CRD - NPA 16/2004

Comment	Response

B. Proposal 07

Paragraph - **Add. info:**

Cmt. *40 / Transport Canada*

Comment	Response
CS 25.121(d)(2)(ii) Suggest change to: 'In icing conditions with the 'Landing Ice' accretion defined..' Justification/Reason. This is the correct icing configuration for the approach climb. Approach climb performance is required following an engine failure and a go-around from a landing approach.	Ice accretions for showing compliance with Subpart B are defined in Appendix C Part II. Landing ice is normally Holding ice, unless modified by the ice protection system operation during the landing phase. In order to reduce the number of ice accretions to be considered, holding ice may be used for the en-route, holding, approach, landing and go-around flight phases. The use of landing ice in CS 25.121(d)(2)(ii) is more precise and also in line with CS 25.125(a)(2). Comment accepted, text CS 25.121(d)(2)(ii) changed accordingly

Cmt. *41 / Transport Canada*

Comment	Response
CS 25.121(d)(2)(ii) Comment: It is recommended that for flight in icing, the minimum climb speed should be either based on a factor of stall speed (e.g. 1.13 VSR) or be VREF. If based on a factor, the climb speed for icing conditions should still be based on this factor unless the increase in stall speed is less than a threshold value of 3% or 3 knots. If based on VREF, the climb speed should only change if VREF for icing is changed. Justification/Reason. There is no minimum value of the climb speed specified for non-icing conditions or for icing conditions. Hence the proposed restriction on climb speed specified in (2)(ii) is meaningless as it could always be met by lowering the factor of an unacceptably increased stall speed.	Justification and explanation of the proposed change to CS 25.121(d) is presented in the document. In CS 25.121(d) no minimum value for the approach climb speed is defined , factors as low as 1.13 VSR have been accepted in the past for non icing conditions. The approach climb speed factor (i.e. stall margin) for icing conditions should not be less than these minimum values that have been accepted for non-icing conditions. The resulting approach climb speeds for icing conditions should also be evaluated to ensure that they provide adequate manoeuvre capability. Comment not accepted.

Cmt. *42 / Transport Canada*

Comment	Response
CS25.125(a)(2) Suggest change to: '..if VREF in icing conditions, determined at maximum landing weight, is greater than VREF in non icing conditions..' Justification/Reason. The weight at which the determination of whether the 5 knot threshold is exceeded should be specified.	VREF for icing conditions in the proposed requirements must provide the manoeuvring capability required by JAR 25.143(g) with the “Landing Ice” accretion defined in proposed part II of Appendix C to JAR-25. This entails demonstrating a constant speed 40 degree banked turn at maximum landing weight without encountering stall warning. The suggested change to specify maximum landing weight in CS25.125(a)(2) is more precise and also in line with e.g. CS 25.105(a)(2)(i). Comment accepted, text CS25.125(a)(2) changed accordingly (including editorial change proposal in cmtnr 9)

Comment	Response

B. Proposal 09

Paragraph - **Add. info:**

Cmt. *9 / FAA, USA*

Comment	Response
CS 25.125(a)(2) Change to read as follows: 'In icing conditions with the 'Landing Ice' accretion defined in Appendix C if VREF for icing conditions .. Greater than (DELETE).. Exceeds.. VREF for non-icing conditions by more than 9.3 km/h (5 knots) CAS.' Justification/Reason. Consistency with other CS 25 text (e.g., CS 25.105(a)(2)(i), 25.121(b)(2)(ii)(A), 25.121(c)(2)(ii)(A), 25.123(b)(2)(i), 25.125(b)(2)(ii)(B)) and harmonization with the expected FAA rule text.	Comment accepted, text changed accordingly.

Comment	Response

B. Proposal 10

Paragraph - **Add. info:**

Cmt. *5 / Raytheon Aircraft Company*

Comment	Response
Proposal 10, page 13: "Add new CS25.143 (i) and (j) (i) When demonstrating compliance with CS 25.143 in icing conditions - (1) Controllability may be demonstrated with the ice accretion described in Appendix C that is most critical for the particular flight phase. For aeroplanes with unpowered elevator controls, 'Sandpaper Ice' must also be considered in determining the critical ice accretion; and (2) It must be shown that a push force is required throughout a pushover manoeuvre down to zero g or the lowest load factor obtainable if limited by elevator power. It must be possible to promptly recover from the manoeuvre without exceeding 222 N. (50 lbf) pull control force; and..' Replace the above proposed 2.143(i)(2) with the following: "(2) The aeroplane must be controllable in a pushover manoeuvre down to zero g, or the lowest load factor obtainable if limited by elevator power. It must be shown that a push force is required throughout the manoeuvre down to 0.5g. It must be possible to promptly recover from the manoeuvre without exceeding 50 pounds pull control force..' Justification/Reason. The Flight Test Harmonisation Working Group (FTHWG) was divided on consensus over the force requirements during the zero g pushover maneuver. The majority position was in favor of the proposed text under Item 2 above. Additionally, the 'push force to zero g' requirement is not a direct measurement of the stall margin on an iced horizontal tail. The additional tail angle of attack induced by the pushover maneuver is a function of flight speed which varies greatly from airplane to airplane. For high performance jets, the pushover may be performed at 200 knots airspeed with a resulting increase in tail angle of attack of only 2 degrees. For turbo prop aircraft, the pushover may be performed at less than 100 knots airspeed resulting in an increase in the tail angle of attack of over 5 degrees. The push force to 0.5 g and recovery force of 50 pounds from zero g is a reasonable compromise.	CS25.143 (i) and (j) of NPA 16/2004 presents a non-consensus item within the FTHWG. The long-time ongoing discussion on longitudinal controllability in icing conditions is clearly outlined in part C of NPA 16/2004 and summarised below. Historically, the pushover test was usually performed to 0.5g total, although this was often done with a high pitch rate and, hence, there was some overshoot of the 0.5g level. A push force on the elevator control was required to reach this g level. Certification testing and service experience has since shown that testing to 0.5g is not adequate, bearing in mind the relatively high frequency of experiencing 0.5g in operations. Since the beginning of the 1980's, the practice of many certification authorities has been to require testing to lower load factors, and the JAA's Notice of Proposed Amendment (NPA) 25F-219 requires a push force throughout the manoeuvre to zero g. The FTHWG agreed that the test manoeuvre should be performed to zero g. However it is the JAA/FAA/ALPA minority contention in the FTHWG that the pass/fail criteria for this test method is a longitudinal push force be required to zero g, as proposed in CS25.143 (i) and (j) of NPA 16/2004. The majority position in the FTHWG is that reversal of the elevator control force below 0.5g is acceptable within limits, as reflected in the proposed text under Item 2 in this cmtnr 5. Results of NASA's Tailplane Icing Program provide a basis for assessing the requirements and demonstrate that the criteria proposed by the majority of the FTHWG provide an adequate safety margin. The position of the majority of the FTHWG, and the recommendation to the FAA by ARAC, is considered the right balance between cost and benefit. It is adequate to ensure against uncontrollable tailplane stalls. Combined with measures to ensure proper operation of the ice protection systems, it could have prevented the ICTS accidents. In NPA 16/2004 the original JAA NPA 25 BEF-332 is maintained in CS 25.143(i) and (j). This approach is harmonized with FAA AC 23.143-1 on ICTS. Comment not accepted.

