Proposed Special Condition on "Flight in Icing Condition"

Applicable to Airbus A350-941

Introductory note:

The following Special Condition has been classified as an important Special Condition and as such shall be subject to public consultation, in accordance with EASA Management Board decision 02/04 dated 30 March 2004, Article 3 (2.) of which states:

"*2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency.*"

Statement of Issue

The CS-25 amendment 3 introduces new 25.21(g) aiming at addressing icing conditions consideration for all subpart B paragraphs except CS-25.121(a), 25.123(c), 25.143(b)(1) and (b)(2), 25.149, 25.201(c)(2), 25.207 (c) and (d) and 25.251(b) through (e).
A350, like the A320, A330, A340 and A380 is equipped with flight envelope protection specificity, therefore 25.21(g) needs to be adapted to take into account these specificities.

The practice used by Airbus for all previous Fly by Wire aircraft (since A320 up to A380) was to apply the NPA 25F-219 iss2 " flight in icing " on top of SC B-1" stalling and scheduled speeds" for A380 (or SC F-1 for A320), as the basic JAR / CS-25 has not been adapted to Airbus fly by wire protected aircraft.

In order to apply flight in icing requirements, and to adapt to Airbus Fly By Wire protected A/C design, the following was applied:

- the need for operational speed increase in icing conditions was checked on Vmin1g instead of V_{CLmax}.
- for stall warning requirement, as Stall Warning only appears in case of failure of FCTL system, basic requirements were adapted.

For A350, it is proposed to adapt the requirements of the new regulation to Airbus Fly By Wire protected aircraft design, in a way that provides for this kind of aircraft an equivalent level of safety to conventional aircraft.

For A350 Type Certification, the following Special Condition is based on NPA 16/2004 (embodied in new CS-25 Amdt 3) and NPA 2008-05 (published on 10-Apr-2008).
As for previous FWB Airbus aircraft, the basic requirements of CS-25 is applied but modified under special conditions to be adapted to Airbus FBW characteristics. Therefore, the paragraphs CS-25.21g, 25.105, 25.121, 25.125, 25.143(j) and appendix1 of AMC 25.21(g) have been amended to take account of the Airbus flight envelope protection specificities in a way to achieve an equivalent level of safety It mainly led to delete the mention of V_{SR} in icing condition in CS-25.105, 25.121, 25.125, 25.143 and relies :

- on the requirement of manoeuvring capability in icing conditions as required in CS25.143(h) whatever the aerodynamic degradation in icing conditions for different flight phases at each characteristics speeds (V2, VFTO, VREF),
- on the check of the robustness of protection in icing conditions and ,

- as per basic regulation ,on the check that there is no significant climb gradient degradation in icing conditions at each characteristics speeds (using the basic CS 25.105 (a)(2)(ii), 25.121.b)2)ii)B, 25. 121(c)2)ii)B), 25.123b)2)ii)

This represents an equivalent level of safety to conventional aircraft. Moreover, requirements for which stop criteria are either Stall or Stall Warning triggering are adapted using more relevant criteria for Airbus FBW protected aircraft.

The paragraphs dealing with stalling and high AOA protection are not addressed in this Special Condition as they are covered by Special Condition B-01 on “Stalling and Scheduled Operating Speeds” that is under concurrent public consultation. As the basic JAR / CS paragraphs CS-25.103, 25.201, 25.207 have been updated to account for new icing considerations introduced in the new paragraph 25.21g in CS-25 amendment 3 (supplemented by NPA 2008-05), the previous wording of the Special Condition is changed to embody the new requirements. Those new requirements have been adapted to Airbus Fly By Wire A/C characteristics and highlighted in yellow in the current consultation, in order to provide an equivalent level of safety to the actual CS-25 at amendment 5, which was the principle followed on previous project.
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Airbus A350-941 - Special Condition

- Flight in Icing Condition -

1) Change CS-25.21(g)(1) to read as follows:

CS-25.21 Proof of compliance

(g) 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)):

(1) Each requirement of this subpart, except CS-25.121(a), 25.123(c),25.143(b)(1) and (b)(2), 25.149, 25.201(c)(2), 25.251(b) through (e), 25.207 (c) and (d) must be met in icing conditions. Compliance must be shown using the ice accretions defined in Appendix C, assuming normal operation of the aeroplane and its ice protection system in accordance with the operating limitations and operating procedures established by the applicant and provided in the Aeroplane Flight Manual.

2) Change CS-25.103 Stall speed to read as defined in CRI B-01

3) Change and replace CS-25.105(a)(2)(i) to read as follows:

CS-25.105 Take-off

(a) The take-off speeds prescribed by CS-25.107, the accelerate-stop distance prescribed by CS-25.109, the take-off path prescribed by CS-25.111, and the take-off distance and take-off run prescribed by CS-25.113, must be determined, and the net take-off flight path prescribed by CS-25.115, must be determined in the selected configuration for take-off at each weight, altitude, and ambient temperature within the operational limits selected by the applicant -

. . .

