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Revision of Braking Systems Airworthiness Standards to Harmonize With European Airworthiness Standards for Transport Category Airplanes; Final Rule and Notice

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[14 CFR Part 25]

[Docket No. FAA–1999–6063; Amendment No. 25–107]

RIN 2120–AG80

Revision of Braking Systems Airworthiness Standards to Harmonize With European Airworthiness Standards for Transport Category Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This amendment revises the braking systems design and test requirements of the airworthiness standards for transport category airplanes. The amendment moves some of the existing regulatory text, considered to be of an advisory nature, to an advisory circular and adds regulations addressing automatic brake systems, brake wear indicators, pressure release devices, and system compatibility. These revisions were developed in cooperation with the Joint Aviation Authorities (JAA) of Europe, Transport Canada, and the U.S. and European aviation industry through the Aviation Rulemaking Advisory Committee (ARAC). These changes benefit the public interest by standardizing certain requirements, concepts, and procedures contained in the airworthiness standards without reducing, but potentially enhancing, the current level of safety.

DATES: Effective May 24, 2002.

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Background

This amendment is based on Notice of Proposed Rulemaking (NPRM) No. 99–16, which was published in the **Federal Register** on August 10, 1999 (64 FR 43570) and Supplemental Notice of Proposed Rulemaking (SNPRM) No. 99–16A, which was published in the **Federal Register** on December 18, 2000 (65 FR 79298). The related background leading to NPRM No. 99–16, and SNPRM No. 99–16A is discussed below.

In 1988, the FAA, in cooperation with the Joint Aviation Authority (JAA) and other organizations representing the American and European aerospace industries, began a process to harmonize the airworthiness requirements of the United States and the airworthiness requirements of Europe, especially in the areas of Flight Test and Structures. Starting in 1992, the FAA harmonization effort for various systems related airworthiness requirements was undertaken by the ARAC. An ARAC working group of industry and government braking systems specialists of Europe, the United States, and Canada was chartered and named as the Braking System Harmonization Working Group (HWG) by notice in the **Federal Register** (59 FR 30080, June 10, 1994).

Statement of the Problem

The ARAC working group was tasked to develop a harmonized standard, such as a Technical Standard Order (TSO), for approval of wheels and brakes to be installed on transport category airplanes and to develop a draft notice of proposed rulemaking (NPRM), with supporting economic and other required analyses, and/or any other related guidance material or collateral documents, such as advisory circulars (AC), concerning new or revised requirements and the associated test conditions for wheels, brakes and braking systems, installed in transport category airplanes (§§ 25.731 and 25.735). The harmonization task was completed by the ARAC working group and recommendations were submitted to the FAA by letter dated May 1, 1998. The FAA concurred with the recommendations and proposed them in NPRM No. 99–16. A Notice of Availability of proposed AC 25.735–1X and request for comments, and a Notice of Availability of proposed TSO–C135 and request for comments, were also published in the **Federal Register** on August 10, 1999 (64 FR 43579). On August 25, 1999, the JAA issued a Notice of Proposed Amendment (NPA) 25D–291 and NPA TSO–7: ''Brakes and Braking Systems,'' which included the proposed advisory material joint (AMJ) 25.735. The amendments proposed in NPA 25D–291 and the advisory material proposed in AMJ 25.735 were substantively the same as the amendments proposed by the FAA in Notice No. 99–16 and the advisory material in proposed AC 25.735–1X. The NPA TSO–7 was substantively the same as proposed in FAA TSO–C135.

As a result, the FAA received comments from the public in response to the proposed rule (Notice No. 99–16), as well as comments on the proposed AC and the proposed TSO. The JAA received comments from the public in response to NPA 25D–291 and NPA TSO–7 (which includes the AMJ 25.735). The comments received on the FAA and the JAA notices are interlinked and addressed jointly. Therefore, the FAA has considered both sets of comments in preparing the final rule contained herein, the new AC, and the new TSO. The FAA will publish a Notice of Availability in the **Federal Register** when the final version of AC 25.735–1 and TSO–C135 are issued. Interested persons have been given an opportunity to participate in this

rulemaking, and due consideration has been given to all matters presented.

The FAA determined that an incremental cost identified by commenters to Notice No. 99–16 must be subject to public scrutiny. Therefore, this resulted in a supplemental notice of proposed rulemaking (SNPRM), No. 99–16A, being published for public comment on December 18, 2000 (65 FR 79278).

Comments received on Notice No. 99–16 are discussed first, followed by comments received on Notice No. 99–16A.

