidance material, and regulations provide for safe operation of the brakes.

The current harmonized FAA/EASA minimum performance standards in TSO-C135a/ETSO-C135a, guidance material in AC 25.735-1/AMC 25.735, and regulations in 14 CFR 25.735/CS 25.735 ensure safe operation by conservatively accounting for fully worn brakes and maximum brake energy (including, for the accelerate-stop condition, no credit for thrust reverse and a decision to reject at  $V_1$  during a brake energy-limited takeoff), in combination with a starting brake heat sink temperature representative of a typical in-service condition determined by rational analysis or that resulting from application of 10%  $KE_{RT}$  for the accelerate-stop condition or 5%  $KE_{RT}$  for the most severe landing stop. The combination of conservative factors used during brake qualification has historically provided for safe operation, despite the potential for the brake heat sink temperature at time of takeoff to operationally exceed that used during qualification testing. Over the past 45 years of Boeing service experience, there have been no known accidents attributed to excessive brake temperature prior to a landing or rejected takeoff.

While brake torque fade is a function of brake heat sink temperature, it is noted that fire risk, not brake torque, is the limiting factor in TSO-C135a/ETSO-C135a accelerate-stop and most severe landing stop capacity for many, if not most, carbon brake applications. The brake heat sink is not the appropriate location at which to measure temperature at time of takeoff to determine the risk of fire in the event of a subsequent high-energy stop. Heat is transferred from the brake heat sink to the wheel and tire as the brake heat sink cools following landing and taxi stops. The wheel and tire have significantly different heating and



cooling rates than the brake heat sink and their temperatures continue to increase as the brake heat sink temperature decreases. The wheel and tire can also retain heat absorbed during multiple previous landing stops and dissipate this heat more slowly than the brake heat sink. The wheel and tire contain grease, seals, paint, and rubber that are more susceptible to fire at elevated temperatures than the brake heat sink material. It would therefore be necessary to provide and utilize real-time indication of wheel and tire temperatures, rather than only brake heat sink temperature, to decrease the likelihood of fire in the event of a subsequent high-energy stop beyond the already safe level provided by existing standards, guidance material, and regulations.

(We should note that we raised some of these same concerns in our comments to the version of the CM that was released for consultation in 2010.)

response

Not accepted.

The proposed AMC does not create new requirements and it is, therefore, not necessary to amend CS 25.735. The purpose is to ensure that the temperature thresholds determined for brake qualification testing will not be exceeded in service.

A new sentence has been added at the end of AMC 25.735 paragraph 4.f(2)(d) in order to remind the applicant that the option to demonstrate a temperature higher than the ETSO C135a determined threshold temperature exists.