Cmt. *10 / FAA, USA*

Comment	Response
CS 25.143© Change to read as follows: ..It.. (DELETE) The aeroplane must be shown ..that the aeroplane is.. (DELETE) to be safely controllable and manoeuvrable with the critical ice accretion appropriate to the phase of flight defined in Appendix C..' Justification/Reason. Consistency with the wording of CS 25.143(a), and harmonization with the expected FAA rule text.	Editorial comment for consistency with CS 25.143(a). Comment accepted, text CS 25.143 (c) changed accordingly

Comment	Response
Cmt. *11 / FAA, USA*	
CS 25.143(i)(3) Change to read as follows: 'Any changes in force that the pilot must apply to the pitch control to maintain speed with increasing sideslip angle must be steadily increasing with no force reversals.' Justification/Reason. Clarity and harmonization with the expected FAA rule text. The term 'steadily increasing,' in reference to the control force change associated with increasing sideslip angle, is suggested to replace 'progressive.' To avoid legal ambiguities, we suggest removing the reference to unacceptable discontinuities.' For example, how would one determine the acceptability of a given discontinuity? Allowing a discontinuity would also conflict with the requirement that the control force change be progressive (or steadily increasing). The proposed text is also intended to allow a constant control force with increasing sideslip angle to be found compliant.	The proposed revision improves the pass/fail criteria by removing qualitative assessment from the test pilot. As such clarification is provided. Comment accepted, text CS25.143(i)(3) changed accordingly.
Cmt. *12 / FAA, USA*	
CS 25.143(j) Change to read as follows: '(j) For flight in icing conditions before the ice protection system has been activated and is performing its intended function, the following requirements apply: (1) If activating the ice protection system depends on the pilot visually recognizing a specified ice accretion on a reference surface, the requirements of CS 25.143 apply with the ice accretion defined in Appendix C, Part II(e). (2) For other means of activating the ice protection system, it must be demonstrated in flight with the ice accretion defined in Appendix C, Part II(e) that: (i) The airplane is controllable in a pull-up maneuver up to 1.5 g load factor; and (ii) There is no longitudinal control force reversal during a pushover maneuver down to 0.5 g load factor.' Justification/Reason. Clarity and harmonization with the expected FAA rule text. The FAA considers the phrase 'prior to activation of normal operation of the ice protection system' to be unclear and potentially subject to different interpretations. The FAA suggests that the intent is captured more clearly by referring to flight in icing conditions before the ice protection system has been activated and is performing its intended function.	The proposed change provides further clarity. Refer to response given to cmtnr 8 in which the proposed change 'prior to activation' to 'before the ice protection system has been activated and is performing its intended function' is proposed in CS 25.21(g)(2). Comment accepted, text CS25.143(j) changed accordingly.
Cmt. *43 / Transport Canada*	
CS 25.143(h) Comment: 25.143(h) is not one of the excluded paragraphs noted in 25.21(g)(1). Hence this requirement is applicable for flight in icing conditions. However the text of 25.143(h) does not specify this nor does it note the ice accretions to be considered for each configuration. Although these can be inferred, it is considered that 25.143(h) should be more specific.	This comment applies to many other paragraphs not excluded in CS.21(g). There are no indicatons that interpretation leads to discussion. Comment not accepted.

Comment	Response

B. Proposal 11

Paragraph - **Add. info:**

Cmt. *1 / CAA, UK*

Comment	Response
Modify the proposed CS 25.21(g) so that CS 25.207© and (d) are not exempted for any landing configuration, i.e. "25.21(g) If certification for flight in icing conditions is desired, the following requirements apply (see AMC 25.21(g)): (1) Unless otherwise prescribed, each requirement of this subpart, except CS 25.121(a), 25.123©, 25.143(b)(1) and (2), 25.149, 25.201©(2), 25.207© and (d), and 25.251(b) through (e), and, except for any landing configuration, 25.207© and (d) must be met for flight in icing conditions with the ice accretions defined in Appendix C during normal operation of the aeroplane in accordance with the operating limitations and operating procedures established by the applicant and contained in the aeroplane Flight Manual. (2) The aeroplane must meet the requirements of.." If considered necessary, CS 25.207(e) then need not be applied to the landing configuration. It is thought that revisions to AMC 25.21(g) are not required. Justification/Reason. Recent certification experience, obtained during a demonstration in a large aeroplane simulator of operation with simulated accreted ice, has shown the possibility of an aeroplane encountering a hazardous situation during the landing phase of flight. In this situation, there may be insufficient manoeuvring margin from the stall for the crew to recover the aircraft to safe controlled flight without significant loss of height. It is thought that discussions in the FTHWG, during development of this NPA, did not identify this concern. The text for CS 25.207 proposed in the NPA specifically breaks the relationship between the stall warning speed (VSW) and the stall reference speed VSR (≥ VS1g) when certifying for flight in icing conditions. Since compliance with CS 25.207(c) and (d) is not required for icing conditions, there is no constraint for these conditions that prevents VSW being below VSR. Instead, CS 25.207(e) determines the stall warning setting for icing conditions solely by a speed/time margin above the stall identification speed. Hence, the minimum manoeuvring capability at VSW, available in non-icing conditions, may no longer be available in icing conditions. If these conditions arose, the aeroplane would be at very low speed, just above the stall warning speed with effectively no manoeuvring capability. In an operational scenario, the aeroplane would be decelerating and/or descending more rapidly than anticipated due to the additional induced drag in this high incidence condition. Any attempt to manoeuvre the aeroplane or further reduce speed would lead to an immediate stall. This situation is of most concern in the landing phase because, unlike the cruise or take-off phases, there are limited options for the crew to effect an escape. The aeroplane is already at low altitude and descending towards the ground, the power setting is low with a longer time to achieve a significant increase in thrust and the potential to pitch nose-down and trade height for speed is extremely limited. To address this concern and retain an adequate level of manoeuvrability, it is suggested that, in the particular case of the landing phase, the speed margin between VSW and VSR for non-icing conditions be retained also for icing conditions so that a prompt recovery from the hazardous situation can be achieved. This can be achieved by modifying the proposed CS 25.21(g) so that CS 25.207(c) and (d) are not exempted for any landing configuration.	Sub-paragraph CS 25.207(b) would be revised to require that stall warning be provided by the same means for both icing and non-icing conditions. It also would reference a new sub-paragraph (e) containing the criteria for stall warning in icing conditions. A new sub-paragraph (h) would specify the stall warning margins that must exist with the ice accretions that will form on the unprotected and protected surfaces prior to normal operation of the ice protection system. Note that CS 25.207(b) in theory still requires compliance with CS 25.207© and (d), which sub-paragraphs are made non applicable through CS 25.21(g)(1). In icing conditions stall warning settings are required based on demonstration of adequacy to prevent stalling when recovery is initiated not less than 3 seconds after the onset of stall warning. In practice the criteria whether the aircraft has stalled or not is defined by the stall identification speed, which can be (slightly) lower than the stall speed VSR. Cmtnr 1 refers to the landing phase of flight. In icing conditions stall warning setting must be compliant with the proposal in NPA 16/2004. The situation that is referred to in cmtnr 1 addresses the condition where the aircraft speed is considerably reduced below VREF to a speed close to VSW. Why the aircraft was flying close to VSW is not specified. The minimum manoeuvring capability at VSW especially in combination with the landing phase is raised as a concern. Application of the stall warning settings required for the non-contaminated aircraft (3kts above VSR) in the landing configuration will slightly increase the manoeuvring capability available at VSW. The table in CS 25.143 (g) presents the speed for the manoeuvring capability demonstration. Tests below the normal operational speeds are required. The proposed change to CS 25.21(g) so that CS 25.207(c) and (d) are not exempted for any landing configuration could also lead to more complexity if a reset of the stall warning system for flight in icing conditions would be required for the landing configuration only. The comment is considered for ongoing discussion outside of the present scope of the NPA.

Comment	Response
Cmt. *13 / FAA, USA*	
CS 25.207(b) Change to read as follows: '..Except for the stall warning ..prior to normal operation of the ice protection system (..DELETE..). prescribed in sub-paragraph (h)(2) of this paragraph, the stall warning for flight in icing conditions prescribed in sub-paragraph (e) of this paragraph must be provided by the same means as the stall warning for flight in non-icing conditions. (See AMC 25.207(b).).'	Proposed revision can be accepted as sub-paragraph CS 25.207 (h)(2) clearly refer to icing conditions prior to activation of the ice protection system. Comment accepted, text CS 25.207(b) changed accordingly.
Cmt. *14 / FAA, USA*	
CS 25.207(e) hange to read as follows: ' (e) In icing conditions, the stall warning margin in straight and turning flight must be sufficient to allow the pilot to prevent stalling (as defined in CS 25.201(d)) when the pilot starts a recovery maneuver not less than three seconds after the onset of stall warning. When demonstrating compliance with this paragraph, the pilot must perform the recovery maneuver in the same way as for the airplane in non-icing conditions. Compliance with this requirement must be demonstrated in flight with the speed reduced at rates not exceeding 0.5 m/sec2 (one knot per second), with (1) The 'Holding Ice' accretion described in Appendix C for the en-route, holding, approach, landing, and go-around high-lift configurations; and (2) The more critical of the 'Takeoff Ice' and 'Final Take-off Ice' accretions described in Appendix C for each high-lift configuration used in the take-off phase of flight.' Justification/Reason. Clarity, consistency with the text of existing CS 25.207(e), and harmonization with the expected FAA rule text.	Editorial comment that provides clarity without changing the intention of the actual proposal. Comment accepted, text CS 25.207(e) changed accordingly.
Cmt. *15 / FAA, USA*	
CS 25.207(f) Change to read as follows: '(f) The stall warning margin must be sufficient in both non-icing and icing conditions to allow the pilot to prevent stalling when the pilot starts a recovery maneuver not less than one second after the onset of stall warning in slow-down turns with at least 1.5 g load factor normal to the flight path and airspeed deceleration rates of at least 1 m/sec2 (2 knots per second). When demonstrating compliance with this sub-paragraph for icing conditions, the pilot must perform the recovery maneuver in the same way as for the airplane in non-icing conditions. Compliance with this requirement must be demonstrated in flight with - (1) The flaps and landing gear in any normal position; (2) The airplane trimmed for straight flight at a speed of 1.3 VSR; and (3) The power or thrust necessary to maintain level flight at 1.3 VSR.' Justification/Reason. Clarity and harmonization with the expected FAA rule text.	Editorial comment that provides clarity without changing the actual proposal. Comment accepted, text CS 25.207(f) changed accordingly.