Discussion of Comments: Notice No. 99–16

Twenty-one commenters responded to the request for comments contained in Notice No. 99–16, the notices of availability of proposed AC 25.735–1, and TSO–C135, and the corresponding JAA documents NPA 25D–291, NPA TSO–7, and AMJ 25.735.

Comments were received from eight foreign and domestic airplane and brake manufacturers, nine foreign airworthiness authorities, one operator, and three foreign and domestic industry organizations. The majority of the commenters agree with the proposal and recommend its adoption. However, some commenters disagree with the proposal while providing alternative proposals that appear to merit further consideration by ARAC. Therefore, the FAA tasked the ARAC on Transport Airplane and Engine (TAE) issues area by letter dated February 8, 2000, to consider the comments and provide recommendations for the disposition of the comments along with any recommendations for changes to the proposal. The disposition of the comments below is based on the agreement reached by the Braking Systems HWG and submitted by ARAC on TAE issues area to the FAA by letter dated June 19, 2000. Several of the commenters address multiple issues, while many commenters address the same issue. As a result, the FAA responses to the comments are organized by individual comment under each proposal, i.e., proposals 1 through 17.

Proposals 1, 2, 4, 5, 6, 8, 9, 12, 15, and 17: §§ 25.735(a), (b), (c), (c)(2), (e), (e)(1), (g), (i) and (k)

No comments were received for these proposals. Sections 25.735(a), (c), (c)(2), (e), (e)(1), (g), (i), and (k) are therefore adopted as proposed.

Proposal 3, § 25.735(b)

One commenter questions the justification of deleting the parenthetical phrase ''(excluding the operating pedal or handle)'' from the current § 25.735(b). The commenter states that excluding the operating pedal or handle is justified to allow use of maximum asymmetric braking capability, use of auto-brakes, and/or thrust reversers in stopping scenarios involving a jammed pedal or high rudder deflection.

FAA's Response: The FAA disagrees with the commenter. Currently, certified airplanes can meet this requirement using rudder and nosewheel steering while providing full braking on one side of the airplane without reverse thrust or autobrakes. The regulations do not require consideration of adverse crosswinds.

Proposal 7, § 25.735(d)

One commenter recommends deleting the idle thrust requirement as use of idle thrust may result in nose gear sliding on high thrust twin engine aircraft. The commenter's suggested text is ''Thrust on any, or all, other engine(s) is to be determined by the applicant.''

FAA's Response: The FAA disagrees with the commenter. The rule, as stated, does not preclude the use of thrust in excess of idle on other engines. The advisory material is expanded to state that compliance is not limited to ground idle thrust; therefore, the applicant may choose what is critical.

Proposal 10, § 25.735(e)(2)

One commenter states that the intent of the rule could probably be better expressed by changing the text from ''(2) It must, at all times, have priority over the automatic braking system, if installed'' to ''If both Anti-Skid and Auto-Brake systems are fitted to the aircraft, then the anti-skid system shall always work independently of the auto-brake and irrespective of the auto-brake configuration/status.''

FAA's Response: The FAA does not concur with the comment. The intent of the rule is to make sure the antiskid function releases a wheel which is going into a skid regardless if the braking is commanded by the pilot or the autobrake function. An explanation to this effect is added in the AC.

Proposal 11, § 25.735(f)

For the comments and response that follow, the heat sink is the mass of the brake that is primarily responsible for absorbing energy during a stop. For a typical brake, this would consist of the stationary and rotating disc assemblies. One commenter states: ''It does not appear that the proposed § 25.735(f) requires the brake with fully worn heat sink to complete 100 cycles of the design landing stop. A brake assembly with fully worn heat sink will not be capable of completing these 100 landing stops. If the proposed § 25.735(f) requires the wheel and brake assembly with fully worn heat sink to complete ONE design landing stop dynamometer test, this test would be unnecessary since the maximum kinetic energy accelerate-stop test will be much more severe. The energy capacity of the accelerate-stop is generally three times the energy capacity of the design landing stop.''

FAA's Response: The FAA concurs; the proposed TSO–C135 does not require the brake with fully worn heat sink to complete 100 cycles of the design landing stop. However, the FAA disagrees that one design landing stop with fully worn brakes is unnecessary; it is required because the one design landing stop requirement cannot be met by the worn brake accelerate-stop test due to differing deceleration requirements.

The same commenter also states that ''the most severe landing stop should not be added until this new regulation is harmonized with other part 25 sections, especially subpart B-Flight (Performance) and § 25.1001, Fuel jettisoning system.''

FAA's Response: The FAA does not agree. The § 25.775(f)(3) requirement is for brake qualification via a dynamometer test per TSO–C135 standard, and not a flight performance test on the aircraft. Compliance with the current § 25.1001 may also result in similar design requirements, especially for aircraft without fuel jettisoning systems.

