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Part VI

Department of Transportation

Federal Aviation Administration

14 CFR Parts 1 and 25
Airworthiness Standards: European Transport Category Airplanes; Changes to Advisory Circular (AC) 25–7; Final Rule and Notice

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 25

[Docket No. 27705; Amendment Nos. 1–40 and 25–84]

RIN 2120–AF25

Revision of Certain Flight Airworthiness Standards To Harmonize With European Airworthiness Standards for Transport Category Airplanes

AGENCY: Federal Aviation Administration, DOT.

ACTION: Final rule.

SUMMARY: The Federal Aviation Administration (FAA) is amending part 25 of the Federal Aviation Regulations (FAR) to harmonize certain flight requirements with the European Joint Aviation Requirements 25 (JAR–25). This action responds to a petition from the Aerospace Industries Association of America, Inc. and the Association Europeenne des Constructeurs de Materiel Aerospatial. These changes are intended to benefit the public interest by standardizing certain requirements, concepts, and procedures contained in the airworthiness standards for transport category airplanes.

EFFECTIVE DATE: July 10, 1995.

FOR FURTHER INFORMATION CONTACT: Donald K. Stimson, Flight Test and Systems Branch, ANM–111, Transport Airplane Directorate, Aircraft Certification Service, FAA, 1601 Lind Avenue SW., Renton, WA 98055–4056; telephone (206) 227–1129, facsimile (206) 227–1320.

SUPPLEMENTARY INFORMATION:

Background

These amendments are based on Notice of Proposed Rulemaking (NPRM) 94–15, which was published in the **Federal Register** on April 22, 1994 (59 FR 19296). In that notice, the FAA proposed amendments to 14 CFR parts 1 and 25 to harmonize certain airworthiness standards for transport category airplanes with the European Joint Aviation Requirements 25 (JAR–25). Harmonizing the U.S. and European airworthiness standards benefits the public interest by reducing the costs associated with showing compliance to disparate standards, while maintaining a high level of safety.

NPRM 94–15 was developed in response to a petition for rulemaking from the Aerospace Industries Association of America, Inc. (AIA) and the Association Europeenne des Constructeurs de Materiel Aerospatial (AECMA). In their petition, AIA and AECMA requested changes to §§ 25.143(c), 25.143(f), 25.149, and 25.201 to standardize certain requirements, concepts, and procedures for certification flight testing and to enhance reciprocity between the FAA and JAA. In addition, AIA and AECMA recommended changes to FAA Advisory Circular (AC) 25–7, "Flight Test Guide for Certification of Transport Category Airplanes," to ensure that the harmonized standards would be interpreted and applied consistently. A copy of that petition is included in the docket.

The proposals published in NPRM 94–15 would harmonize not only the sections of part 25 and JAR–25 addressed in the petition, but also related sections. These proposals were developed by the Aviation Rulemaking Advisory Committee (ARAC) and forwarded to the FAA as an ARAC recommendation. The FAA accepted the recommendation and published NPRM 94–15 for public comment in accordance with the normal rulemaking process.

The Aviation Rulemaking Advisory Committee

The ARAC was formally established by the FAA on January 22, 1991 (56 FR 2190), to provide advice and recommendations concerning the full range of the FAA's safety-related rulemaking activity. This advice was sought to develop better rules in less overall time using fewer FAA resources than are currently needed. The committee provides the opportunity for the FAA to obtain firsthand information and insight from interested parties regarding proposed new rules or revisions of existing rules.

There are over 60 member organizations on the committee, representing a wide range of interests within the aviation community. Meetings of the committee are open to the public, except as authorized by section 10(d) of the Federal Advisory Committee Act.

The ARAC establishes working groups to develop proposals to recommend to the FAA for resolving specific issues. Tasks assigned to working groups are published in the **Federal Register**. Although working group meetings are not generally open to the public, all interested parties are invited to participate as working group members. Working groups report directly to the ARAC, and the ARAC must concur with a working group proposal before that proposal can be presented to the FAA as an advisory committee recommendation.

The activities of the ARAC will not, however, circumvent the public rulemaking procedures. After an ARAC recommendation is received and it is found acceptable by the FAA, the agency proceeds with the normal public rulemaking procedures. Any ARAC participation in a rulemaking package will be fully disclosed in the public docket.

Discussion of the Proposals

In NPRM 94–15, the FAA proposed amending certain sections of the FAR, as recommended by the ARAC, to harmonize these sections with JAR–25. Concurrently, the JAA circulated Notice of Proposed Amendment (NPA) 25B–261, which proposed revising JAR–25, as necessary, to ensure harmonization in those areas for which the amendments proposed in NPRM 94–15 differ from the current JAR–25.

The FAA proposed to: (1) Introduce the term "go-around power or thrust setting" to clarify certain part 25 flight requirements; (2) revise the maximum control forces permitted for demonstrating compliance with the controllability and maneuverability requirements; (3) provide requirements for stick force and stick force gradient in maneuvering flight; (4) revise and clarify the requirements defining minimum control speed during approach and landing; (5) clarify the procedural and airplane configuration requirements for demonstrating stalls and revise the list of acceptable flight characteristics used to define the occurrence of stall; and (6) require that stall characteristics be demonstrated for turning flight stalls at deceleration rates up to 3 knots per second.

Revisions were also proposed for AC 25–7 to ensure consistent application of these proposed revised standards. Public comments concerning the revisions to AC 25–7 were invited by separate notice in the same issue of the **Federal Register** as NPRM 94–15 (59 FR 19303).

Proposal 1. Certain part 25 flight requirements involving flight conditions other than takeoff (i.e., §§ 25.119, 25.121(d), 25.145(b)(3), 25.145(b)(4), 25.145(b)(5), 25.145(c)(1), 25.149(f)(6), and 25.149(g)(7)(ii)) specify using the maximum available takeoff power or thrust as being representative of the appropriate maximum in-flight power or thrust. In practice, however, the power or thrust setting used to obtain the maximum in-flight power or thrust (commonly referred to as the go-around power or thrust setting) usually differs from the setting used for takeoff. In the

past, the FAA interpreted the words "maximum available takeoff power or thrust" to mean the maximum in-flight power or thrust, with the takeoff power or thrust setting not always being "available" in flight. In NPRM 94–15, the FAA proposed changing the nomenclature to "go-around power or thrust setting" for clarification and to reflect terminology commonly used in the operational environment. (The term "go-around" refers to a deliberate maneuver to abort a landing attempt prior to touchdown by applying the maximum available power or thrust, retracting flaps, and climbing to a safe level-off altitude.)

The go-around power or thrust setting may differ from the takeoff power or thrust setting, for example, due to the airspeed difference between the takeoff and go-around flight conditions. In addition, complying with the powerplant limitations of § 25.1521 may result in a lower power setting at the higher airspeeds associated with a go-around. As another example, the controllability requirements of §§ 25.145(b)(3), 25.145(b)(4), 25.145(b)(5), 25.149(f), and 25.149(g) may also limit the go-around power or thrust setting to less than that used for takeoff. Another reason to separate the takeoff and go-around power (or thrust) nomenclature is that certification practice has not required, and applicants have not always proposed, changing the go-around power or thrust setting when a previously approved takeoff power or thrust is increased.