Comment	Response
Cmt. *16 / FAA, USA*	
CS 25.207(h) Change to read as follows: '(h) For flight in icing conditions before the ice protection system has been activated and is performing its intended function, the following requirements apply, with the ice accretion defined in Appendix C, Part II(e): (1) If activating the ice protection system depends on the pilot visually recognizing a specified ice accretion on a reference surface, the requirements of this section apply, except for paragraphs © and (d). (2) For other means of activating the ice protection system, the stall warning margin in straight and turning flight must be sufficient to allow the pilot to prevent stalling without encountering any adverse flight characteristics when the speed is reduced at rates not exceeding 0.5 m/sec2 (one knot per second) and the pilot performs the recovery maneuver in the same way as for flight in non-icing conditions. (i) If stall warning is provided by the same means as for flight in non-icing conditions, the pilot may not start the recovery maneuver earlier than one second after the onset of stall warning. (ii) If stall warning is provided by a different means than for flight in non-icing conditions, the pilot may not start the recovery maneuver earlier than 3 seconds after the onset of stall warning. Also, compliance must be shown with CS 25.203 using the demonstration prescribed by CS 25.201, except that the deceleration rates of CS 25.201©(2) need not be demonstrated.' Justification/Reason. Clarity and harmonization with the expected FAA rule text.	Editorial comment that provides clarity without changing the actual proposal. Comment accepted, text CS 25.207(h) changed accordingly. Text change includes cmtnr 8 related to prior to activation of normal operation.
Cmt. *44 / Transport Canada*	
CS 25.207(e)(1) Suggest change to: 'The 'En-route Ice' accretion described in Appendix C for the en-route configuration, the 'Holding Ice' accretion described in Appendix C for the holding configuration and the 'Landing Ice' accretion described in Appendix C for the approach, landing and go-around configurations..' Justification/Reason. It may be possible to use a common ice shape for compliance but the correct icing configurations should be specified in the requirement.	CS 25.207 Sub-paragraph (e)(1) would permit the use of "Holding Ice" accretion to be used in evaluating the stall warning margin for the en-route, holding, approach, landing and go-around high lift configurations. Consistent with the use of the "Holding Ice" accretion for evaluating stall warning in the listed configurations, the proposed definitions in part II of Appendix C for the ice accretions appropriate to the en-route and landing configurations permit the use of "Holding Ice" in lieu of defining additional accretions. In practice this reduces the number of configurations to be tested because holding ice is most critical. Comment not accepted.

Comment	Response
Cmt. *45 / Transport Canada*	
CS 25.207(b), 25.207(h) Comment: Suggest to remove the alleviation in 25.207(b) and in 25.207(h)(2)(ii) for a different means of stall warning prior to activation of normal operation of the ice protection system. Justification/Reason. A review of icing incidents and accidents due to stalls indicates that in some of these events stall warning characteristics and/or stall characteristics may not have been quickly recognized by the crew and appropriate recovery action taken. Hence it is considered necessary to always provide the same means of stall warning so that the flight crew can recognize and respond. Although the suggested criteria may be deemed adequate in a test environment, Transport Canada considers that crews may not always recognize and react to a different means of stall warning.	Sub-paragraph CS 25.207(h)(2) applies to ice protection system activation based on other means than visual recognition, for example a more reliable ice detector. In this case a different means of stall warning would be acceptable than for flight in non-icing conditions. If stall warning is provided by the same means as for flight in non-icing conditions sub-paragraph CS 25.207(h)(2)(i) require stall warning margins based on the shorter and consistent time of ice accretion that results from the detection system installed. The comment in fact address sub-paragraph CS 25.207(h)(2)(ii) that assumes different means of stall warning as for flight in non-icing conditions. TC considers that crews may not always recognize and react to different means of stall warning. This is more a human factors aspect. The comment is considered for ongoing discussion to identify practical applications and human factors issues addressed.

Comment	Response

B. Proposal 15

Paragraph - **Add. info:**

Cmt. *17 / FAA, USA*

Comment	Response
CS 25.773(b)(1)(ii) Change to read as follows: '(ii) The icing conditions specified in CS 25.1419 if certification for flight in icing conditions is requested.' Justification/Reason. The current text is "The icing conditions specified in CS 25.1419 if certification with ice protection provisions is requested." As with CS 25.1419, this requirement should apply whenever flight in icing conditions is requested, regardless of whether ice protection provisions are included.	CS 25.773(b)(1)(ii) is a system design specification to maintain clear portion of the windshield in the icing conditions specified in CS 25.1419. The comment is justified but not accepted within the scope of this NPA

Comment	Response

B. Proposal 16

Paragraph - **Add. info:**

Cmt. *4 / DGAC, France*

Comment	Response
Proposal 16 (Appendix C) 1. The proposal is not clear. Is it to transform the existing appendix as Part I of the revised appendix, add a new definition of 'take-off maximum icing' to the existing ones (keeping the figures 1 to 6), and add a Part II related to ice accretions ? 2. Definitions of 'Continuous maximum icing' and 'Intermittent maximum icing' could be replaced by a reference to CS Definitions and the new definition of 'take-off maximum icing' may be better placed in CS Definitions (if it needs to be used in other airworthiness codes). Justification/Reason. 1. Clarification 2. CS Definitions already contains a definition of 'Continuous maximum icing' and 'Intermittent maximum icing'. Item 20 of the explanatory note to Decision NO. 2003/11/RM of the Executive Director of the Agency of 5 November 2003 on definitions and abbreviations used in certification specifications for products, parts and appliances (« CS-Definitions »), states that 'the general policy is that [CS Definitions] should only contain definitions that are used in more than one code. Definitions only applicable to one code should be included in that specific code. In that regard a definition should only be included in a particular CS, when the Agency is satisfied that those contained in the Basic Regulation, the implementing Regulations or in CS Definitions need to be complemented.' CS-E 780 (a) refers to the 'icing atmospheric conditions of CS-Definitions' and CS-APU 510 (a) refers to the 'icing envelopes specified in CS-1' (NB : of course, this should be CS-Definitions).	The proposed amendment of CS 25 Appendix C is considered clear: Part I presents definitions of already existing CM and IM icing conditions. Additional information is presented on the atmospheric conditions for take-off maximum icing. In fact it forms the icing envelope to be considered for the take-off phase. The information in Part I is essential for the design of ice protection systems and the prediction of ice accretion on unprotected parts. Part II presents the airframe ice accretions for showing compliance with Subpart B. The comment raised concerns implementation of Decision NO. 2003/11/RM of the Executive Director of the Agency of 5 November 2003 on definitions and abbreviations used in certification specifications for products, parts and appliances (« CS-Definitions ») The definitions of the CM and IM icing conditions presented in Part I are also used in other codes, e.g. CS-E 780 and as such it is Agency policy not to include them in the individual code. The information on atmospheric conditions for take-off maximum icing in Appendix C Part I is used to define take-off ice specified in Part II. In practice it is preferred to have flight in icing related design information and requirements combined together in CS 25. For this reason NPA 16-2004 is not changed. Comment not accepted.