A second commenter, while supporting the general intent of harmonizing, expresses a concern

> with some aspects of the proposed rule that create significant additional constraints on braking system design and other systems architecture, and on compliance demonstration, without any clear safety benefit. In particular, the Summary of Costs and Benefits in the NPRM preamble, indicates a type certification testing cost increase from $20,000–$60,000, resulting from proposal 11 on ''most severe landing stop'' that would be balanced by the savings expected from rule harmonization. Then this summary adds considerations on potential safety benefits: ''Although there were numerous (approximately 170) accidents involving brake failures during landings in the period 1982–1995, none were determined to have been directly preventable by the subject provisions. Different designs in future type certifications, however, could present other problems (unexpected) and raise future accident rates.''

The commenter concludes ''that, in fact, the expected safety benefit is so

vague that it is hard to justify the additional certification expenses, even if balanced by administrative simplifications, especially for a technically questionable requirement.''

FAA's Response: The FAA does not agree with this commenter. The requirement is conditional in that ''it need not be considered for extremely improbable failure conditions or if the maximum kinetic energy accelerate-stop energy is more severe.'' Without specifying it in the regulations, the applicant may not consider such a situation, however likely.

The second commenter continues, adding: ''Contrary to what is indicated in the Regulatory Evaluation Summary, the Most Severe Landing Stop (MSL) requirement has not been in effect in Europe per British Civilian Aviation Authority (CAA), and there is no evidence that 'many large part 25 airplane manufacturers currently meet this standard.' '' The JAR–25 does not contain this concept. Before JAR–25 adoption, British Civil Airworthiness Requirments (BCAR) Section D was the U.K. Certification code for large airplanes. The brake energy absorption capacity was based on different concepts, namely Certified Normal Brake Energy Capacity and Certified Emergency Brake Energy Capacity (BCAR chapter D–4–5, § 3.8). It is meaningless to determine a ''most severe landing stop'' case for the sole purpose of brake system certification, without considering the global use of return to land capability that will take into account such other parameters as controllability, other retardation means, landing distances, and operational procedures. The commenter therefore suggests withdrawal of the MSL concept, and proposes modifying paragraph (f) in § 25.735 as follows:

(1) Replace the first sentence with: ''Kinetic energy absorption requirements of each wheel and brake assembly must be determined for the design landing stop and the maximum kinetic energy accelerate-stop.''

(2) Delete the last sentence: ''The most severe landing stop need not be considered for extremely improbable failure conditions or if the maximum kinetic energy accelerate-stop energy is more severe.''

(3) Replace the last sentence with: ''In addition to the design landing stop and maximum kinetic energy accelerate-stop, the brake energies associated with forseeable cases of immediate return to land must also be considered. For these cases, operational procedures, possible fuel jettisoning for a maximum of 15 minutes, use of retardation means, and landing distances must be taken into account.''

The same recommendations, (1), (2), and (3) above, are made by a third commenter who states that ''the concept of an MSL is inter-related to an FAA document regarding Return Landing Capability (Issue Paper F–7), and a recent recommendation No. 99–23 from the UK Air Accidents Investigation Branch (AAIB).'' A fourth commenter, the UKCAA, states that the AAIB recommendation is a result of a serious incident at London Heathrow airport in July 1998. An aircraft, following illumination of a caution light during climb and shutdown of one engine, returned for an overweight landing in a crosswind. During this landing, the brakes overheated, the tires deflated, and the aircraft went off the runway. The third commenter continues, stating that the problem of aircraft retardation in foreseeable abnormal operating conditions cannot be adequately addressed by looking at the brakes and brake system alone. The third commenter recommends (1) that this proposal should be reassessed in view of the other current regulatory activity (Issue Paper F–7 and AAIB recommendation No. 99–23); and (2) rewording the regulation per recommendations (1), (2), and (3), above.

FAA's Response: The FAA does not agree. The FAA has reviewed the recommendation and determined that prior to the formation of the ARAC Braking Systems HWG, the requirement for the most severe landing stop condition was included in the European JAA-industry harmonized document ED–69, published in December 1992. In addition, as pointed out by two other commenters, an existing FAA issue paper (FAA Issue Paper F–7) has required applicants to address a return landing capability condition for compliance with § 25.1001. This means the applicant should address the effects and consequences of typical single and multiple failure conditions which are foreseeable events and can necessitate landings at abnormal speeds and weights. The most severe landing stop requirement is therefore retained.

The AAIB recommendation specifically states that the FAA, CAA, and JAA review the requirements for aircraft brake system certification to cover the need to consider overweight landing situations, together with the effects of crosswind and asymmetric engine thrust during ground roll.