The FAA proposed to substitute the term "go-around power or thrust setting" for "maximum available takeoff power or thrust" in §§ 25.119, 25.121(d), 25.145(b)(3), 25.145(b)(4), 25.145(c)(1), 25.149(f)(6), and 25.149(g)(7)(ii). (Note that the requirement of § 25.145(b)(5) also uses the power specified in § 25.145(b)(4).) In addition, the FAA proposed to define "go-around power or thrust setting" in part 1 as "the maximum allowable in-flight power or thrust setting identified in the performance data." By this revision, the FAA intended to clarify that the applicable controllability requirements should be based on the same power or thrust setting used to determine the approach and landing climb performance contained in the approved Airplane Flight Manual (AFM).

The proposed terminology referred to a power or thrust "setting" rather than a power or thrust to make it clear that existing engine ratings would be unaffected. The powerplant limitations of § 25.1521 would continue to apply at the go-around power (or thrust) setting. Existing certification practices would also remain the same, including the relationship between the power or thrust values used to comply with the landing and approach climb requirements of §§ 25.119 and 25.121(d). For example, the thrust value used to comply with § 25.121(d) may be greater than that used for § 25.119, if the operating engine(s) do not reach the maximum allowable in-flight thrust by the end of the eight second time period specified in § 25.119.

Proposal 2. The FAA proposed to revise the table in § 25.143(c) to match the control force limits currently provided in JAR 25.143(c). This table prescribes the maximum control forces for the controllability and maneuverability flight testing required by §§ 25.143(a) and 25.143(b). For transient application of the pitch and roll control, the revised table would contain more restrictive maximum control force limits for those maneuvers in which the pilot might be using one hand to operate other controls, relative to those maneuvers in which both hands are normally available for applying pitch and roll control. The revised table would retain the current control force limits for transient application of the yaw control, and for sustained application of the pitch, roll, and yaw controls.

For maneuvers in which only one hand is assumed to be available, the FAA proposed to reduce the maximum permissible control forces from 75 pounds to 50 pounds for pitch control, and from 60 pounds to 25 pounds for roll control. These lower control forces would be more consistent with § 25.145(b), which states that a force of 50 pounds for longitudinal (pitch) control is "representative of the maximum temporary force that readily can be applied by one hand." In addition to adding more restrictive control force limits for maneuvers in which only one hand may be available to apply pitch and roll control, the FAA proposed to reduce the maximum permissible force for roll control from 60 pounds to 50 pounds for maneuvers in which the pilot normally has both hands available to operate the control.

The FAA proposed to further revise § 25.143(c) by specifying that the table of maximum permissible control forces applies only to conventional wheel type controls. This restriction, also specified in the current JAR 25.143(c), recognizes that different control force limits may be necessary when considering sidestick controllers or other types of control systems.

For clarification, the FAA proposed to replace the terms "temporary" and "prolonged," used in §§ 25.143(c), 25.143 (d), 25.143(e), and 25.145(b), with "transient" and "sustained," respectively. "Transient" forces are those control forces resulting from maintaining the intended flight path during changes to the airplane configuration, normal transitions from one flight condition to another, or regaining control after a failure. The pilot is assumed to take immediate action to reduce or eliminate these forces by retrimming or by changing the airplane configuration or flight condition. "Sustained forces," on the other hand, are those control forces resulting from normal or failure conditions that cannot readily be trimmed out or eliminated. The FAA proposed adding these definitions of "transient" and "sustained" forces to AC 25–7.

In addition, the FAA proposed several minor editorial changes for §§ 25.143(c) through 25.143(e) to improve readability and correct grammatical errors. For example, the words "immediately preceding" were proposed to replace "next preceding" in § 25.143(d). These editorial changes were intended only to clarify the regulatory language, while retaining the existing interpretation of the affected sections.

Proposal 3. The FAA proposed to add the JAR 25.143(f) requirements regarding control force characteristics during maneuvering flight to part 25 as a new § 25.143(f). By adding these requirements, the FAA would ensure that the force to move the control column, or "stick," must not be so great as to make excessive demands on the pilot's strength when maneuvering the airplane, and must not be so low that the airplane can easily be overstressed inadvertently.

These harmonized requirements would apply up to the speed V_{FC}/M_{FC} (the maximum speed for stability characteristics) rather than the speed V_{MC}/M_{MC} (the maximum operating limit speed) specified by the current JAR 25.143(f). Requiring these maneuvering requirements to be met up to V_{FC}/M_{FC} is consistent with other part 25 stability requirements. Section 25.253, which defines V_{FC}/M_{FC}, would be revised to reference the use of this speed in the proposed § 25.143(f). An acceptable means of compliance with § 25.143(f), including detailed interpretations of the stick force characteristics that meet these requirements, would be added to AC 25–7.

Proposal 4. Section 25.149(f) requires that the minimum control speed be determined assuming the critical engine suddenly fails during (or just prior to) a go-around from an all-engines-operating approach. For airplanes with

three or more engines, § 25.149(g) requires the minimum control speed to be determined for a one-engine-inoperative landing approach in which a second critical engine suddenly fails. The FAA proposed to revise §§ 25.149(f) through 25.149(h) to clarify and revise the criteria for establishing these minimum control speeds, V_{MCL} and V_{MCL-2}, respectively, for use during approach and landing.

The FAA proposed to clarify that V_{MCL} and V_{MCL-2} apply not only to the airplane's approach configuration(s), as prescribed in the current standards, but also to the landing configuration(s). The FAA recognizes that configuration changes occur during approach and landing (e.g. flap setting and landing gear position) and considers that the minimum control speeds provided in the AFM should ensure airplane controllability, following a sudden engine failure, throughout the approach and landing.

Applicants would have the option of determining V_{MCL} and V_{MCL-2} either for the most critical of the approach and landing configurations (i.e., the configuration resulting in the highest minimum control speed), or for each configuration used for approach or for landing. By determining the minimum control speeds in the most critical configuration, applicants would not be required to conduct any additional testing to that already required by the current standards. Only if these resulting speeds proved too constraining for other configurations would the FAA expect applicants to exercise the option of testing multiple configurations.

The FAA also proposed to add provisions to state the position of the propeller, for propeller airplanes, when establishing these minimum control speeds. For the critical engine that is suddenly made inoperative, the propeller position must reflect the most critical mode of powerplant failure with respect to controllability, as required by § 25.149(a). Also, since credit cannot be given for pilot action to feather the propeller during this high flightcrew workload phase of flight, the FAA proposed that V_{MCL} and V_{MCL-2} be determined with the propeller position of the most critical engine in the position it automatically achieves. For $_{MCL-2}$, the engine that is already inoperative before beginning the approach may be feathered, since the pilot is expected to ensure the propeller is feathered before initiating the approach.

To ensure that airplanes have adequate lateral control capability at V_{MCL} and V_{MCL-2}, the FAA proposed to require airplanes to be capable of rolling, from an initial condition of steady straight flight, through an angle of 20 degrees in not more than 5 seconds, in the direction necessary to start a turn away from the inoperative engine. This proposed addition to § 25.149 is contained in the current JAR 25.149.