Cmt. *18 / FAA, USA*

Comment	Response
CS 25 Appendix C, Part II, paragraph (a) Change to read as follows: '(a) Ice accretions - General. CS 25.21(g) states that if certification for flight in icing conditions is desired, the applicable requirements of subpart B must be met in the icing conditions of Appendix C, unless otherwise prescribed. The most critical ice accretion in terms of handling characteristics and performance for each flight phase must be determined, taking into consideration the atmospheric conditions of part I of this Appendix, and the flight conditions (for example, configuration, speed, angle-of-attack, and altitude). The following ice accretions must be determined:' Justification/Reason. Clarity and harmonization with the expected FAA rule text.	Editorial comment not affecting the intention of the proposed paragraph. Comment accepted, text CS 25 Appendix C, Part II, paragraph (a) changed accordingly.

Comment	Response
Cmt. *19 / FAA, USA*	
CS 25 Appendix C, Part II, sub-paragraph (d)(1) Change to read as follows: 'Aerofoils, control surfaces and, if applicable, propellers are free from frost, snow, or ice at the start of the take-off, except for underwing frost in the area of the fuel tanks or polished frost for which the affects are demonstrated not to be hazardous and appropriate information about airplane performance, flying qualities, and the allowable amount and location of frost is provided in the AFM,' Justification/Reason. JAR-OPS 1.345 allows takeoff with contaminants on external surfaces as permitted in the Aeroplane Flight Manual. U.S. operating rules allow takeoff with frost on the wings or stabilizing or control surfaces that has been polished to make it smooth (parts 91 and 135)), or frost under the wing in the area of the fuel tanks when authorized by the Administrator (parts 121 and 135). This issue was recently discussed at a meeting of the Joint Aviation Authorities' Flight Study Group. It was pointed out that there was inconsistency in how and where information regarding takeoff with polished or underwing frost has been provided to operators. This paragraph presents an opportunity to begin addressing this inconsistency. More importantly, from the context of the proposed rule, if an airplane is permitted to depart with some amount of frost already adhering to it, this should be in the initial state of the airplane in regards to this paragraph	The original JAA NPA 25BEF-332 proposal justification (part C of NPA 16/2004) erroneously refers to Part II(b) instead of Part II(d). Part II(d) address ice accretion for the take-off phase. Compliance with operating rules is assumed, which prohibit pilots from conducting take-offs with any frost, snow, or ice adhering to certain aeroplane surfaces and require the aeroplane to be operated in accordance with an approved ground de-icing/anti-icing programme. Part II(d) CS 25 Appendix C, Part II, sub-paragraph (d) address the ice accretion due to atmospheric conditions defined in Part I©) for the take-off phase, which starts from brake release. In showing compliance with this sub-paragraph the applicant must define the initial state of the aeroplane as permitted in the Aeroplane Flight Manual. Discussion in the JAA FSG indicated inconsistency in how and where information regarding takeoff with polished or underwing frost has been provided to operators. The proposal to take the opportunity to begin addressing this inconsistency and add exception for underwing frost in the area of the fuel tanks or polished frost in Part II(d)(1) is not supported. The comment is considered for ongoing discussion outside of the present scope of the NPA.
Cmt. *20 / FAA, USA*	
CS 25 Appendix C, Part II, sub-paragraph (d)(5) Change to read as follows: 'Crew activation of the ice protection system is in accordance with a normal operating procedure provided in the Airplane Flight Manual, except that after beginning the takeoff roll, it must be assumed that the crew takes no action to activate the ice protection system until the airplane is at least 122 m (400 feet) above the takeoff surface.' Justification/Reason. Clarity and harmonization with the expected FAA rule text. Also, the NPA draft text does not include the parenthetical 400 feet (English units) following the 122 m height reference.	Editorial comment not affecting the intention of the requirement. Comment accepted, text CS 25 Appendix C, Part II, sub-paragraph (d)(5) changed accordingly.
Cmt. *21 / FAA, USA*	
CS 25 Appendix C, Part II, paragraph (e) Change to read as follows: '(e) Ice accretion before the ice protection system has been activated and is performing its intended function. The ice accretion before the ice protection system has been activated and is performing its intended function is the ice accretion formed on the unprotected and normally protected surfaces before activation and effective operation of the ice protection system in continuous maximum atmospheric icing conditions.' Justification/Reason. Clarity and harmonization with the expected FAA rule text.	Comment accepted in line with cmtnr 8. Text CS 25 Appendix C, Part II, paragraph (e) changed accordingly.

Comment	Response
Cmt. *46 / Transport Canada*	
CS 25 Appendix C, Part II(a)(3) Suggest deletion of: 'At the applicant’s option, Holding Ice..En-route Ice' Justification/Reason. Paragraph (b)(2) specifies when Holding Ice can be used for the en-route flight phase.	Comment refers to duplication of requirement. Comment accepted, text CS 25 Appendix C, Part II(a)(3) changed accordingly.
Cmt. *47 / Transport Canada*	
CS 25 Appendix C, Part II(a)(5) Suggest change to: 'Landing ice is the critical ice accretion on the unprotected surfaces, and any ice accretion on the protected surfaces appropriate to normal ice protection system operation following exit from the holding flight phase and transition to the final landing configuration.' Justification/Reason. Aeroplane controllability incidents have occurred where ice on the unprotected leading edges of extended flap leading edge or flap vane leading edges have caused changes in aerodynamic characteristics. Following exit from the holding flight phase, which for most aeroplanes is normally conducted with flaps retracted, the aeroplane will transition to the approach flight phase followed by the landing flight phase. During this transition ice may accrete on flap leading edges. Hence it should be specified in the definition that the landing ice is a distinct configuration, although as allowed in paragraph (b) Holding Ice may be used if it is shown to be more critical.	Part II(a) defines the ice accretions for showing compliance with Subpart B during the operational phases of flight. As such landing ice should refer to the actual aeroplane configuration during the landing phase. The permitted use of other configurations in order to reduce the number of ice accretions to be considered is covered in Part II(b). Part II 9(a)(5) defines landing ice normally as holding ice, only taking into account change in ice protection system operation (e.g. reduce cycle time or apply more heat). Any change in aeroplane (high lift) configuration is not considered. Cmtnr 47 addresses this issue. In practice the proposed change will probably result in additional flight tests e.g. holding ice (clean configuration) plus ice accretion on unprotected leading edges of extended flap or flap vane during limited exposure in the transition phase from holding configuration into the final landing configuration. Comment accepted, text CS 25 Appendix C, Part II(a)(5) changed accordingly.
Cmt. *48 / Transport Canada*	
CS 25 Appendix C, Part II(b) Suggest changing to: '(2) Holding Ice may be used for the en-route flight phase provided that the en-route configuration is the same as the holding configuration. And add new item: '(3) Holding ice may be used for the approach, landing and go-around flight phases, provided that it is shown that the effects of ice accretion on flap leading edges and flap vane leading edges, are not significant. Renumber existing item (3) to (4) Justification/Reason. Some aeroplanes may have a holding slat/flap position, which is different from the en route configuration. As noted in earlier comment, the Landing Ice accretion can be different from the Holding Ice accretion due to ice accretion on flap leading edges and flap vane leading edges.	Cmtnr 47 defines landing ice appropriate to the phase of flight. Cmtnr 48 addresses the conditions where holding ice may be used for landing ice. Comment accepted, text CS 25 Appendix C, Part II(b) changed accordingly.

Comment	Response

B. Proposal 26

Paragraph - **Add. info:**

Cmt. *2 / CAA, UK*

Comment	Response
AMC 25.21(g), Para 6.21.2.1(a)(i) and Appendix A.1.2.1.3 It is proposed that 3 inches be converted to 75 mm. Justification/Reason. 3 inches of ice accretion has been converted to 8 cm. Not only is this conversion more stringent (76.2 mm being the strict equivalent), millimetres are the more usual engineering unit.	With the introduction of NPA 25F-219 Issue 2 the maximum ice accretion on unprotected parts is defined as not to exceed a pinnacle height of typically 3 inches (75mm) in a plane in the direction of flight. Primary effects on aerodynamic degradation are shape and texture, the difference in pinnacle height between 75mm and 80mm being negligible. Conversion made according Units of Measurement Conversion based on table 3-4 of ICAO Annex 5 adopted by EASA. The use of mm is not excluded as can be seen e.g. in NPA 14/2004. It is also noted that in AMC 25.1419 also refers to 75 mm (3 inch) Comment accepted, text changed accordingly.