The commenter references the existing FAA Issue Paper F–7 on this subject that indicates that the FAA too see the need to expand the scope of the requirement. The commenter continues stating that the FAA position seems to indicate that this incident would be regarded as a ''foreseeable operating condition'' when considering compliance with § 25.1309(a).

In accordance with the AAIB Safety Recommendation, the fourth commenter (UKCAA) proposes that JAR 25.735(f) be further amended to include consideration of crosswind and asymmetric engine thrust, in combination with the severe landing stop condition maximum weight.

FAA's Response: The FAA does not concur with this comment. The FAA has reviewed the UKCAA recommendation and considers that there is sufficient conservatism in the proposed requirements. This conservatism, while not provided specifically to accommodate the possible crosswind effects in an overweight return to land case, is nevertheless available as follows:

(a) The capability to stop the aircraft with only half the brakes functioning;

(b) Dynamometer testing to demonstrate the capability to complete the maximum kinetic energy rejected takeoff (RTO) stop with all brakes worn to the limit;

(c) Dynamometer testing to demonstrate the capability to complete the most severe landing stop with all brakes worn to the limit, should this be more severe than the maximum kinetic energy RTO stop, and not shown to be extremely improbable;

(d) No allowance being given for the reverse thrust capabilities for the demonstration of (b) and (c) above.

The FAA has added appropriate advisory material to the AC 25.735–1, Brakes and Braking Systems Certification Tests and Analysis.

A fifth commenter suggests changing the wording of the second sentence of § 25.735(f) from ''* * * most severe landing stop brake kinetic energy absorption requirements of each wheel and brake assembly * * *'' to ''* * * most severe landing stop kinetic energy absorption requirements of each brake-wheel-tire assembly * * *'' The commenter suggests the same change in terminology for the third sentence.

FAA's Response: The FAA concurs with the commenter. The final rule text is revised accordingly.

A sixth commenter states that, as proposed, § 25.735(f) is difficult to read and contains too many separate requirements, which could create undue difficulties during the finding of compliance. The commenter suggests that the paragraph be rearranged such that:

(1) There is a distinct sub-paragraph that can be identified for the requirement for the determination of the levels of kinetic energy and the energy absorption rates. This should indicate that three cases are to be considered (design landing stop, accelerate-stop and most severe landing stop). This sub-paragraph could also mention the caveats about the need to consider, or not consider, during testing the most severe landing stop.

(2) There is a distinct sub-paragraph for the requirement for the wheel and brake assembly to meet the levels of kinetic energy.

(3) There is a distinct sub-paragraph for the requirement for the wheel and brake assembly to meet the energy absorption rates.

(4) The definitions of the three stop cases (the last nine lines of the currently proposed paragraph, starting with: ''* * * Design landing stop is an operational * * *'') are taken out of the requirement and placed in the proposed AC 25.735–1X.

FAA's Response: The FAA concurs with the commenter that rearranging § 25.735(f) into three distinct sub-paragraphs clarifies the requirement. The FAA, however, has decided that it is more appropriate to retain the definitions as part of the regulatory text since this is the only place where these terms are identified. The text of this paragraph is divided into three subparagraphs (f)(1), (f)(2), and (f)(3) with appropriate headings. The subparagraphs cover each of the three tests and include the definitions.

Two of the commenters suggest adding a requirement that the accelerate-stop test, reference: paragraph 3.3.3.2 of the proposed TSO–C135 and § 25.735(f) of Notice No. 99–16 must be completed on both a new brake and a fully worn brake. The fully worn brake is the worst case condition for energy absorption capability; however, the new brake condition is the worst case condition for performance for some heat sink materials.

FAA's Response: The FAA concurs with these commenters. Applicable text in the final TSO–C135 paragraph 3.3.3.2, and the final rule new subparagraph § 25.735(f)(2) add a new brake accelerate-stop test requirement with the new brake defined as a brake worn no more than 5 percent of its usable wear range. The accelerate-stop applicable portion of § 25.735(f) text, NPRM No. 99–16, is revised from: ''It must be substantiated by dynamometer testing that at the declared fully worn limit(s) of the brake heat sink, the wheel and brake assemblies are capable of absorbing not less than these levels of kinetic energy'' to ''(f)(2): It must be substantiated by dynamometer testing that the wheel, brake, and tire assembly is capable of absorbing not less than this level of kinetic energy throughout the defined wear range of the brake.'' Although not a part of the TSO, large airplane manufacturers currently require a new brake RTO test as part of brake qualification. Small airplane manufacturers may experience a cost increase of $20,000 per certification.