The FAA also proposed guidance material for AC 25–7 to enable applicants to additionally determine the appropriate minimum control speeds for an approach and landing in which one engine, and, for airplanes with three or more engines, two engines, are already inoperative prior to beginning the approach. These speeds, $V_{MCL(1\ out)}$ and $V_{MCL-2(2\ out)}$, would be less restrictive than V_{MCL} and V_{MCL-2} because the pilot is assumed to have trimmed the airplane for the approach with an inoperative engine (for $V_{MCL(1\ out)}$) or two inoperative engines (for $V_{MCL-2(2\ out)}$). Also, the approach and landing procedures under these circumstances may use different approach and landing flaps than for the situations defining V_{MCL} or V_{MCL-2}. These additional speeds could be used as guidance in determining the recommended procedures and speeds for a one-engine-inoperative, or, in the case of an airplane with three or more engines, a two-engine-inoperative approach and landing.

The FAA proposed to revise § 25.125 to require the approach speed used for determining the landing distance to be equal to or greater than V_{MCL}, the minimum control speed for approach and landing with all-engines-operating. This provision would ensure that the speeds used for normal landing approaches with all-engines-operating would provide satisfactory controllability in the event of a sudden engine failure during, or just prior to, a go-around.

Proposal 5. The FAA proposed to revise the stall demonstration requirements of § 25.201 to clarify the airplane configurations and procedures used in flight tests to demonstrate stall speeds and stall handling characteristics. The list of acceptable flight characteristics used to define the occurrence of stall would also be revised. To be consistent with current practice, § 25.201(b)(1) would require that stall demonstrations also be conducted with deceleration devices (e.g., speed brakes) deployed. Additionally, the FAA proposed clarifying the intent of § 25.201(b) to cover normal, rather than failure, conditions by requiring that stalls need only be demonstrated for the approved configurations.

Section 25.201(c) would be revised to more accurately describe the procedures used for demonstrating stall handling characteristics. The cross-reference to § 25.103(b), currently contained in § 25.201(c)(1), would be moved to a new § 25.201(b)(4) for editorial clarity and harmony with the JAR–25 format. Reference to the pitch control reaching the aft stop, which would be interpreted as one of the indications that the airplane has stalled, would be moved from § 25.201(c)(1) to § 25.201(d)(3).

The list of acceptable flight characteristics that define the occurrence of a stall, used during the flight tests demonstrating compliance with the stall requirements, is provided in § 25.201(d). The FAA proposed to revise this list to conform with current practices. Section 25.201(d)(1)(ii) would be removed to clarify that a rolling motion, occurring by itself, is not considered an acceptable flight characteristics for defining the occurrence of a stall. The proposed § 25.201(d)(2) would replace the criteria of §§ 25.201(d)(1)(iii) and 25.201(d)(2) because only deterrent buffeting (i.e., a distinctive shaking of the airplane that is a strong and effective deterrent to further speed reduction) is considered to comply with those criteria. Finally, the proposed § 25.201(d)(3) would define as a stall a condition in which the airplane does not continue to pitch up after the pitch control has been pulled back as far as it will go and held there for a short period of time. Guidance material was proposed for AC 25–7 to define the length of time that the control stick must be held in this full aft position when using § 25.201(d)(3) to define a stall.

Proposal 6. Section 25.201 currently requires stalls to be demonstrated at airspeed deceleration rates (i.e., entry rates) not exceeding one knot per second. JAR 25.201 currently requires, in addition, that turning flight stalls must be demonstrated at accelerated rates of entry into the stall (i.e., dynamic stalls). According to the JAA, the intended procedure for demonstrating dynamic stalls begins with a 1 knot per second deceleration from the trim speed (similar to normal stalls). Then, approximately halfway between the trim speed and the stall warning speed, the flight test pilot applies the elevator control to achieve an increase in the rate of change of angle-of-attack. The final angle-of-attack rate and the control input to achieve it should be appropriate to the type of airplane and its particular control characteristics.

The AIA/AECMA petition detailed various difficulties with interpretation of the JAR–25 requirement, noted that

the requirement is not contained in the FAR, and proposed that dynamic stalls be removed from JAR–25. Some of the concerns with the JAR–25 dynamic stall requirement include: (1) A significant number of flight test demonstrations for compliance used inappropriate piloting techniques considering the capabilities of transport category airplanes; (2) the stated test procedures depend, to a large extent, on pilot interpretation, resulting in test demonstrations that could vary significantly for different test pilots; (3) the safety objective of the requirement is not well understood within the aviation community; and (4) the flight test procedures that are provided are inconsistent with the flight characteristics being evaluated. As a result, applicants are unable to ensure that their designs will comply with the JAR–25 dynamic stall requirement prior to the certification flight test.

In practice, FAA certification testing has typically included stall demonstrations at entry rates higher than 1 knot per second. For airplanes with certain special features, such as systems designed to prevent a stall or that are needed to provide an acceptable stall indication, higher entry rates are demonstrated to show that the system will continue to safely perform its intended function under such conditions. These higher entry rate stalls are different, however, from the JAR–25 dynamic stalls.

Rather than simply deleting the dynamic stall requirements from JAR–25, or adding this requirement to part 25, the ARAC recommended harmonizing the two standards by requiring turning flight stalls be demonstrated at steady airspeed deceleration rates up to 3 knots per second. The FAA agrees with this recommendation and proposed to add the requirement for a higher entry rate stall demonstration to part 25 as § 25.201(c)(2). The current § 25.201(c)(2) would be redesignated § 25.201(c)(3). The JAA would replace the JAR–25 dynamic stall requirement with the ARAC recommendation.

The proposed higher entry rate stall demonstration is a controlled and repeatable maneuver that meets the objective of evaluating stall characteristics over a range of entry conditions that might reasonably be encountered by transport category airplanes in operational service. Some degradation in characteristics would be accepted at the higher entry rates, as long as it does not present a major threat to recovery from the point at which the pilot has recognized the stall. Guidance material was proposed for AC 25–7 to point out that the specified deceleration rate, and associated rate of increase in angle of attack, should be established from the trim speed specified in § 25.103(b)(1) and maintained up to the point at which the airplane stalls.

The FAA proposed to revise § 25.203(c) to specify a bank angle that must not be exceeded during the recovery from the turning flight stall demonstrations. Currently, § 25.203(c) provides only a qualitative statement that a prompt recovery must be easily attainable using normal piloting skill. By specifying a maximum bank angle limit, the FAA proposed to augment this qualitative requirement with a quantitative one.

For deceleration rates up to 1 knot per second, the maximum bank angle would be approximately 60 degrees in the original direction of the turn, or 30 degrees in the opposite direction. These bank angle limits are currently contained in JAR–25 guidance material, and have been used informally during FAA certification programs as well. For deceleration rates higher than 1 knot per second, the FAA proposed to allow a greater maximum bank angle—approximately 90 degrees in the original direction of the turn, or 60 degrees in the opposite direction. These are the same acceptance criteria currently used by the JAA to evaluate dynamic stall demonstrations.

In addition to the amendments to part 25 adopted by this final rule, AC 25–7 is being revised to ensure that these harmonized standards will be interpreted and applied consistently. AC 25–7 provides guidelines that the FAA has found acceptable regarding flight testing transport category airplanes to demonstrate compliance with the applicable airworthiness requirements. The changes to AC 25–7 are described in a separate notice published elsewhere in this issue of the **Federal Register**. Copies of the affected pages will be available for distribution shortly after publication of this final rule.