Cmt. *25 / FAA, USA*

Comment	Response
AMC 25.21(g), sub-paragraph 4.7a Add the following new text at the end of this sub-paragraph: 'The effect of power or thrust setting should also be considered in determining the applicable ice accretions. For example, a thermal bleed air system may not be able to completely evaporate the liquid after melting the ice, resulting in the potential for runback ice, under low system mass flow conditions, such as at low engine power or thrust.' Justification/Reason. Some thermal ice protection systems, designed to be fully evaporative at most power or thrust settings, may act as running wet systems at certain low power or thrust conditions. This may result in runback ice that would not normally be considered for a thermal system. This possibility should be identified in the advisory material.	The applicant may decide to design the thermal ice protection system to be fully evaporative in Continuous Maximum icing conditions during holding. Runback ice accretion than occurs in conditions where the ice protection system is running wet e.g. in high speed cruise or in Intermittent Maximum icing conditons. Within this design philosophy the effect of runback ice accretion on aeroplane handling and performance characteristics should be defined. Comment accepted, text AMC 25.21(g), sub-paragraph 4.7a changed in line with intention of the comment.

Cmt. *26 / FAA, USA*

Comment	Response
AMC 25.21(g), sub-paragraph 6.1.4 Add this new sub-paragraph to read as follows: '6.1.4 Unless otherwise specified, the speeds (e.g., VSR, VREF, V2, etc.) referenced in the flight tests described below refer to the speeds used with the appropriate ice accretion on the airplane.' Justification/Reason. Clarity and harmonization with the expected FAA advisory circular text.	Comment provides further clarification inline with the intention of the AMC. The comment is also valid for the aeroplane configuration appropriate to flight in icing. For example landing configuration if the use of full flaps in icing conditions is inhibited. In practice sofar no misinterpretation is experienced. Comment not accepted.

Comment	Response
Cmt. *27 / FAA, USA*	
AMC 25.21(g), sub-paragraph 6.17.2 Add the following new text to the end of this sub-paragraph: 'Slow decelerations (much slower than 1 knot/sec) may be critical on airplanes with anticipation logic in their stall protection system or on airplanes with low directional stability, where large sideslip angles could develop.' Justification/Reason. Certification experience from testing of several part 25 turboprop airplanes	With respect to the flight test program on handling and performance characteristics in icing conditions it is clearly stated that the applicant should consider the results obtained with the non-contaminated aeroplane (ref AMC 25.21(g), sub-paragraph 5.2.1.1). The approach to define the test matrix based on review of the non-contaminated aeroplane characteristics is again outlined in AMC 25.21(g), sub-paragraph 6.17.1 Cmtnr 27 provides useful information based on certification experience, the proposed addition however is not followed since this is a possible performance characteristic that should be considered based on the non-contaminated test results. Comment not accepted.
Cmt. *28 / FAA, USA*	
AMC 25.21(g), sub-paragraph 6.18.1 Revise this sub-paragraph to read as follows: 'Stall warning should be assessed in conjunction with stall speed testing and stall demonstration ..characteristics.. (DELETE) testing (CS 25.103, CS 25.2013 and paragraphs 6.2 and 6.17 of this AMC, respectively) and in tests with faster entry rates.' Justification/Reason. Clarity. Neither paragraph 6.2 nor 6.17 refer to stall characteristics testing or CS 25.203. Paragraph 6.17 instead refers to stall demonstration testing (for stall characteristics) and CS 25.201.	CS 25.201 refers to Stall Demonstration. Comment provides clarity. Comment accepted, text AMC 25.21(g), sub-paragraph 6.18.1 changed accordingly.
Cmt. *29 / FAA, USA*	
AMC 25.21(g), sub-paragraph 6.14.1 Revise to read as follows: '..Although the maximum speed for substantiation of stability characteristics is the lower of 556 km/h (300 knots) CAS, ..or..(DELETE) VFC, or a speed at which it is demonstrated that the airframe will be free of ice accretion due to the effects of increased dynamic pressure (CS 25.253©), the maximum speed for demonstration can be limited to 519 km/h (280 knots) CAS, provided that the stick force gradient can be satisfactorily extrapolated to the applicable maximum speed ..556 km/h (300 knots) CAS, or VFC..(DELETE) (e.g., there is no gradient decrease with increasing speed).' Justification/Reason. The proposed CS 25.253(c) would allow the lower of: (1) 556 km/h (300 knots) CAS, (2) VFC, or (3) a speed at which it is demonstrated that the airframe will be free of ice accretion due to the effects of increased dynamic pressure (CS 25.253(c)) to be used as the maximum speed for substantiation of stability characteristics with ice accretions. The text of the AMC should be revised to be consistent with the proposed rule change.	Cmnr 29 addresses two issues: 1. Inconsistency between the proposed CS 25.2539© and AMC 25.21(g), sub-paragraph 6.14.1. This comment is accepted and the text of AMC 25.21(g), sub-paragraph 6.14.1 is changed accordingly. 2. The acceptance of the maximum speed for demonstration to be limited to 519 km/h (280 knots) is to avoid extensive repeated testing e.g. change of natural ice shedding at high speed. This limitation is acceptable provided the stickforce gradient can be satisfactorily extrapolated to higher speed as proposed in CS 25.2539©. Cmtnr 60 suggests deleting the acceptance of the lower speed for demonstration, because it is unclear how a stickforce gradient can be satisfactorily extrapolated. This issue will be subject for discussion between the applicant and the Authority. Comment not accepted.
Cmt. *30 / FAA, USA*	
AMC 25.21(g), sub-paragraph 6.14.2©(i) Revise to read as follows: 'i. Climb : With high lift devices retracted, trim at the speed for best rate-of-climb, except that the speed need not be less than 1.3 VSR.' Justification/Reason. Clarification and harmonization with the expected FAA advisory circular text.	AMC 25.21(g), sub-paragraph 6.14.2© refers to CS 25.175(a) through (d). Avoid inconsistencies. Comment accepted, text AMC 25.21(g), sub-paragraph 6.14.2(c)(i) changed accordingly.

Comment	Response
Cmt. *31 / FAA, USA*	
AMC 25.21(g), sub-paragraph A1.2.1.3 Revise this sub-paragraph to read as follows: 'The applicant should determine the effect of the 45 minute hold in continuous maximum icing conditions. The analysis should assume that the airplane will remain in a rectangular 'race track' pattern, with all turns being made within the icing cloud. Therefore, no horizontal extent correction should be used for this analysis. The applicant should substantiate the critical mean effective drop diameter, LWC, and temperature that result in the formation of an ice shape that is critical to the airplane's performance and handling qualities. The shape and texture of the ice are important and should be agreed by the Authority.' Justification/Reason. This comment highlights an issue that remains unharmonized between the FAA and EASA. This issue is currently undergoing further discussion within the Flight Test Harmonization Working Group (FTHWG) and the Ice Protection Harmonization Working Group (IPHWG). We recommend that EASA revise this paragraph in accordance with the harmonized agreement that is expected to be reached shortly in the FTHWG and IPHWG.	Cmtnr 31 highlights a fundamental non-consensus issue between FAA and EASA. The proposed revision to AMC 25.21(g), sub-paragraph A1.2.1.3 defines the atmospheric conditions of Appendix C Part I(a) to be considered to calculate the holding ice accretion. The exposure time is explicitly added. No maximum pinnacle height is applied. In summary, the non-consensus is: EASA -exposure time not specified, -maximum pinnacle height 3 inch on most critical unprotected main airfoil surface FAA -45 minutes exposure -pinnacle height not defined (not limited) Experience indicates the following approach made by the applicant. 1)Calculate exposure time to accrete 3 inch ice in direction of flight on most critical part unprotected main airfoil surface (usually the tip which has the highest collection efficiency) 2)Check resulting exposure time, that should be between 30 and 45 minutes 3)Calculate ice accretion on other parts of main airfoil surface considered with the exposure time resulting from 1) . As shown in practice a mix between FAA and EASA regulations is applied, because the majority of the large aeroplanes apply for both FAA and EASA type certification. The comment is considered for ongoing discussion outside of the present scope of this rulemaking task, and will be covered in rulemaking task 25.022 and 25.058, which are part of Rulemaking Advance planning.
Cmt. *32 / FAA, USA*	
AMC 25.21(g), sub-paragraph A1.2.3.2 Add the following statement at the end of this sub-paragraph: 'The airplane should be assumed to be in the continuous maximum icing conditions of appendix C to part 25 during this time.' Justification/Reason. Clarification and harmonization with the expected FAA advisory circular text.	The proposed addition related to Continuous Maximum icing conditions is already in the middle of AMC 25.21(g), sub-paragraph A1.2.3.2 Comment not accepted.