Proposal 13, § 25.735(g)

The first commenter wonders whether the case specified in the rule (immediate application of the parking brake after the RTO for at least 3 minutes, with no fire allowed for at least 5 minutes) is indeed the worst case. The commenter opines that a more severe case, representing a likely in-service scenario, would be for the aircraft to taxi off the runway before the parking brake is applied, and that it should be allowable for the aircraft manufacturer to incorporate this scenario into the test if so desired. However, this is specifically precluded due to the current wording of the rule.

FAA's Response: The FAA does not concur. The regulation does not preclude the applicant from considering such a scenario and addressing it in their brake specification.

A second commenter states that as proposed under § 25.735(g), it must be demonstrated that with the parking brake applied for three minutes after the high kinetic energy stop demonstration of § 25.735(f), no condition (including fire) that could prejudice the safe and complete evacuation of the airplane shall occur for at least five minutes.

The commenter continues, stating: ''In recent aircraft certification programs, Transport Canada (TC) has required that the parking brake be applied for a minimum of five minutes. This is a more stringent requirement that impacts the design, testing and certification of the braking system that is currently only being applied to Canadian certifications and is violating the premise of harmonization.''

The commenter adds that ''the ARAC sub committee does not recommend the increased parking brake period, however, the significant issue is that all National Airworthiness Authorities must accept the same standard to realize the benefits of harmonization.''

FAA's Response: The FAA agrees with the second commenter that clarification of the parking brake set period is needed. The FAA has reaffirmed the 3-minute parking brake applied period for the dynamometer test. There is no intent by the FAA to dictate that the parking brake must be released at 3 minutes, but that it must be applied at least that long. Figures 3–1 and 3–2 and paragraphs 3.3.3.5 and 3.3.4.5 in the TSO will be changed to minimize ambiguity in this respect.

The certification test on the airplane (worn brake RTO) need not follow the procedure prescribed in the TSO. But it is important that the brake manufacturer know early in the development period what procedure will be used on the airplane (i.e. the certification basis) since it can impact the design. This approach allows authorities that are not part of the harmonization process the needed flexibility.

A third commenter adds that the new JAR 25.735(g) requires the parking brake to be promptly and fully applied for at least 3 minutes; in addition, it must be demonstrated that for at least 5 minutes no condition occurs that could prejudice the safe and complete evacuation of the airplane (a similar requirement is also included in JTSO–C135 paragraph 3.3.3.5). Both the 3- and 5-minute timeframes, according to the proposals, are related to a safe evacuation of the airplane, however, there are no data to support the use of those figures. The commenter states that advice is needed from the Cabin Safety Study Group (CSSG) on the use of three and five minutes in conjunction to a safe evacuation.

FAA's Response: The FAA does not agree that the CSSG advice is needed. The criteria are based on regulations for 90-second cabin evacuation; pilot recognition time; time to deploy slides; and time for fire trucks to arrive at the scene of the fire, as well as previous certification tests experience. If the CSSG changes the criteria (3 minutes versus 5 minutes), then a change to § 25.735(g) should be evaluated.

Proposal 14, § 25.735(h)

One commenter states that ''although this rule is only invoked if the aircraft relies on accumulators to provide back-up brake pressure, and this is generally not the case with AIRBUS aircraft, [the commenter] is not aware of an existing system that would satisfy this requirement. The display of available brake energy is a complex task, and a system would need to be devised to allow this information to be obtained.'' The commenter suggests that overall safety would probably be better enhanced by placing a reliability requirement on the accumulator system, rather than demanding a new monitoring system be developed which could degrade the system safety.

FAA's Response: The FAA disagrees with this comment. Alternate means of

compliance will be discussed in AC 25–735–1. As explained in the preamble and advisory circular material, the intent is to ensure proper indication of available accumulator energy, not just pressure which has been determined to be insufficient indication. Unless available energy is displayed, there is no assurance that a backup system is available.

Proposal 16, § 25.735(j)

One commenter recommends that the proposed § 25.735(j), Overtemperature burst prevention, should be moved to § 25.731.

FAA's Response: The FAA does not concur with this comment. The overtemperature condition is caused by brake heat and, therefore, needs to be addressed in the brake section. Cross references are provided in both §§ 25.735 and 25.731.

Another commenter suggests that the intent would be better expressed by changing the words ''* * * wheel failure or tire burst * * * '' to '' * * * wheel failure and/or tire burst * * *''

FAA's Response: The FAA concurs that clarification is necessary. The final rule text is revised to read ''* * * a wheel failure, a tire burst, or both * * *''

Discussion of Comments: Notice No. 99–16A

Five commenters responded to the request for comments contained in Notice No. 99–16A. Three commenters fully support the proposal and recommend its adoption. Two other commenters made recommendations as follows.