Discussion of the Comments

Five commenters responded to the request for comments contained in NPRM 94–15. All five commenters support the proposals, with two of the commenters requesting that the FAA and JAA concurrently adopt the proposed amendments soon. One of the commenters supports the proposals as long as they apply only to future airplane certification programs, and not to existing fleets.

The FAA appreciates the widespread support for these proposals, which the FAA attributes to the use of the ARAC process. As a result of this support, the FAA is adopting the proposed rules with only a few minor clarifying changes. These changes, which do not affect the intended application of the requirements, were made to prevent any confusion that may have resulted from the proposed wording.

In § 25.125(a)(2), the FAA has added the words "whichever is greater" in reference to the two constraints on the stabilized approach speed used to determine the landing distance. This addition provides consistency with other sections of part 25 containing multiple constraints, and clarifies that the more critical of the two constraints must be satisfied.

In § 25.143(c), the FAA proposed to replace the term "temporary" with the term "transient" to refer to those control forces that the pilot is assumed to take immediate action to reduce or eliminate. Examples of such forces are those resulting from raising or lowering the flaps or landing gear, changing altitude or speed, or recovering from some type of failure. The intended requirement relates to the initial stabilized force resulting from these events, not to any force peaks that may occur instantaneously. The term "transient," however, could too easily be misinterpreted to refer to an instantaneous peaking of the force level. Therefore, the FAA is replacing "temporary" with "short term" rather than "transient" in § 25.143(c). For consistent terminology, the FAA is also replacing the term "prolonged" in § 25.143(c) with "long term." These changes are carried through to the other sections of the proposal in which the terms "temporary" and "prolonged" appear (§§ 25.143(d) and (e) and 25.145(b)). The accompanying advisory material that was proposed for AC 25–7 will also be revised accordingly.

Due to a comment on the revisions proposed for AC 25–7 associated with the proposed rule changes, the FAA finds it necessary to clarify the requirements for the position of the propeller on the engine suddenly made inoperative during the V_{MCL} and V_{MCL-2} determination of §§ 25.149(f) and 25.149(g). A windmilling propeller creates significantly more drag than a feathered propeller, and hence is the more critical position relative to maintaining control of the airplane after an engine failure. Since § 25.149(a) requires V_{MCL} and V_{MCL-2} to be determined using the most critical mode of powerplant failure with respect to controllability, the windmilling position must be assumed. Subsequent feathering of the propeller would be accomplished either by an automatic system that

senses the engine failure or by the pilot manually adjusting the cockpit controls.

The requirements proposed in NPRM 94–15 would allow the propeller to be in the feathered position if the propeller feathering is done automatically. Credit for pilot action to manually feather the propeller would be inappropriate during this high workload phase of flight. Because an autofeather system may not be designed to respond to an engine failure at low power settings, one commenter proposes adding a statement to the advisory material in AC 25–7 to state that the engine failure could be assumed to occur after the pilot sets go-around power. The commenter's proposal would ensure that automatic propeller feathering could be taken into account in determining V_{MCL} and V_{MCL-2}, even if the automatic feathering would not occur for engine failures at low power settings.

The FAA does not concur with the commenter's proposal. As was noted in the NPRM 94–15 preamble discussion, V_{MCL} and V_{MCL-2} must be determined assuming the critical engine suddenly fails during, or just prior to, the go-around maneuver. A sudden engine failure during an approach for landing may be the reason for initiating the go-around. If the autofeather system does not feather the propeller in this situation, the minimum control speeds should not assume the propeller is feathered.

To clarify this point, §§ 25.149(f)(5) and 25.149(g)(5) have been revised to state that the engine failure must be assumed to occur from the power setting associated with maintaining a three degree approach path angle. The revised wording also clarifies that these provisions apply only to propeller airplanes. The word "automatically," referring to the position achieved by the propeller, has been replaced with "without pilot action." This revision further clarifies the intent of the requirement and is more appropriate terminology for applying these requirements to airplanes lacking an autofeather system.

The FAA is clarifying § 25.201(d)(1) by removing the reference to rolling motion. Section 25.201(d) defines and lists the airplane behavior that gives the pilot a clear indication that the airplane has stalled. The presence of rolling motion is immaterial to determining whether or not the airplane has stalled. The proposed wording had been intended to emphasize that a rolling motion by itself would be unacceptable as a stall indication, and that any rolling motion that did occur must be within the bounds allowed by §§ 25.203 (b) and (c); however, the FAA has decided that this explanatory material would be better placed in AC 25–7.

With the exceptions noted above, the FAA is revising parts 1 and 25 as proposed. These amendments apply only to airplanes for which an application for a new (or amended or supplemental, if applicable) type certificate is made after the date the amendment becomes effective.

Regulatory Evaluation Summary

Final Regulatory Evaluation, Final Regulatory Flexibility Determination, and Trade Impact Assessment

Three principal requirements pertain to the economic impacts of changes to the Federal Aviation Regulations. First, Executive Order 12866 directs Federal agencies to promulgate new regulations or modify existing regulations only if the expected benefits to society outweigh the expected costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effect of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) Will generate benefits exceeding costs; (2) is not "significant" as defined in the Executive Order and the Department of Transportation's (DOT) policies and procedures; (3) will not have a significant impact on a substantial number of small entities; and (4) will lessen restraints on international trade. These analyses, available in the docket, are summarized below.

Cost Benefit Analysis

Three of the 48 provisions will require additional flight testing and engineering analysis, resulting in compliance costs of $18,500 per type-certification, or about $37 per airplane when amortized over a representative production run of 500 airplanes. The primary benefits of the rule are harmonization of flight test airworthiness standards with the European Joint Aviation Requirements and clarification of existing standards. The resulting increased uniformity of flight test standards will simplify airworthiness approvals and reduce over flight testing costs. While not readily quantifiable, these benefits will far exceed the incremental costs of the rule.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Federal regulations. The RFA requires a Regulatory Flexibility Analysis if a rule will have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, prescribes standards for complying with RFA review requirements in FAA rulemaking actions. The Order defines "small entities" in terms of size thresholds, "significant economic impact" in terms of annualized cost thresholds, and "substantial number" as a number which is not less than eleven and which is more than one-third of the small entities subject to the proposed or final rule.

The rule will affect manufacturers of transport category airplanes produced under future new airplane type certifications. For manufacturers, Order 2100.14A specifies a size threshold for classification as a small entity as 75 or fewer employees. Since no part 25 airplane manufacturer has 75 or fewer employees, the rule will not have a significant economic impact on a substantial number of small airplane manufacturers.

Trade Impact Assessment

This final rule will not constitute a barrier to international trade, including the export of American airplanes to foreign countries, and the import of foreign airplanes into the United States. Instead, the flight testing standards have been harmonized with those of foreign aviation authorities, thereby lessening restraints on trade.

Federalism Implications

This final rule will not have substantial direct effects on the States, on the relationship between the national government and the State, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this final rule will not have sufficient federalism implications to warrant preparing a Federalism Assessment.

