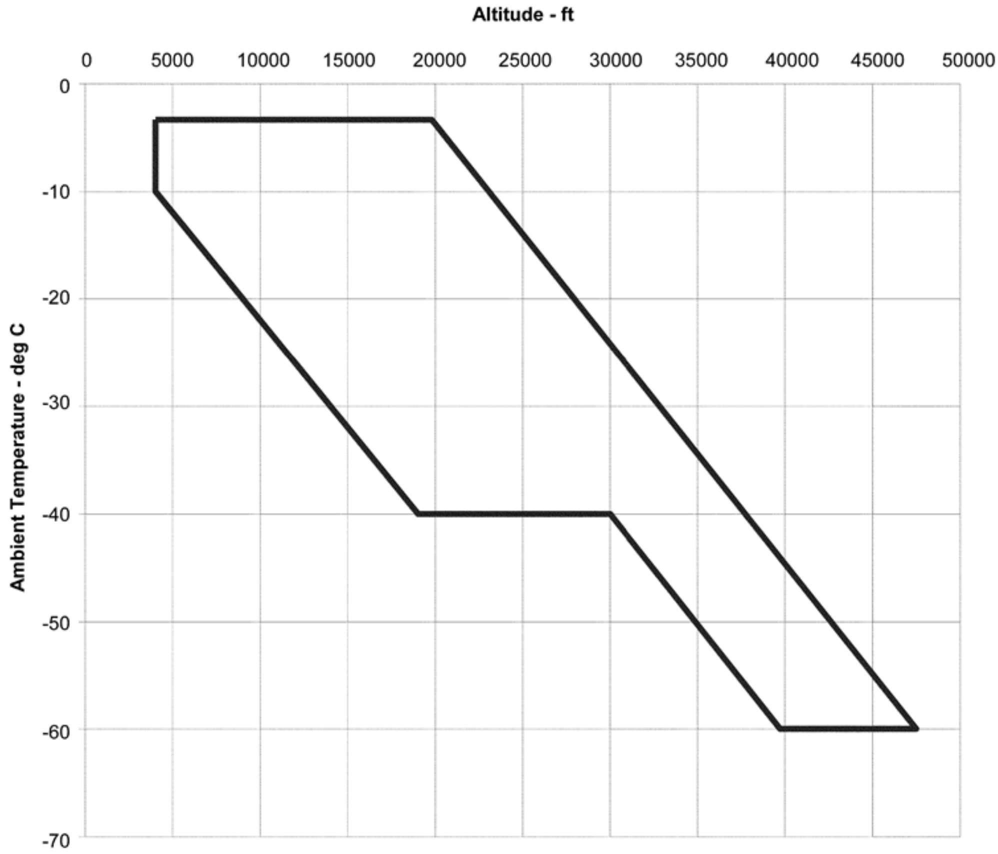
APPENDIX P – MIXED PHASE AND ICE CRYSTAL ICING ENVELOPE (DEEP CONVECTIVE CLOUDS)

ED Decision 2015/008/R

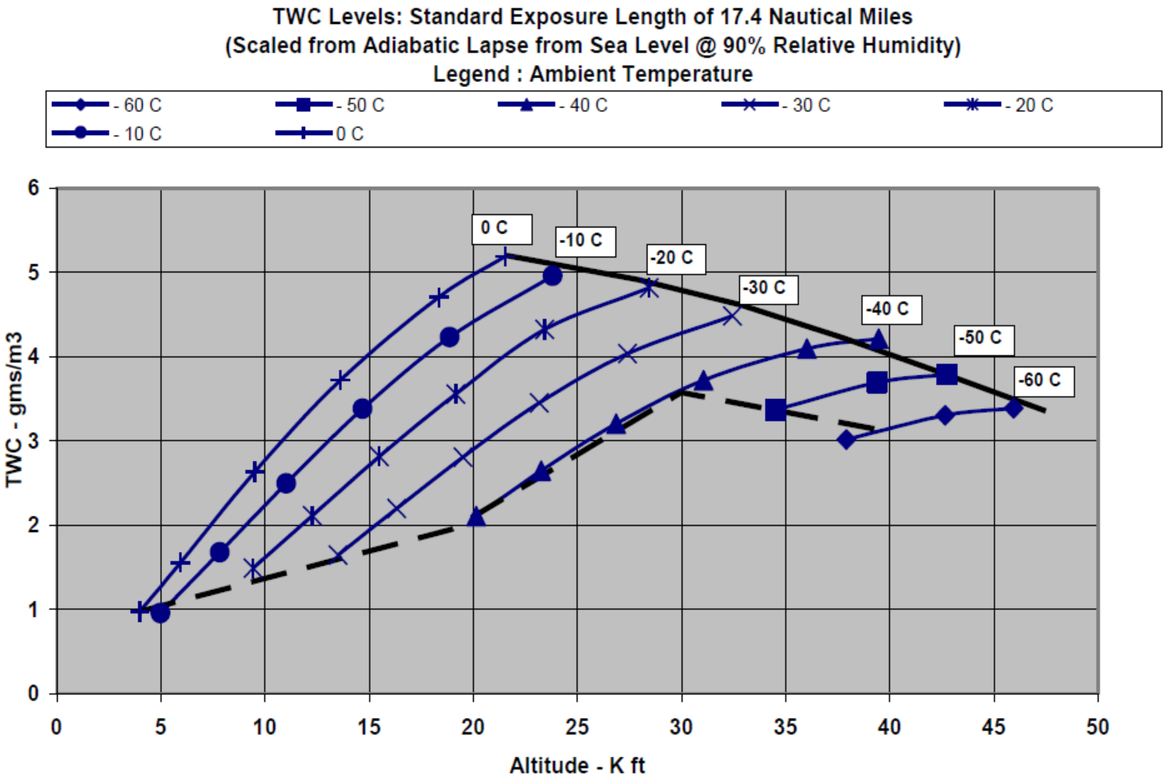
The ice crystal icing envelope is depicted in Figure 1 below.