The first commenter states ''Airplane braking systems differ between airplane models. Consideration must be given to the additional braking equipment, which is installed on certain model airplanes. When that additional equipment fails or has been rendered inoperative, a more critical condition can exist with the three proposed testing conditions for kinetic energy capacity, i.e., design landing stop, accelerate-stop, and most severe landing stop. This SNPRM does not account for model specific test qualifications for airplanes equipped with additional braking equipment such as brake fan systems. For example, the brake fan system on an airplane may be rendered inoperative due to system failure or by deactivation in accordance with the airplane minimum equipment list (AMEL). The lack of additional brake cooling, coupled with the additional mass (heat sink) of the brake fan, will further deteriorate conditions at the brake installation. Consequently, braking performance is reduced.'' Recognition of such abnormal conditions must be part of the qualification testing for kinetic energy capacity in all three proposed conditions.

FAA's Response: The FAA does not concur with this comment. While the revised regulations do not specifically address items such as brake cooling fans, they provide the basic requirements that must be met. The final AC, once it is published, will provide information on how the regulations are applied. In the case of brake cooling fans, two paragraphs are appropriate. Paragraph 4a(1)(c) of the AC will state that the brake must meet the energy requirements without the use of auxiliary cooling devices. Paragraph 4f(2)(a) states that, in calculating the energy requirements for the accelerate-stop, use of cooling fans may not be considered in determining the heat sink state at the beginning of the stop. No change in the rule text is necessary.

The second commenter recommends the following changes to §§ 25.735(f)(2) and (f)(3) for consistency with § 25.735(f)(1):

''(1) In § 25.735(f)(2) remove the words 'defined by the airplane manufacturer must be achieved,' and add the words, 'derived from the airplane manufacturer's braking requirements must be achieved.' ''

''(2) In § 25.735(f)(3), add the sentence 'The energy absorption rate derived from the airplane manufacturer's braking requirements must be achieved.' ''

FAA's Response: The FAA concurs with (1) and the final rule text has been revised accordingly. The FAA does not concur with (2) because the HWG specifically decided not to put a deceleration requirement on the most severe landing. Addition of the proposed sentence to § 25.735(f)(3) is not necessary and doing so would not have any any impact on brake design.

With the exceptions of the changes noted in §§ 25.735(f) and (j), this final rule is adopted as proposed in Notice No. 99–16 and Notice No. 99–16A.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has determined that there are no new requirements for information collection associated with this amendment.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices that correspond to these regulations.

Regulatory Evaluation Summary, Regulatory Flexibility Determination, International Trade Impact Assessment, and Unfunded Mandates Assessment

Changes to Federal Regulations must undergo several economic analyses. First, Executive Order 12866 directs that each federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. 2531–2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires agencies to consider international standards, and, where appropriate, to use those standards as the basis of U.S. standards. Fourth, Title II of the Unfunded Mandates Reform Act of 1995 requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million in any one year. In conducting these analyses, the FAA has determined that this rule: (1) Will generate benefits that justify its costs and is not ''a significant regulatory action(as defined in Executive Order 12866 or in the Department of Transportation's Regulatory Policies and Procedures; (2) will not have a significant impact on a substantial number of small entities; (3) will not constitute a barrier to international trade, and (4) does not contain a Federal intergovernmental or private sector mandate that exceeds $100 million in any one year.

These analyses, available in the docket, are summarized below. All estimates are expressed in year 2000 dollars.

Regulatory Evaluation Summary

None of the commenters to Notice No. 99–16 disputed FAA's estimates of specific incremental certification costs. One commenter, however, questioned FAA's contention that costs would be balanced by the savings expected from rule harmonization.

In answer to that commenter's concerns, and based on industry experience with recent type certifications, the FAA re-calculated both the harmonization cost savings and the costs attributable to the ''proposed'' amendments (in the original NPRM), and estimated the costs associated with the proposed new requirement in Notice No. 99–16A. These cost estimates are delineated in the next several paragraphs.

Based on the previous analyses in the economic evaluations for both notices, the FAA has determined that only two changes in § 25.735(f) *Kinetic energy capacity*, will result in any incremental cost increases; those are the dynamometer testing requirements in (f)(2) and (f)(3), pertaining to the ''Maximum kinetic energy accelerate-stop'' and the ''Most severe landing stop (MSL),'' respectively.