Conclusion

Because the changes to standardize specific flight requirements of part 25 of the FAR are not expected to result in substantial economic cost, the FAA has determined that this regulation is not significant under Executive Order 12866. Because this is an issue that has not prompted a great deal of public concern, the FAA has determined that this action is not significant under DOT

Regulatory Policies and Procedures (44 FR 11034, February 25, 1979). In addition, since there are no small entities affected by this rulemaking, the FAA certifies, under the criteria of the Regulatory Flexibility Act, that this regulation will not have a significant economic impact, positive or negative, on a substantial number of small entities. A copy of the regulatory evaluation prepared for this regulation has been placed in the public docket. A copy may be obtained by contacting the person identified under the caption, **FOR FURTHER INFORMATION CONTACT.**

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Adoption of the Amendment

In consideration of the foregoing, the Federal Aviation Administration (FAA) amends 14 CFR parts 1 and 25 of the Federal Aviation Regulations (FAR) as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

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

Authority: 49 U.S.C. app. 1347, 1348, 1354(a), 1357(d)(2), 1372, 1421 through 1430, 1432, 1442, 1443, 1472, 1510, 1522, 1652(e), 1655(c), 1657(f), and 49 U.S.C. 106(g).

2. Section 1.1 is amended by adding a new definition to read as follows:

§ 1.1 General definitions.

* * * * *

Go-around power or thrust setting means the maximum allowable in-flight power or thrust setting identified in the performance data.

* * * * *

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

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

Authority: 49 U.S.C. app. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g); and 49 CFR 1.47(a).

4. Section 25.119 is amended by revising paragraph (a) to read as follows:

§ 25.119 Landing climb: All-engines-operating.

* * * * *

(a) The engines at the power or thrust that is available eight seconds after initiation of movement of the power or thrust controls from the minimum flight idle to the go-around power or thrust setting; and

* * * * *

5. Section 25.121 is amended by revising paragraph (d)(1) to read as follows:

§ 25.121 Climb: One-engine-inoperative.

* * * * *

(d) * * *

(1) The critical engine inoperative, the remaining engines at the go-around power or thrust setting;

* * * * *

6. Section 25.125 is amended by revising paragraph (a)(2) to read as follows:

§ 25.125 Landing.

* * * * *

(a) * * *

(2) A stabilized approach, with a calibrated airspeed of not less than 1.3 V_S or V_{MCL}, whichever is greater, must be maintained down to the 50 foot height.

* * * * *

7. Section 25.143 is amended by revising paragraphs (c), (d), and (e) and adding a new paragraph (f) to read as follows:

§ 25.143 General.

* * * * *

(c) The following table prescribes, for conventional wheel type controls, the maximum control forces permitted during the testing required by paragraphs (a) and (b) of this section:

Force, in pounds, applied to the control wheel or rudder pedals	Pitch	Roll	Yaw
For short term application for pitch and roll control—two hands available for control	75	50	.....
For short term application for pitch and roll control—one hand available for control	50	25	.....
For short term application for yaw control	.....	.....	150
For long term application	10	5	20

(d) Approved operating procedures or conventional operating practices must be followed when demonstrating compliance with the control force limitations for short term application that are prescribed in paragraph (c) of this section. The airplane must be in trim, or as near to being in trim as practical, in the immediately preceding steady flight condition. For the takeoff condition, the airplane must be trimmed according to the approved operating procedures.

(e) When demonstrating compliance with the control force limitations for long term application that are prescribed in paragraph (c) of this section, the airplane must be in trim, or as near to being in trim as practical.

(f) When maneuvering at a constant airspeed or Mach number (up to V_{FC}/M_{FC}), the stick forces and the gradient of the stick force versus maneuvering load factor must lie within satisfactory limits. The stick forces must not be so great as to make excessive demands on the pilot's strength when maneuvering the airplane, and must not be so low that the airplane can easily be overstressed inadvertently. Changes of gradient that occur with changes of load factor must not cause undue difficulty in maintaining control of the airplane, and local gradients must not be so low as to result in a danger of overcontrolling.

8. Section 25.145 is amended by revising paragraphs (b) introductory paragraph, (b)(3), (b)(4), and (c)(1) to read as follows:

§ 25.145 Longitudinal control.

* * * * *

(b) With the landing gear extended, no change in trim control, or exertion of more than 50 pounds control force (representative of the maximum short term force that can be applied readily by one hand) may be required for the following maneuvers:

* * * * *

(3) Repeat paragraph (b)(2), except at the go-around power or thrust setting.

(4) With power off, flaps retracted, and the airplane trimmed at 1.4 V_{SI}, rapidly set go-around power or thrust while maintaining the same airspeed.

* * * * *

(c) * * *

(1) Simultaneous movement of the power or thrust controls to the go-around power or thrust setting;

* * * * *

9. Section 25.149 is amended by revising paragraphs (f), (g) and (h) to read as follows:

§ 25.149 Minimum control speed.

* * * * *

(f) V_{MCL}, the minimum control speed during approach and landing with all engines operating, is the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it

is possible to maintain control of the airplane with that engine still inoperative, and maintain straight flight with an angle of bank of not more than 5 degrees. V_{MCL} must be established with—

(1) The airplane in the most critical configuration (or, at the option of the applicant, each configuration) for approach and landing with all engines operating;

(2) The most unfavorable center of gravity;

(3) The airplane trimmed for approach with all engines operating;

(4) The most favorable weight, or, at the option of the applicant, as a function of weight;

(5) For propeller airplanes, the propeller of the inoperative engine in the position it achieves without pilot action, assuming the engine fails while at the power or thrust necessary to maintain a three degree approach path angle; and

(6) Go-around power or thrust setting on the operating engine(s).

(g) For airplanes with three or more engines, V_{MCL-2}, the minimum control speed during approach and landing with one critical engine inoperative, is the calibrated airspeed at which, when a second critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with both engines still inoperative, and maintain straight flight with an angle of bank of not more than 5 degrees. V_{MCL-2} must be established with—

(1) The airplane in the most critical configuration (or, at the option of the applicant, each configuration) for approach and landing with one critical engine inoperative;

(2) The most unfavorable center of gravity;

(3) The airplane trimmed for approach with one critical engine inoperative;

(4) The most unfavorable weight, or, at the option of the applicant, as a function of weight;

(5) For propeller airplanes, the propeller of the more critical inoperative engine in the position it achieves without pilot action, assuming the engine fails while at the power or thrust necessary to maintain a three degree approach path angle, and the propeller of the other inoperative engine feathered;

(6) The power or thrust on the operating engine(s) necessary to maintain an approach path angle of three degrees when one critical engine is inoperative; and

(7) The power or thrust on the operating engine(s) rapidly changed, immediately after the second critical engine is made inoperative, from the power or thrust prescribed in paragraph (g)(6) of this section to—

(i) Minimum power or thrust; and

(ii) Go-around power or thrust setting.

(h) In demonstrations of V_{MCL} and V_{MCL-2}—

(1) The rudder force may not exceed 150 pounds;

(2) The airplane may not exhibit hazardous flight characteristics or require exceptional piloting skill, alertness, or strength;

(3) Lateral control must be sufficient to roll the airplane, from an initial condition of steady flight, through an angle of 20 degrees in the direction necessary to initiate a turn away from the inoperative engine(s), in not more than 5 seconds; and

(4) For propeller airplanes, hazardous flight characteristics must not be exhibited due to any propeller position achieved when the engine fails or during any likely subsequent movements of the engine or propeller controls.

10. Section 25.201 is amended by revising paragraphs (b), (c), and (d) to read as follows:

§ 25.201 Stall demonstration.