(2) In icing conditions, if in the configuration of CS 25.121(b) with the “Take-off Ice” accretion defined in Appendix C:

i) the V2 speed scheduled in non-icing conditions does not provide the manoeuvring capability specified in CS-25.143(h) for the take-off configuration, or

4) Change CS-25.107(c) (g) and add CS-25.107(c') (g') to read as follows:

CS-25.107 Take-off speeds

(c) In non-icing conditions V2, in terms of calibrated airspeed, must be selected by the applicant to provide at least the gradient of climb required by CS 25.121(b) but may not be less than –

(1) V2MIN;

(2) VR plus the speed increment attained
(in accordance with CS 25.111(c)(2)) before reaching a height of 11 m (35 ft) above the takeoff surface; and

(3) A speed that provides the manoeuvring capability specified in CS 25.143(h).

(c') in icing conditions with the "Take-off ice" accretion defined in Appendix C, V2 may not be less than –

(1) the V2 speed determined in non-icing conditions

(2) A speed that provides the manoeuvring capability specified in CS 25.143(h).

(g) in non-icing conditions, VFTO, in terms of calibrated airspeed, must be selected by the applicant to provide at least the gradient of climb required by CS 25.121(c), but may not less than

(1) 1.18 VSR; and

(2) A speed that provides the manoeuvring capability specified in CS 25.143(h).

(g') in icing conditions with the "Final take-off ice" accretion defined in Appendix C,, VFTO, may not less than

(1) the VFTO speed determined in non icing conditions

(2) A speed that provides the manoeuvring capability specified in CS 25.143(h).

5) Change CS-25.121(b)(2)(ii)(A), CS-25.121(c)(2)(ii)(A), CS-25.121(d)(2)(ii), replace by new paragraph CS-25.121(b)(2)(ii)(A), CS-25.121(c)(2)(ii)(A), CS-25.121(d)(2)(ii), to read as follows:

CS-25.121 Climb: one-engine inoperative :

(b) *Take-off; landing gear retracted.* In the take-off configuration existing at the point of the flight path at which the landing gear is fully retracted, and in the configuration used in CS25.111 but without ground effect,

. . .

(2) The requirements of subparagraph (b)(1) of this paragraph must be met:

. . .

(ii) In icing conditions with the "Take-off Ice" accretion defined in Appendix C, if in the configuration of CS 25.121(b) with the "Take-off Ice" accretion:

(A) The V2 speed scheduled in non-icing conditions does not provide the manoeuvring capability specified in CS-25.143(h) for the take-off configuration; or

(c) *Final take-off.* In the en-route configuration at the end of the take-off path determined in accordance with CS-25.111:

(2) The requirements of subparagraph (c)(1) of this paragraph must be met:

. . .

(ii) In icing conditions with the "Final Take-off Ice" accretion defined in Appendix C, if:

(A) The V_{FTO} speed scheduled in non-icing conditions does not provide the manoeuvring capability specified in CS-25.143(h) for the en-route configuration; or

(B) The degradation of the gradient of climb with the "Take-off Ice" in accordance with CS 25.121(b) is greater than one-half of the applicable actual-to-net take-off flight path gradient reduction defined in CS 25.115(b**).**

(d) (2) The requirements of sub-paragraph (d)(1) of this paragraph must be met

. . .

(ii) In icing condition with the approach Ice accretion defined in Appendix C, in a configuration corresponding to the normal all-engines-operating procedure in which Vmin1g for this configuration does not exceed 110% of the Vmin1g for the related all-engines-operating landing configuration in icing, with a climb speed established with normal landing procedures, but not more than 1,4 Vsr (Vsr determined in non-icing conditions).

6) Change CS-25.123 (b)(2)(i) to read as follows:
CS-25.123 En-route flight paths :

(b) The one-engine-inoperative net flight path data must represent the actual climb performance diminished by a gradient of climb of 1·1% for two-engines aeroplanes, 1·4% for three-engines aeroplanes, and 1·6% for four engines aeroplanes.

(1) In non-icing conditions; and

(2) In icing conditions with the "En-route ice" accretion defined in Appendix C, if:

(i) The minimum en-route speed scheduled in non-icing conditions does not provide the manoeuvring capability specified in CS-25.143(h) for the en-route configuration, or

(ii) [UNCHANGED]

7) Delete CS-25.125(b)(2)(ii)(B) and replace it by CS-25.125(b)(2)(ii)(C) to read as follows:

CS-25.125 Landing

. . .

(b) In determining the distance in (a):

(1) The aeroplane must be in the landing configuration.

(2) A stabilised approach, with a calibrated airspeed of not less than VREF, must be maintained down to the 15 m (50 ft) height.

(i) In non-icing conditions, VREF may not be less than:

(A) 1.23VSR0;

(B) VMCL established under CS-25.149(f); and

(C) A speed that provides the manoeuvring capability specified in CS-25.143(h).

(ii) In icing conditions, VREF may not be less than:

(A) The speed determined in sub-paragraph (b)(2)(i) of this paragraph;

(B) A speed that provides the manoeuvring capability specified in CS-25.143(h) with the landing ice accretion defined in appendix C.

8) Change CS-25.143(j)(2)(i) to read as follows:

Controllability and Manoeuvrability
CS-25.143 General

(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 seeing a specified ice accretion on a reference surface (not just the first indication of icing), 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 aeroplane is controllable in a pull-up manoeuvre up to 1.5 g load factor or lower if limited by AOA protection; and

(ii) There is no pitch control force reversal during a pushover manoeuvre down to 0.5 g load factor

9) Change CS-25.207 Stall warning to read as defined in CRI B-01