Comment	Response
Cmt. *33 / FAA, USA*	
AMC 25.21(g), sub-paragraph A1.2.3.3 Add a new paragraph between the proposed A1.2.3.2 and A1.2.3.3 to read: 'An ice detection system may be installed that will provide information either to the flightcrew or directly to the ice protection system regarding inflight icing conditions or ice accretions. There are basically two classes of ice detection systems: A. A primary ice detection system, when used in conjunction with approved AFM procedures, can be relied upon as the sole means of detecting ice accretion or icing conditions. The ice protection system may be automatically activated by the primary ice detection system, or it may be manually activated by the flightcrew following an annunciation from the primary ice detection system. B. Advisory ice detection system provides an advisory annunciation of the presence of ice accretion or icing conditions, but is not relied on as the sole, or primary, means of detection. The flight crew is responsible for monitoring the icing conditions using a primary method as directed in the AFM. The advisory ice detection system provides information to advise the cockpit crew of the presence of ice accretion or icing conditions, but it can only be used in conjunction with other primary methods to determine the need for operating the ice protection system..' Justification/Reason. Clarification and harmonization with the expected FAA advisory circular text. The means of compliance should be different for primary and advisory ice detection systems.	The proposed new sub-paragraph is a useful addition to the AMC related to ice accretion prior to normal system operation, in which the means of detection are an important parameter. Different means of compliance are applicable for primary and advisory ice detection systems to be included in AMC 25.21(g), sub-paragraph A1.2.3.3 . (see cmtnr 34 and 35) Comment accepted, text AMC 25.21(g), sub-paragraph A1.2.3.3 changed accordingly.
Cmt. *34 / FAA, USA*	
AMC 25.21(g), sub-paragraph A1.2.3.3, sub-paragraphs d and e. Replace references to 'following indication from an ice detection system' with 'following an annunciation from a primary ice detection system.' Justification/Reason. Clarification and harmonization with the expected FAA advisory circular text. The means of compliance in these sub-paragraphs are only appropriate for a primary ice detection system.	AMC 25.21(g), sub-paragraph A1.2.3.3(d) and (e) refer to the situation where the ice protection system is activated following annunciation of an ice detection system, either activated manually by the flight crew (d) or automatic (e). In these cases the exposure to account for flight crew delay is reduced or even zero. Cmtnr 34 states that this is only appropriate in case the aeroplane is fitted with a primary ice detection system. Comment accepted, text AMC 25.21(g), sub-paragraph A1.2.3.3(d) and AMC 25.21(g), sub-paragraph A1.2.3.3(d) changed accordingly.
Cmt. *35 / FAA, USA*	
AMC 25.21(g), sub-paragraph A1.2.3.3, sub-paragraph f. Add a new sub-paragraph f to read: 'f. If the airplane is equipped with an advisory ice detection system that supplements the means of detection referenced in paragraphs (a) through © above, the ice accretions should continue to be determined as specified in paragraph (a), (b), or © above, as appropriate for the primary means of detecting icing conditions specified in the AFM procedures.' Justification/Reason. Clarification and harmonization with the expected FAA advisory circular text. For an advisory ice detection system, the means of compliance should be based on the primary means of ice detection as set forth in the Airplane Flight Manual.	Comment is inline with cmtnr 33 and 34. Comment accepted, text AMC 25.21(g), sub-paragraph A1.2.3.3(f) changed accordingly.

Comment	Response
Cmt. *36 / FAA, USA*	
AMC 25.21(g), paragraph A2.2.2, and sub-paragraphs A2.2.2.1 and A2.2.2.2. Revise to read as follows: 'In the absence of another agreed definition of texture the roughness height should be 3 mm with a particle density of 8 to 10/cm2.' Justification/Reason. Icing tunnel tests (DOT/FAA/AR-02/68, Effect of Residual and Intercycle Ice Accretions on Airfoil Performance, plus other recent part 23 certification tests, Certification of Part 23 Airplanes for Flight in Icing, presentation to SAE Aircraft Icing Technology Subcommittee AC-9C, April 20, 2004) have shown that the amount of clear and mixed ice that accretes during de-icing boot rest times is rougher than 1 mm. Intercycle ice can continue to accrete for up to 20 boot cycles until a steady state roughness of 3 mm is reached. Using the smaller roughness height that would be permitted by the AMC should not be allowed without further showing that it was appropriate for the particular airplane design.	AMC 25.21(g), paragraph A2.2.2 defines typically roughness to be applied on artificial ice shapes to simulate the texture of natural ice. These values have been applied since introduction of NPA 25F-219 Issue 2. The comment proposes to apply a 3mm roughness height for small amounts of ice for example residual ice or intercycle ice. Information is based on ice tunnel tests plus recent part 23 certification. FAA is requested to provide additional information for discussion on this issue. The comment is considered for ongoing discussion outside of the present scope of the NPA.
Cmt. *49 / Transport Canada*	
AMC 25.21(g), Paragraph 1.5 and various following paragraphs Paragraph 1.5, Suggest change to: 'Section 6 provides a representative flight test program' Justification/Reason. Various following paragraphs, suggest changing to 'Test Programme' or 'Representative test programme', as required The intent is to provide a representative programme which will be altered depending on the aeroplane being considered.	AMC 25.21(g) paragraph 6 provides an acceptable flight test program where flight testing is selected by the applicant and agreed by the Authority. The flight test program selected is established from experience with aeroplanes of similar size, and from review of the ice protection system design, control system design, wing design, horizontal and vertical stabiliser design, performance characteristics, and handling characteristics of the non-contaminated aeroplane. The proposed addition representative is considered not necessary. Comment not accepted.
Cmt. *50 / Transport Canada*	
AMC 25.21(g), Paragraph 4.4.3 Suggest Changing to: '..may be determined by a suitable conservative analysis or by flight test' Justification/Reason. Predicting the critical ice shape and determining the exact values of drag due to these ice shapes is not a clear-cut science. However conservative analyses and test results have been found acceptable.	AMC 25.21(g), Paragraph 4.4.3 accepts analysis to define increment in drag due to the effects of ice accumulation on the components mentioned. The applicant may decide to perform flight tests. Comment accepted text AMC 25.21(g), Paragraph 4.4.3 changed accordingly.
Cmt. *51 / Transport Canada*	
AMC 25.21(g), Paragraph 4.6.4 Suggest changing to: '..it should be shown that with the appropriate 'Failure Ice', the operating procedures and speeds provide an adequate operating envelope, and acceptable performance and handling characteristics.' Justification/Reason. The reference to continued safe flight and landing is not appropriate to the assessment of the failure condition.	Historically the reference to safe operation is based on CS 25.1419 which in fact is an ice protection system requirement. The original NPA 25F-219 Issue 2 is defined to address handling and performance in icing. In CS 25.1419 the reference to safe operation still exists. Operational procedures and related speeds should provide an adequate operating envelope to ensure continued safe flight and landing with acceptable handling and performance characteristics. The reference to continued safe flight and landing may not be appropriate to the assessment of the failure condition but it does not affect the intention of the paragraph. Comment not accepted.