* * * * *

(b) In each condition required by paragraph (a) of this section, it must be possible to meet the applicable requirements of § 25.203 with—

(1) Flaps, landing gear, and deceleration devices in any likely combination of positions approved for operation;

(2) Representative weights within the range for which certification is requested;

(3) The most adverse center of gravity for recovery; and

(4) The airplane trimmed for straight flight at the speed prescribed in § 25.103(b)(1).

(c) The following procedures must be used to show compliance with § 25.203;

(1) Starting at a speed sufficiently above the stalling speed to ensure that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction does not exceed one knot per second until the airplane is stalled.

(2) In addition, for turning flight stalls, apply the longitudinal control to achieve airspeed deceleration rates up to 3 knots per second.

(3) As soon as the airplane is stalled, recover by normal recovery techniques.

(d) The airplane is considered stalled when the behavior of the airplane gives the pilot a clear and distinctive indication of an acceptable nature that the airplane is stalled. Acceptable indications of a stall, occurring either individually or in combination, are—

(1) A nose-down pitch that cannot be readily arrested;

(2) Buffeting, of a magnitude and severity that is a strong and effective deterrent to further speed reduction; or

(3) The pitch control reaches the aft stop and no further increase in pitch attitude occurs when the control is held full aft for a short time before recovery is initiated.

11. Section 25.203 is amended by revising paragraph (c) to read as follows:

§ 25.203 Stall characteristics.

* * * * *

(c) For turning flight stalls, the action of the airplane after the stall may not be so violent or extreme as to make it difficult, with normal piloting skill, to effect a prompt recovery and to regain control of the airplane. The maximum bank angle that occurs during the recovery may not exceed—

(1) Approximately 60 degrees in the original direction of the turn, or 30 degrees in the opposite direction, for deceleration rates up to 1 knot per second; and

(2) Approximately 90 degrees in the original direction of the turn, or 60 degrees in the opposite direction, for deceleration rates in excess of 1 knot per second.

12. Section 25.253 is amended by revising paragraph (b) to read as follows:

§ 25.253 High-speed characteristics.

* * * * *

(b) *Maximum speed for stability characteristics, V_{FC}/M_{FC}.* V_{FC}/M_{FC} is the maximum speed at which the requirements of §§ 25.143(f), 25.147(e), 25.175(b)(1), 25.177, and 25.181 must be met with flaps and landing gear retracted. It may not be less than a speed midway between V_{MO}/M_{MO} and V_{DF}/M_{DF}, except that for altitudes where Mach number is the limiting factor, M_{FC} need not exceed the Mach number at which effective speed warning occurs.

Issued in Washington, D.C. on June 2, 1995.

David R. Hinson,

Administrator.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Advisory Circular 25–7, Flight Test Guide for Certification of Transport Category Airplanes

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of changes to advisory circular.

SUMMARY: This notice describes the changes to Advisory Circular (AC) 25–7, "Flight Test Guide for Certification of Transport Category Airplanes," that accompany Amendment 25–84, published elsewhere in this issue of the **Federal Register**.

FOR FURTHER INFORMATION CONTACT: Donald K. Stimson, Flight Test and Systems Branch, ANM–111, Transport Airplane Directorate, Aircraft Certification Service, FAA, 1601 Lind Avenue SW., Renton, WA 98055–4056; telephone (206) 227–1129; facsimile (206) 227–1320.

SUPPLEMENTARY INFORMATION:

Discussion

On May 22, 1990, the Aerospace Industries Association of America, Inc. (AIA) and the Association Europeenne des Constructeurs de Materiel Aerospatial (AECMA) jointly petitioned the FAA and the European Joint Aviation Authorities (JAA) to harmonize certain airworthiness requirements that apply to transport category airplanes. In their petition, a summary of which was published in the July 17, 1990, edition of the **Federal Register** (55 FR 137), AIA and AECMA also recommended changes to Advisory Circular (AC) 25–7, "Flight Test Guide for Certification of Transport Category Airplanes," to ensure that the harmonized standards would be interpreted and applied consistently.

Part 25 of the Federal Aviation Regulations (FAR) prescribes the United States airworthiness standards for transport category airplanes. Advisory Circular (AC) 25–7 provides guidelines that the FAA has found acceptable for flight testing transport category airplanes to demonstrate compliance with those airworthiness standards. Revisions to part 25, in response to the AIA/AECMA petition, were proposed by the FAA in Notice of Proposed Rulemaking (NPRM) 94–15, which was published in the **Federal Register** on April 22, 1994 (59 FR 19296). The proposed revisions to AC 25–7 were published in the same issue of the **Federal Register** as NPRM 94–15 (59 FR 19303).

Amendment 25–84, which resulted from publication of Notice 94–15, is published elsewhere in this issue of the **Federal Register**. The changes to AC 25–7 that accompany Amendment 25–84 are detailed below. Copies of the affected pages will be available for distribution shortly after publication of this notice.

Revisions to AC 25–7 to Accompany Amendment 25–84

1. Replace Paragraph 16.a With the Following

a. Section 25.119(a) states that the engines are to be set at the power or thrust that is available eight seconds after initiating movement of the power or thrust controls from the minimum flight idle position to the go-around power or thrust setting. The procedures given are for the determination of this maximum thrust for showing compliance with the climb requirements of § 25.119.

2. Replace Paragraph 16.b.(3) With the Following

(3) *For the critical air bleed configuration,* stabilize the airplane in level flight with symmetric power on all engines, landing gear down, flaps in the landing position, at a speed of 1.3 V_{SO}, simulating the estimated minimum climb limiting landing weights at an altitude sufficiently above the selected test altitude so that the time to descend to the test altitude with the throttles closed equals the appropriate engine r.p.m. stabilization time determined in paragraph (2). Retard the throttles to the flight idle position and descend at 1.3 V_S to approximately the test altitude; when the appropriate time has elapsed, rapidly advance the power or thrust controls to the go-around power or thrust setting. The power or thrust controls may first be advanced to the forward stop and then retarded to the go-around power or thrust setting. At the applicant's option, additional less critical bleed configurations may be tested.

3. Add the Following Sections to Paragraph 20.a

(1) The maximum forces given in the table in § 25.143(c) for pitch and roll control for short-term application are applicable to maneuvers in which the control force is only needed for a short period. Where the maneuver is such that the pilot will need to use one hand to operate other controls (such as during the landing flare or a go-around, or during changes of configuration or power resulting in a change of control force that must be trimmed out) the single-handed maximum control forces will be applicable. In other cases (such as takeoff rotation, or maneuvering during en route flight), the two-handed maximum forces will apply.

(2) Short-term and long-term forces should be interpreted as follows:

(i) Short-term forces are the initial stabilized control forces that result from maintaining the intended flight path following configuration changes and normal transactions from one flight condition to another, or from regaining control following a failure. It is assumed that the pilot will take immediate action to reduce or eliminate such forces by re-trimming or changing configuration or flight conditions, and consequently short-term forces are not considered to exist for any significant duration. They do not include transient force peaks that may occur during the configuration change, change of flight conditions, or recovery of control following a failure.

(ii) Long-term forces are those control forces that result from normal or failure conditions that cannot readily be trimmed out or eliminated.