The dynamometer test, also called a new brake rejected takeoff test, is currently conducted by brake manufacturers as specified by large airplane manufacturers in the brake qualification specification and is an industry practice as such. For some small airplane manufacturers, however, the new ''accelerate-stop'' test will result in a cost increase of $20,000 per certification. This incremental, but nonrecurring, cost for some manufacturers of part 25 small airplanes will easily be offset by the harmonization cost savings cited below. Any potential safety benefits from avoiding even one minor accident would add to such benefits.

The MSL requirement, while a new FAA requirement, has been in effect in Europe (per British CAA); consequently, many large part 25 airplane manufacturers currently meet this standard. Notwithstanding, large part 25 airframe and brake manufacturers note that in almost all cases either the MSL stop energy would not exceed the maximum kinetic energy accelerate-stop energy, or the MSL stop condition is extremely improbable. One part 25 large airplane manufacturer, however, estimates one additional dynamometer test in the $20,000–$40,000 range. Manufacturers of small part 25 airplanes will experience incremental one-time testing costs totaling approximately $20,000 per type certification.

These incremental, but nonrecurring, costs for some manufacturers of part 25 (large and small) airplanes will easily be offset by the estimated harmonization cost savings. Any potential safety benefits from avoiding even one minor accident would add to such benefits.

In summary, the incremental costs for the aforementioned new dynamometer tests will total between $20,000 and $40,000 per type certification for one manufacturer of part 25 large airplanes. Similar costs for some manufacturers of part 25 small airplanes are estimated at $40,000 per type certification.

As stated in the Regulatory Evaluation Summary in Notice No. 99–16A, the FAA had contacted industry sources to obtain estimated harmonization cost savings attributable to the revisions originally proposed in Notice No. 99–16. These cost savings are estimated to be, at a minimum, between $50,000 and $75,000 for a part 25 small airplane type certification and $100,000 to $300,000 for a part 25 large airplane type certification. These harmonization benefits exceeded the incremental costs of all the revisions specified in the NPRM as well as the costs attributable to the SNPRM change. Since there were no public comments to the SNPRM disputing these estimates, the FAA includes these same benefits in this final rule economic assessment. Given that the rule's incremental benefits exceed the incremental costs for both part 25 large and small airplane manufacturers, the FAA finds the final rule cost-beneficial.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the Act. However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The subject rule will affect manufacturers of part 25 transport category airplanes produced under future new airplane type certifications. For manufacturers, a small entity is one with 1,500 or fewer employees. No part 25 airplane manufacturer has 1,500 or fewer employees. Notwithstanding, the relatively low annualized incremental certification costs are not considered significant. Consequently, the FAA certifies that the final rule will not have a ''significant economic impact on a substantial number of small entities'' (manufacturers).

International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards. In accordance with the above statute, the FAA has assessed the potential effect of this final rule and has determined that it will eliminate regulatory differences between the airworthiness standards of the U.S. and the Joint Aviation Requirements of Europe, without affecting current industry practice. This is consistent with the Trade Agreement Act.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Public Law 104–4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed ''significant intergovernmental mandate.'' A ''significant intergovernmental mandate'' under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203

of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals. The FAA determines that this final rule does not contain a significant intergovernmental or private sector mandate as defined by the Act.

Executive Order 3132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action will not have a substantial direct effect on the States, or the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, we determined that this final rule does not have federalism implications.

Regulations Affecting Intrastate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying regulations in Title 14 of the CFR in a manner affecting intrastate aviation in Alaska, to consider the extent to which Alaska is not served by transportation modes other than aviation, and to establish such regulatory distinctions as he or she considers appropriate. Because this final rule applies to the certification of future designs of transport category airplanes and their subsequent operation, it could affect intrastate aviation in Alaska. The Administrator has considered the extent to which Alaska is not served by transportation modes other than aviation, and how the final rule could have been applied differently to intrastate operations in Alaska. However, the Administrator has determined that airplanes operated solely in Alaska would present the same safety concerns as all other affected airplanes; therefore, it would be inappropriate to establish a regulatory distinction for the intrastate operation of affected airplanes in Alaska.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of the final rule has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Public Law 94–163, as amended (42 U.S.C. 6362) and FAA Order 1053.1. It has been determined that the final rule is not a major regulatory action under the provisions of the EPCA.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends Chapter I of Title 14, Code of Federal Regulations as follows:

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702 and 44704.

2. Amend § 25.731 by adding paragraphs (d) and (e) to read as follows:

§ 25.731 Wheels.

* * * * *

(d) *Overpressure burst prevention.* Means must be provided in each wheel to prevent wheel failure and tire burst that may result from excessive pressurization of the wheel and tire assembly.

(e) *Braked wheels.* Each braked wheel must meet the applicable requirements of § 25.735.