Comment	Response
Cmt. *52 / Transport Canada*	
AMC 25.21(g), Paragraph 4.7.9, 6.17 Comment: A significant number of icing accidents have occurred because of stalls following autopilot disengagement or stall approaches when the autopilot is engaged (see Transport Canada Discussion Paper No. 12, attached). Although revised autopilot and associated guidance material requires consideration of autopilot behaviour in icing conditions, it is unclear whether specific flight tests of inadvertent approach to the stall with the critical ice accretions, will be required. Transport Canada considers that such tests should be an essential part of any aeroplane icing flight test program. Stall behavior will very possibly be different from that determined from the existing stall tests (e.g. because of the trim setting at autopilot disengagement) Since the AMC is likely going to be used as a basis for flight test planning of aeroplane flight characteristics in icing conditions, Transport Canada considers that this additional aspect should be high lighted in the AMC.	Stall characteristics with critical ice accretions may be affected in stalls following autopilot disconnect or stall approaches with the autopilot engaged. The comment is considered for ongoing discussion on this subject. The current NPA is revised to address the issue without providing specific advisory material on the associated flight test programme. Comment accepted. Change text of AMC 25.21(g), Paragraph 4.7(g) accordingly.
Cmt. *53 / Transport Canada*	
AMC 25.21(g), Paragraph 5.1.2 Suggest changing to: '..methods listed in this section, as agreed by the Authority.. Justification/Reason. As written, it appears to be the applicant's choice of methods of compliance. It is important that the Certifying Authority agrees the methodology and this should be specified.	AMC 25.21(g), Paragraph 6 defines an acceptable flight test program where flight testing is selected by the applicant and agreed by the Authority as being the primary means for showing compliance. This implies early discussions between applicant and Authority on the certification plan for flight in icing which is supported by experience. Reference to based on agreement by the Authority is not incorporated consistently, but is not considered to effect application/interpretation of AMC 25.21(g). Comment not accepted
Cmt. *54 / Transport Canada*	
AMC 25.21(g), Paragraph 5.2.2.2 Suggest changing to: '..are discussed in paragraph 5.2.3.2, below.' Justification/Reason. Editorial revision.	Editorial revision only. Comment accepted, text AMC 25.21(g), Paragraph 5.2.2.2 changed accordingly.
Cmt. *55 / Transport Canada*	
AMC 25.21(g), Paragraph 5.2.3.1, 5.2.3.2 Suggest changing, Paragraph 5.2.3.1, to: 'Where flight testing with ice accretions obtained in natural icing conditions..' Suggest changing, Paragraph 5.2.3.2, to: '..should be conducted with ice accretions obtained in natural icing conditions.' Justification/Reason. The handling and performance tests are to be conducted with the ice accretions obtained in natural icing conditions. Flight test practice normally requires exiting the actual natural atmospheric icing conditions in order to do the tests.	The performance and handling tests may be based on flight testing in dry air using artificial ice shapes that have been agreed by the Authority. Shape and texture of the artificial ice should be established and substantiated by agreed methods as listed in AMC 25.21(g), Appendix 2 paragraph A2.2.1. Most likely the artificial ice shapes are substantiated using an ice accretion code validated in natural icing. AMC 25.21(g), Paragraph 5.2.3.1 requires atmospheric conditions to be measured when flight test in natural icing conditions is the primary means of compliance. In practice this is also required to demonstrate compliance with CS 25.1419 for the adequacy of the ice protection system. The justification to this comment that the handling and performance tests are to be conducted with the ice accretions obtained in natural icing conditions is not supported. Comment not accepted.

Comment	Response
Cmt. *56 / Transport Canada*	
AMC 25.21(g), Paragraph 6.1.3 Suggest changing to 'The test programme is based on the assumption that the applicant has demonstrated that 'Holding Ice' is the most conservative shape and that the applicant chooses to do the majority of the testing with this conservative shape. Where it is not shown to be the most conservative shape, the ice shape appropriate to the particular phase of flight must be used. In particular, Holding Ice may only be used for approach, landing and go-around flight phase tests, when it is shown that the aerodynamic effects of the ice accretion are equivalent to Landing Ice. Justification/Reason. The content of the test program is predicated on the assumption that the Holding Ice accretion is the most critical for the en-route, approach, landing and go-around flight phases. However this assumption may not always be valid. It would be preferable to change 'Holding Ice' to 'Enroute Ice' or 'Landing Ice', as applicable, in the subsequent text of Paragraph 6, but this would require extensive editorial changes.	The issue raised is already covered in the definition of the airframe ice accretions for showing compliance with Subpart B presented in Appendix C Part II (a) and (b). See also cmtnr 47 and 48. The flight test program provided in AMC 25.21(g), Paragraph 6 is an acceptable program based on the assumption that the applicant will choose to use the holding ice for the majority of the testing on the basis that this is the most conservative shape. AMC 25.21(g), Paragraph 6.1.3 is clear and in practice without misinterpretation. Comment not accepted.
Cmt. *57 / Transport Canada*	
AMC 25.21(g), Paragraph 6.9.2.c.i, 6.21.1.1, 6.21.2.2 Comment: In 6.9.2.c.i, the terminology '30o banked turns left and right with rapid reversals" is used. In 6.21.1.1 and 6.21.2.2, the terminology 'Bank-to-bank rapid roll, 30o - 30o ' is used. It is believed that the same flight test maneuver is intended in both cases. The text should be clarified. Possible text is as follows (extracted for Transport Canada Discussion Paper No. 33, attached): 'Trim aircraft in level flight Establish 30 degree bank level turn in one direction Using step input of approximately 1/3 full lateral control deflection, roll aircraft in other direction Maintain step input as aircraft passes through wings level. At approximately 20 degrees bank apply step input in opposite direction to the same deflection from neutral as initially input Release input and recover as aircraft passes wings level Repeat test procedure with 2/3 and up to full lateral control deflection unless roll rate is judged to be excessive'	AMC 25.21(g), Paragraph 6.9 covers general controllability and manoeuvrability. The comment addresses the text that describes the roll capability test, which indeed is not consistent. In practice the applicant will apply the same test procedure as used for the handling tests with the non-contaminated aeroplane. The proposal to add a detailed description of the test procedure is not supported. Comment not accepted.

Comment	Response
Cmt. *58 / Transport Canada*	
AMC 25.21(g), Paragraph 6.9.2.d, f, h Suggest changing to; '..(or simulated inoperative if all effects can be taken into account)..' Justification/Reason. Clarification that procedure should take into account all effects associated with an engine failure	AMC 25.21(g), Paragraph 6.9.2.d, f, h allow simulated one inoperative testing for flight safety reasons, specially when the tests are performed in natural icing conditions. The proposed comment provides clarification. Comment accepted, text AMC 25.21(g), Paragraph 6.9.2.d, f, h changed accordingly.
Cmt. *59 / Transport Canada*	
AMC 25.21(g), Paragraph 6.12 Suggesting renumber existing paragraph 6.12 to 6.12.1 Suggest addition to the end of paragraph 6.12.1: 'In addition a specific check should be made to demonstrate compliance with CS 25.161©(2). And add new paragraph 6.12.2: 'Test Program. The following represents a representative test program for compliance with 25.161©(2). A. Holding ice b. Most critical landing weight, forward centre of gravity position, symmetric fuel loading c. In the configurations below, trim the aircraft at the specified speed i. Maximum lift landing configuration, and the most critical of: - Speed 1.3VSR1 with Idle power or thrust; or, - Speed VREF with power or thrust corresponding to a 3 deg glidepath' Justification/Reason. Certification experience has shown that the trim requirement of CS 25.161(c)(2) can be critical for some aircraft and has resulted in limitations on the forward center of gravity position. It is unclear whether this would have been determined from other qualitative evaluations or review of tests for the non-contaminated aeroplane. Hence it is recommended that a specific check be included in the AMC.	Comment refers to certification experience. The impact of the proposed additional test on the extent of the flight test program is small. Comment accepted, text AMC 25.21(g), Paragraph 6.12 changed accordingly.
Cmt. *60 / Transport Canada*	
AMC 25.21(g), Paragraph 6.14.1 Suggest deleting last sentence : 'Although ..with increasing speed)' Justification/Reason. It is unclear how a stick force gradient can be satisfactorily extrapolated.	The acceptance of the maximum speed for demonstration to be limited to 519 km/h (280 knots) is to avoid extensive repeated testing e.g. change of natural ice shedding at high speed. This limitation is acceptable provided the stickforce gradient can be satisfactorily extrapolated to higher speed as proposed in CS 25.2539©. Cmtnr 60 suggests deleting the acceptance of the lower speed for demonstration, because it is unclear how a stickforce gradient can be satisfactorily extrapolated. No guidance material is available. This issue will be subject for discussion between the applicant and the Authority on a case by case basis. See cmtnr 29. Comment not accepted.

Comment	Response
Cmt. *61 / Transport Canada*	
AMC 25.21(g), Paragraph 6.21.2.1.b Comment: See earlier comments on 'Bank-to-bank rapid roll, 30o - 30o' Comment: It may be inappropriate to use the Holding speed as the trim speed for a full stall. Also it should be clarified that a power off, straight, 1 knot/s stall is intended. Comment: It should be clarified that the 'Deceleration to stall warning' tests are to stall warning plus 3 seconds	Comment refers to Table 3 in AMC 25.21(g), Paragraph 6.21.2.1. The table summarises the manoeuvres that should be carried out in natural icing conditions (with the ice accretions representative of normal operation of the ice protection system) when flight testing with artificial shapes is the primary means of compliance demonstration. The description of the manoeuvres in Table 3 is short. Actual test procedures are to be defined by the applicant and agreed by the Authority. Comment not accepted (see also cmtnr 57)

Comment	Response

B. Proposal 01

Paragraph - **Add. info:**

Cmt. *6 / FAA, USA*

Comment	Response
CS 25.21(g) Replace the current text of CS 25.21(g) with - 'The requirements of this subpart associated with icing conditions apply only if certification for flight in icing conditions is desired. If certification for flight in icing conditions is desired, the following requirements also apply (see AMC 25.21(g)):' Justification/Reason. The subpart B requirements of this NPA that are associated with icing conditions should only apply if the applicant desires certification for flight in icing conditions. This is not clear with the current text.	Through sub-paragraph (g) in CS 25.21 the requirements are specified that must be met in icing conditions if an applicant elects to seek certification for flight in icing. For this purpose the current text is considered clear and in line with the original JAA NPA 25BEF-332, accepted without comments. Comment not accepted.