4. Add the Following Sections to Paragraph 20

d. *Acceptable Means of Compliance.* An acceptable means of compliance with the requirement that stick forces may not be excessive when maneuvering the airplane is to demonstrate that, in a turn for 0.5g incremental normal acceleration (0.3g above 20,000 feet) at speeds up to V_{FC}/M_{FC}, the average stick force gradient does not exceed 120 lbs/g.

e. *Interpretive Material.* (1) The objective of § 25.143(f) is to ensure that the limit strength of any critical component on the airplane would not be exceeded in maneuvering flight. In much of the structure, the load sustained in maneuvering flight can be assumed to be directly proportional of the load factor applied. However, this may not be the case for some parts of the structure, e.g., the tail and rear fuselage. Nevertheless, it is accepted that the airplane load factor will be a sufficient guide to the possibility of exceeding limit strength on any critical component if a structural investigation is undertaken whenever the design positive limit maneuvering load factor is closely approached. If flight testing indicates that the design positive limit maneuvering load factor could be exceeded in steady maneuvering flight with a 50-pound stick force, the airplane structure should be evaluated for the anticipated load at a 50-pound stick force. The airplane will be considered to have been overstressed if limit strength has been exceeded in any critical

component. For the purposes of this evaluation, limit strength is defined as the larger of either the limit design loads envelope increased by the available margins of safety, or the ultimate static test strength divided by 1.5.

(2) Minimum Stick Force to Reach Limit Strength. (i) A stick force of at least 50 pounds to reach limit strength in steady maneuvers or wind-up turns in considered acceptable to demonstrate adequate minimum force at limit strength in the absence of deterrent buffeting. If heavy buffeting occurs before the limit strength condition is reached, a somewhat lower stick force at limit strength may be acceptable. The acceptability of a stick force of less than 50 pounds at the limit strength condition will depend upon the intensity of he buffet, the adequacy of the warning margin (i.e., the load factor increment between the heavy buffet and the limit strength condition), and the stick force characteristics. In determining the limit strength condition for each critical component, the contribution of buffet loads to the overall maneuvering loads should be taken into account.

(ii) This minimum stick force applies in the en route configuration with the airplane trimmed for straight flight, at all speeds above the minimum speed at which the limit strength condition can be achieved without stalling. No minimum stick force is specified for other configurations, but the requirements of § 25.143(f) are applicable in these conditions.

(3) Stick Force Characteristics. (i) At all points within the buffet onset boundary determined in accordance with § 25.251(e), but not including speeds above V_{FC}/M_{FC}, the stick force should increase progressively with increasing load factor. Any reduction in stick force gradient with change of load factor should not be so large or abrupt as to impair significantly the ability of the pilot to maintain control over the load factor and pitch attitude of the airplane.

(ii) Beyond the buffet onset boundary, hazardous stick force characteristics should not be encountered within the permitted maneuvering envelope as limited by paragraph 20.e.(3)(iii). It should be possible, by use of the primary longitudinal control alone, to pitch the airplane rapidly nose down so as to regain the initial trimmed conditions. The stick force characteristics demonstrated should comply with the following:

(A) For normal acceleration increments of up to 0.3g beyond buffet onset, where these can be achieved, local reversal of the stick force gradient may be acceptable, provided that any tendency to pitch up is mild and easily controllable.

(B) For normal acceleration increments of more than 0.3g beyond buffet onset, where these can be achieved, more marked reversals of the stick force gradient may be acceptable. It should be possible for any tendency to pitch up to be contained within the allowable maneuvering limits without applying push forces to the control column and without making a large and rapid forward movement of the control column.

(iii) In flight tests to satisfy paragraphs 20.e.(3) (i) and (ii), the load factor should be increased until either:

(A) The level of buffet becomes sufficient to provide a strong and effective deterrent to further increase of load factor; or

(B) Further increase the load factor requires a stick force in excess of 150 pounds (or in excess of 100 pounds when beyond the buffet onset boundary) or is impossible because of the limitations of the control system; or

(C) The positive limit maneuvering load factor established in compliance with § 25.337(b) is achieved.

(4) Negative Load Factors. It is not intended that a detailed flight test assessment of the maneuvering characteristics under negative load factors should necessarily be made throughout the specified range of conditions. An assessment of the characteristics in the normal flight envelope involving normal accelerations from 1g to zero g will normally be sufficient. Stick forces should also be assessed during other required flight testing involving negative load factors. Where these assessments reveal stick force gradients that are unusually low, or that are subject to significant variation, a more detailed assessment, in the most critical of the specified conditions, will be required. This may be based on calculations provided these are supported by adequate flight test or wind tunnel data.

5. Replace Paragraph 21.a.(e) With the Following

(3) *Section 25.145(c)* contains requirements associated primarily with attempting a go-around maneuver from the landing configuration. Retraction of the high-lift devices from the landing configuration should not result in a loss of altitude if the power or thrust controls are moved to the go-around setting at the same time that flap/slat retraction is begun. The design features involved with this requirement are the rate of flap/slat retraction, the presence of any flap gates, and the go-around power or thrust setting.

(i) Flap gates, which prevent the pilot from moving the flap selector through the gated position without a separate and distinct movement of the selector, allow compliance with these requirements to be demonstrated in segments. High lift device retraction must be demonstrated beginning from the maximum landing position to the first gated position, between gated positions, and from the last gated position to the fully retracted position.

(ii) The go-around power or thrust setting should be the same as is used to comply with the approach and landing climb performance requirements of §§ 25.121(d) and 25.119, and the controllability requirements of §§ 25.145(b)(3), 25.145(b)(4), 25.145(b)(5), 25.149(f), and 25.149(g). The controllability requirements may limit the go-around power or thrust setting.

6. Replace Paragraph 21.c.(3)(i)(E) With the Following

(E) Engine power at flight idle and the go-around power or thrust setting.

7. Replace Paragraph 21.c.(4)(ii) With the Following

(ii) The airplane should be trimmed at a speed of 1.4 V_S. Quickly set go-around power or thrust while maintaining the speed of 1.4 V_S. The longitudinal control force should not exceed 50 lbs. throughout the maneuver without changing the trim control.

8. Replace Paragraph 21.c.(6)(ii) With the Following

(ii) Test procedure: With the airplane stable in level flight at a speed of 1.1 V_S for propeller driven airplanes, or 1.2 V_S for turbojet powered airplanes, retract the flaps to the full up position, or the next gated position, while simultaneously setting go-around power. Use the same power or thrust as is used to comply with the performance requirement of § 25.121(d), as limited by the applicable controllability requirements. It must be possible, without requiring exceptional piloting skill, to prevent losing altitude during the maneuver. Trimming is permissible at any time during the maneuver. If gates are provided, conduct this test beginning from the maximum landing flap position to the first gate, from gate to gate, and from the last gate to the fully retracted position. (The gate design requirements are specified within the rule.) Keep the landing gear extended throughout the test.

9. Revise the First Sentence of Paragraph 23.a by Replacing "Landing Approach (V_{MCL})" by "Approach and Landing V_{MCL} and V_{MCL-2}). " Revise the Second Sentence in the Same Paragraph by Replacing "V_{MCL}" with "V_{MCL} and V_{MCL-2}"

10. Replace Paragraph 23.b.(2)(iii) With the Following

(iii) During determination of V_{MCG}, engine failure recognition should be provided by:

(A) The pilot feeling a distinct change in the directional tracking characteristics of the airplane, or

(B) The pilot seeing a directional divergence of the airplane with respect to the view outside the airplane.

11. Replace Paragraph 23.b.(3) With the Following

(3) Minimum Control Speed During Approach and Landing (V_{MCL})—§ 25.149(f).