Figure 1 – Convective Cloud Ice Crystal Envelope



Within the envelope, total water content (TWC) in g/m3 has been determined based upon the adiabatic lapse defined by the convective rise of 90 % relative humidity air from sea level to higher altitudes and scaled by a factor of 0.65 to a standard cloud length of 32.2 km (17.4 nautical miles). Figure 2 displays TWC for this distance over a range of ambient temperature within the boundaries of the ice crystal envelope specified in Figure 1.

Figure 2 – Total Water Content



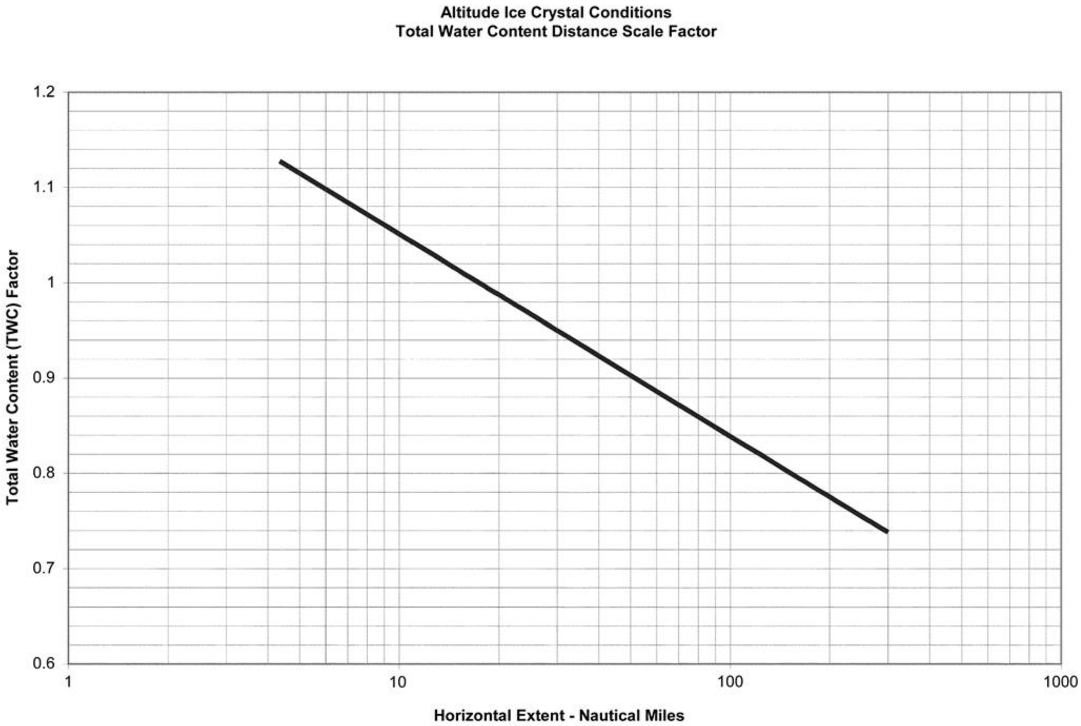
Ice crystal size median mass dimension (MMD) range is 50–200 microns (equivalent spherical size) based upon measurements near convective storm cores. The TWC can be treated as completely glaciated (ice crystal) except as noted in the Table 1.