3. Revise § 25.735 to read as follows:

§ 25.735 Brakes and braking systems.

(a) *Approval.* Each assembly consisting of a wheel(s) and brake(s) must be approved.

(b) *Brake system capability.* The brake system, associated systems and components must be designed and constructed so that:

(1) If any electrical, pneumatic, hydraulic, or mechanical connecting or transmitting element fails, or if any single source of hydraulic or other brake operating energy supply is lost, it is possible to bring the airplane to rest with a braked roll stopping distance of not more than two times that obtained in determining the landing distance as prescribed in § 25.125.

(2) Fluid lost from a brake hydraulic system following a failure in, or in the vicinity of, the brakes is insufficient to cause or support a hazardous fire on the ground or in flight.

(c) *Brake controls.* The brake controls must be designed and constructed so that:

(1) Excessive control force is not required for their operation.

(2) If an automatic braking system is installed, means are provided to:

(i) Arm and disarm the system, and

(ii) Allow the pilot(s) to override the system by use of manual braking.

(d) *Parking brake.* The airplane must have a parking brake control that, when selected on, will, without further attention, prevent the airplane from rolling on a dry and level paved runway when the most adverse combination of maximum thrust on one engine and up to maximum ground idle thrust on any, or all, other engine(s) is applied. The control must be suitably located or be adequately protected to prevent inadvertent operation. There must be indication in the cockpit when the parking brake is not fully released.

(e) *Antiskid system.* If an antiskid system is installed:

(1) It must operate satisfactorily over the range of expected runway conditions, without external adjustment.

(2) It must, at all times, have priority over the automatic braking system, if installed.

(f) *Kinetic energy capacity*—(1) *Design landing stop.* The design landing stop is an operational landing stop at maximum landing weight. The design landing stop brake kinetic energy absorption requirement of each wheel, brake, and tire assembly must be determined. It must be substantiated by dynamometer testing that the wheel, brake and tire assembly is capable of absorbing not less than this level of kinetic energy throughout the defined wear range of the brake. The energy absorption rate derived from the airplane manufacturer's braking requirements must be achieved. The mean deceleration must not be less than 10 fps^2.

(2) *Maximum kinetic energy accelerate-stop.* The maximum kinetic energy accelerate-stop is a rejected takeoff for the most critical combination of airplane takeoff weight and speed. The accelerate-stop brake kinetic energy absorption requirement of each wheel, brake, and tire assembly must be determined. It must be substantiated by dynamometer testing that the wheel, brake, and tire assembly is capable of absorbing not less than this level of kinetic energy throughout the defined wear range of the brake. The energy absorption rate derived from the

airplane manufacturer's braking requirements must be achieved. The mean deceleration must not be less than 6 fps ^{2}.

(3) *Most severe landing stop.* The most severe landing stop is a stop at the most critical combination of airplane landing weight and speed. The most severe landing stop brake kinetic energy absorption requirement of each wheel, brake, and tire assembly must be determined. It must be substantiated by dynamometer testing that, at the declared fully worn limit(s) of the brake heat sink, the wheel, brake and tire assembly is capable of absorbing not less than this level of kinetic energy. The most severe landing stop need not be considered for extremely improbable failure conditions or if the maximum kinetic energy accelerate-stop energy is more severe.

(g) *Brake condition after high kinetic energy dynamometer stop(s).* Following the high kinetic energy stop demonstration(s) required by paragraph (f) of this section, with the parking brake promptly and fully applied for at least 3 minutes, it must be demonstrated that for at least 5 minutes from application of the parking brake, no condition occurs (or has occurred during the stop), including fire associated with the tire or wheel and brake assembly, that could prejudice the safe and complete evacuation of the airplane.

(h) *Stored energy systems.* An indication to the flightcrew of the usable stored energy must be provided if a stored energy system is used to show compliance with paragraph (b)(1) of this section. The available stored energy must be sufficient for:

(1) At least 6 full applications of the brakes when an antiskid system is not operating; and

(2) Bringing the airplane to a complete stop when an antiskid system is operating, under all runway surface conditions for which the airplane is certificated.

(i) *Brake wear indicators.* Means must be provided for each brake assembly to indicate when the heat sink is worn to the permissible limit. The means must be reliable and readily visible.

(j) *Overtemperature burst prevention.* Means must be provided in each braked wheel to prevent a wheel failure, a tire burst, or both, that may result from elevated brake temperatures. Additionally, all wheels must meet the requirements of § 25.731(d).

(k) *Compatibility.* Compatibility of the wheel and brake assemblies with the airplane and its systems must be substantiated.

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Vi L. Lipski,

Manager, Transport Airplane Directorate, Aircraft Certification Service.

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