Cmt. *7 / FAA, USA*

Comment	Response
CS 25.21(g)(1) Change to read as follows: 'Unless otherwise prescribed, each requirement of this subpart, except CS 25.121(a), 25.123(c), 25.143(b)(1) and (b)(2), 25.149, 25.201©(2), 25.207(c) and (d), 25.239, and 25.251(b) through (e), must be met for flight in icing conditions. Compliance must be shown using the ice accretions defined in Appendix C, assuming normal operation of the airplane and its ice protection system in accordance with the operating limitations and operating procedures established by the applicant and provided in the Airplane Flight Manual.' Justification/Reason. Clarity and harmonization with the expected FAA rule text.	Proposed change provides further clarity, CS 25.239 however is a FAR 25 paragraph and none existing in CS 25 and therefore should be left out. Comment accepted, CS 25.21(g)(1) changed accordingly.

Cmt. *8 / FAA, USA*

Comment	Response
CS 25.21(g)(2) Change to read as follows: 'The airplane must meet the requirements of CS 25.143(j), 25.207(b), and 25.207(h) before the ice protection system has been activated and is performing its intended function.' Justification/Reason. The general stall warning requirement of CS 25.207(b) must also be met in icing conditions before the ice protection system has been activated and is performing its intended function. ...There is no need to further identify here the Appendix C section containing the applicable ice accretions. CS 25.21(g)(1) already states that for flight in icing conditions, compliance must be shown with the ice accretions identified in Appendix C. The title of Part II(e) of Appendix C makes it clear that it defines the ice accretions to use before the ice protection system has been activated and is performing its intended function. Additionally, CS 25.143(j) and 25.207(h) state that Part II(e) of Appendix C define the applicable ice accretion to use in showing compliance with those requirements.	Sub-paragraph (g)(2) in CS 25.21 is added to ensure that aeroplanes will have adequate handling characteristics in the period between the aeroplane entering the icing conditions and the ice protection system performing its intended function. The essential guidance for defining the ice accretion in this period based on the means of detection is given in Appendix C, Part II (e). CS 25.207(b) is applicable through CS 25.207(h)(1). Comment accepted, text CS 25.21(g)(2) changed accordingly

Comment	Response
Cmt. 38 / Transport Canada	
CS 25.21(g)(1), 25.143(b)(1), 25.143(c) Comment: It is not at all clear why CS 25.143(b)(1) should be on the list of excluded paragraphs for flight in icing conditions noted in 25.21(g)(1). Justification/Reason. The aeroplane should be safely controllable following a sudden engine failure when in icing conditions. Proposed 25.143(c) only requires the aeroplane to be safely controllable with the critical engine inoperative	It has never been customary to address simulated sudden engine failure (as opposed to flight with one engine inoperative) with ice accretions and there is no evidence of any lack of safety as a result. It was therefore decided not to make CS 25.143(b)(1) applicable to certification for flight in icing conditions. Comment not accepted.
Cmt. 39 / Transport Canada	
CS 25.21(g)(2) Comment: It is unclear why this sub paragraph is required. Subparagraph (1) specifies which requirements in the subpart must be met. These include 25.143(j) and 25.207(h).	Sub-paragraph (g)(2) in CS 25.21 is added to ensure that aeroplanes will have adequate handling characteristics in the period between the aeroplane entering the icing conditions and the ice protection system performing its intended function. Noted (text changed based on cmtnr 8)

Comment	Response

GENERAL COMMENT(S)

Paragraph - **Add. info:**

Cmt. *3 / ACG, Austria*

Comment	Response
No comments	Noted.

Cmt. *22 / FAA, USA*

Comment	Response
AMC 25.21(g), paragraph 2 Add the following CS paragraphs to the list of related regulations: 25.23, 25.25, 25.29, 25.31, 25.33, 25.101, 25.109, 25.145, 25.147, 25.161, 25.171, 25.175, 25.177, 25.181, 25.201, 25.203, 25.231, 25.233, 25.235, 25.251, 25.255. Justification/Reason. Guidance related to the means of compliance for the above sections of CS 25 for flight in icing conditions are provided in the AMC.	Comment addresses the fact that the list of related requirements in AMC 25.21(g), paragraph 2 is incomplete. In view of this also CS 25.27 should be added. Reading through AMC 25.21(g) all these sections of CS 25 are covered. Some of them only by indicating that no additional detailed substantiation of compliance is required. As such AMC 25.21(g), paragraph 2 lists those requirements that do need substantiation. Comment not accepted.

Cmt. *23 / FAA, USA*

Comment	Response
AMC 25.21(g), sub-paragraph 4.4.3 Add the following new text at the end of the sub-paragraph: 'Certification experience has also shown that runback ice may be critical for propellers, and propeller analyses do not always account for it. Therefore, runback ice on the propeller should be addressed, which may necessitate airplane performance checks in natural icing conditions or the use of an assumed (conservative) loss in propeller efficiency.' Justification/Reason. Current propeller icing analyses calculate intercycle ice but not runback ice, which the SAAB SF340 experience (Experience from a Propeller Icing Certification, Paper presented to SAE Aircraft Icing Technology Subcommittee AC-9C, September 18-22, 1989, S. Rodling of SAAB-SCANIA) has shown to be critical.	Operation of propeller ice protection system related to performance is addressed in AMC 25.21(g) Paragraph 4.4.1(b). The concern raised is not reflected in the current NPA. Comment address concern based on propeller icing analysis, based on experience from a propeller icing certification. The proposed revision would address the issue without further means to investigate. Investigation will require icing tunnel test or flight test in natural icing conditions with the propeller running wet. Comment accepted. AMC 21(g), Paragraph 4.4 changed by adding new subparagraph 4.4.6 with the text as proposed

Comment	Response
Cmt. *24 / FAA, USA*	
AMC 25.21(g), sub-paragraph 4.6.4 Change to read as follows: For probable failure conditions that are annunciated to the flight crew, with an associated operating procedure that requires the aeroplane to leave the icing conditions as soon as practicable, it should be shown that the aeroplane's resulting performance and handling characteristics with the 'Failure Ice' configuration are commensurate with the hazard level as determined by a system safety analysis in accordance with CS 25.1309. ..is capable of continued safe flight and landing with the 'Failure Ice' configuration..(DELETE). The operating procedures and related speeds may restrict the operating envelope, but the size of the restricted envelope should be consistent with the safety analysis. ..provide an adequate operating envelope and acceptable performance and handling characteristics to ensure continued safe flight and landing..(DELETE) Justification/Reason. The ice protection system must comply with CS 25.1309. Therefore, failures must be assessed in a manner that in accordance with and consistent with CS 25.1309. For probable failure conditions, the airplane should meet a higher level of safety than just 'continued safe flight and landing.' In accordance with CS 25.1309, probable failures should have no more than a minor effect.	Primary objectives of NPA 16/2004 (evolved from NPA 25F-219 Issue2) is to be more precise on safe operation (see also cmtnr 51). The comment proposes to apply the relation between probability of the failure and the classification of the failure condition as given in AMC CS 25.1309, figure 2. For the severity classification minor, the effect on the aeroplane should only be a slight reduction in functional capabilities or safety margins. Operational procedures and related speeds should provide an adequate operating envelope to ensure continued safe flight and landing with acceptable handling and performance characteristics as demonstrated in the flight test program in AMC 21.21(g), sub-paragraph 6.22. The intention of the AMC 25.21(g) sub-paragraph 4.6.4 is clear. The proposed revision to refer to the level of safety required by CS 25.1309 will not change the intention of nor provide additional clarification to AMC 25.21(g), sub-paragraph 4.6.4 . Comment not accepted.
Cmt. *37 / ECA*	
No comments	Noted.