(i) This section is intended to ensure that the airplane is safely controllable following an engine failure during an all-engines-operating approach and landing. From a controllability standpoint, the most critical case usually consists of an engine failing after the power or thrust has been increased to perform a go-around from an all-engines-operating approach. Section 25.149(f) requires the minimum control speed to be determined that allows a pilot of average skill and strength to retain control of the airplane after the critical engine becomes inoperative and to maintain straight flight with less than five degrees of bank angle. Section 25.149(h) requires that sufficient lateral control be available at V_{MCL} to roll the airplane through an angle of 20 degrees, in the direction necessary to initiate a turn away from the inoperative engine, in not more than five seconds when starting from a steady flight condition.

(ii) Conduct this test using the most critical of the all-engines-operating approach and landing configurations, or at the option of the applicant, each of the all-engines-operating approach and landing configurations. The procedures given in paragraph 23.b.(1)(ii) for V_{MCA} may be used to determine V_{MCL}, except that flap and trim settings should be appropriate to the approach and landing configurations, the power or thrust on the operating engine(s) should be set to the go-around power or thrust setting, and compliance with all V_{MCL} requirements of §§ 25.149 (f) and (h) must be demonstrated.

12. Add the Following New Sections to Paragraph 23.b.(3)

(iii) For propeller driven airplanes, the propeller must be in the position it achieves without pilot action following engine failure, assuming the engine fails while at the power or thrust necessary to maintain a three degree approach path angle.

(iv) At the option of the applicant, a one-engine-inoperative landing minimum control speed, $V_{MCL(1\ out)}$, may be determined in the conditions appropriate to an approach and landing with one engine having failed before the start of the approach. In this case, only those configurations recommended for use during an approach and landing with one engine inoperative need be considered. The propeller of the inoperative engine, if applicable, may be feathered throughout. The resulting value of $V_{MCL(1\ out)}$ may be used in determining the recommended procedures and speeds for a one-engine-inoperative approach and landing.

13. Replace and Re-Designate Paragraphs 23.b.(4), 23.b.4(ii), and 23.b.4(ii)(A) With the Following

(4) Minimum Control Speed With One Engine Inoperative During Approach and Landing (V_{MCL-2})—§ 25.149(g).

(iii) Conduct this test using the most critical approved one-engine-inoperative approach or landing configuration (usually the minimum flap deflection), or at the option of the applicant, each of the approved one-engine-inoperative approach and landing configurations. The following demonstrations are required to determine V_{MCL-2}:

(A) With the power or thrust on the operating engines set to maintain a minus 3 degree glideslope with one critical engine inoperative, the second critical engine is made inoperative and the remaining operating engine(s) are advanced to the go-around power or thrust setting. The V_{MCL-2} speed is established by the procedures presented in paragraph 23.b.(1)(ii) for V_{MCA}, except that flap and trim setting should be appropriate to the approach and landing configurations, the power or thrust on the operating engine(s) should be set to the go-around power or thrust setting, and compliance with all V_{MCL-2} requirements of §§ 25.149(g) and (h) must be demonstrated.

14. Add the Following New Section to Paragraph 23.b.(4)

(ii) For propeller driven airplanes, the propeller of the engine inoperative at the beginning of the approach may be in the feathered position. The propeller of the more critical engine must be in the position it automatically assumes following engine failure.

(iii)(C) Starting from a steady straight flight condition, demonstrate that sufficient lateral control is available at V_{MCL-2} to roll the airplane through an angle of 20 degrees in the direction necessary to initiate a turn away from the inoperative engines in not more than five seconds. This maneuver may be flown in a bank-to-bank roll through a wings level attitude.

(iv) At the option of the applicant, a two-engines-inoperative landing minimum control speed, $V_{MCL-2(2\ out)}$, may be determined in the conditions appropriate to an approach and landing with two engines having failed before the start of the approach. In this case, only those configurations recommended for use during an approach and landing with two engines inoperative need be considered. The propellers of the inoperative engines, if applicable, may be feathered throughout. The values of V_{MCL-2} or $V_{MCL-2(2\ out)}$ should be used as guidance in determining the recommended procedures and speeds for a two-engines-inoperative approach and landing.

15. Add the Following New Section to Paragraph 23.b

(5) *Autofeather Effects.* Where an autofeather or other drag limiting system is installed and will be operative at approach power settings, its operation may be assumed in determining the propeller position achieved when the engine fails. Where automatic feathering is not available, the effects of subsequent movements of the engine and propeller controls should be considered, including fully closing the power lever of the failed engine in conjunction with maintaining the go-around power setting on the operating engine(s).

16. Replace Paragraph 29.b.(3)(i) With the Following

(i) The pitch control reaches the aft stop is held full aft for two seconds, or until the pitch attitude stops increasing, whichever occurs later. In the case of turning flight stalls, recovery may be initiated once the pitch control reaches the aft stop when accompanied by a rolling motion that is not immediately controllable (provided the rolling motion complies with § 25.203 (c)).

17. Replace Paragraph 29.b.(3)(ii) With the Following

(ii) An uncommanded, distinctive and easily recognizable nose down pitch that cannot be readily arrested. This nose down pitch may be accompanied

by a rolling motion that is not immediately controllable, provided that the rolling motion complies with § 25.203(b) or (c) as appropriate.

18. Remove Paragraph 29.b.(3)(iii) (and Redesignate Paragraph 29.b.(3) (iv) and (v) as 29.b.(3) (iii) and (iv), Respectively

(iii) A roll that cannot be readily arrested with normal use of lateral/directional control.

19. Replace Paragraph 29.d.(3)(i) With the Following

(i) The airplane should be trimmed for hands-off flight at a speed 20 percent to 40 percent above the stall speed, with the appropriate power setting and configuration. Then, using only the primary longitudinal control, establish and maintain a deceleration (entry rate) consistent with that specified in §§ 25.201(c)(1) or 25.201(c)(2), as appropriate, until the airplane is stalled. Both power and pilot selectable trim should remain constant throughout the stall and recovery (angle of attack has decreased to the point of no stall warning).

20. Replace Paragraph 29.d.(3)(iii) With the Following

(iii) In addition, for turning flight stalls, apply the longitudinal control to achieve airspeed deceleration rates up to 3 knots per second. The intent of evaluating higher deceleration rates is to demonstrate safe characteristics at higher rates of increase of angle of attack than are obtained from the 1 knot per second stalls. The specified airspeed deceleration rate, and associated angle of attack rate, should be maintained up to the point at which the airplane stalls.

21. Replace Paragraph 29.d.(3)(iv) With the Following

(iv) For those airplanes where stall is defined by full nose-up longitudinal control for both forward and aft c.g., the time at full aft stick during characteristics testing should be not less than that used for all speed determination. For turning flight stalls, however, recovery may be initiated once the pitch control reaches the aft stop when accompanied by a rolling motion that is not immediately controllable (provided the rolling motion complies with § 25.203(c)).

22. Add the Following New Section to Paragraph 29.d.(3)

(vi) In level wing stalls the bank angle may exceed 20 degrees occasionally, provided that lateral control is effective during recovery.

Issued in Renton, Washington, on March 9, 1995.

Ronald T. Wojnar,

Manager, Transport Airplane Directorate, Aircraft Certification Service, ANM–100.

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