Table 1 – Supercooled Liquid Portion of TWC

Temperature range – deg C	Horizontal cloud length	LWC – g/m^3
0 to -20	≤92.6 km (50 nautical miles)	≤1.0
0 to -20	Indefinite	≤0.5
< -20		0

The TWC levels displayed in Figure 2 represent TWC values for a standard exposure distance (horizontal cloud length) of 32.2 km (17.4 nautical miles) that must be adjusted with length of icing exposure.

Figure 3 – Exposure Length Influence on TWC



[Amdt 25/16]

APPENDIX Q – ADDITIONAL AIRWORTHINESS REQUIREMENTS FOR APPROVAL OF A STEEP APPROACH LANDING (SAL) CAPABILITY

ED Decision 2016/010/R

(See AMC to Appendix Q)

(SAL) 25.1 Applicability

ED Decision 2013/010/R

This Appendix contains airworthiness requirements that enable an aeroplane to obtain approval for a steep approach landing capability using an approach path angle greater than or equal to 4.5° (a gradient of 7.9 %).

The requirements of this Appendix cover only CS-25 Subparts B and G and they apply in lieu of CS 25.121(d). They also apply in lieu of CS 25.125 if a reduced landing distance is sought, or if the landing procedure (speed, configuration, etc.) differs significantly from normal operation, or if the screen height is greater than 50 ft. Additional requirements may apply with respect to aeroplane systems or equipment or other relevant items such as autopilot, flight guidance, or GPWS. It is likely that the GPWS mode 1 (sink rate) envelope will need modification to prevent nuisance alerts. Also, the structural implications of the increased probability of high rates of descent at touchdown must be considered.

If a steep approach approval is required for flight in icing conditions, substantiation must be provided accordingly for the steep approach condition.

An applicant may choose to schedule information for an all-engines approach or for an approach with one engine inoperative. If an all-engines approach is scheduled, it is assumed that a diversion is required if an engine failure occurs prior to the decision to land.

[Amdt 25/13]

(SAL) 25.2 Definitions

ED Decision 2013/010/R

For the purposes of this Appendix:

— Steep Approach Landing: An approach to land made using a glide path angle greater than or equal to 4.5°, as selected by the applicant.

— Screen Height: The reference height above the runway surface from which the landing distance is measured. The screen height is a height selected by the applicant, at 50 ft or another value from 35 to 60 ft.

— $V_{REF(SAL)}$ is the calibrated airspeed selected by the applicant used during the stabilised approach at the selected approach path angle and maintained down to the screen height defined above. $V_{REF(SAL)}$ may not be less than 1.23 V_{SR}, V_{MCL}, or a speed that provides the manoeuvring capability specified in CS 25.143(h), whichever is greater and may be different from the VREF used for standard approaches.

— $V_{REF(SAL)-1}$ is the calibrated airspeed selected by the applicant used during the stabilised one-engine-inoperative approach at the selected approach path angle and maintained down to the screen height defined above. $V_{REF(SAL)-1}$ may not be less than $V_{REF(SAL)}$.

[Amdt 25/13]

(SAL) 25.3 Steep Approach Landing Distance

ED Decision 2013/010/R

(Applicable only if a reduced landing distance is sought, or if the landing procedure (speed, configuration, etc.) differs significantly from normal operation, or if the screen height is greater than 50 ft.)

(a) The steep approach landing distance is the horizontal distance necessary to land and to come to a complete stop from the landing screen height and must be determined (for standard temperatures, at each weight, altitude and wind within the operational limits established by the applicant for the aeroplane) as follows:

(1) The aeroplane must be in the all-engines-operating or one-engine-inoperative steep approach landing configuration, as applicable.

(2) A stabilised approach, with a calibrated airspeed of $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate, and at the selected approach angle must be maintained down to the screen height.

(3) Changes in configuration, power or thrust, and speed must be made in accordance with the established procedures for service operation (see AMC 25.125(b)(3)).

(4) The landing must be made without excessive vertical acceleration, tendency to bounce, nose over or ground loop and with a vertical touchdown velocity not greater than 6 ft/sec.

(5) The landings may not require exceptional piloting skill or alertness.

(b) The landing distance must be determined on a level, smooth, dry, hard-surfaced runway (see AMC 25.125(c)). In addition,

(1) The pressures on the wheel braking systems may not exceed those specified by the brake manufacturer;

(2) The brakes may not be used so as to cause excessive wear of brakes or tyres (see AMC 25.125(c)(2)); and

(3) Means other than wheel brakes may be used if that means

(i) Is safe and reliable;

(ii) Is used so that consistent results can be expected in service; and

(iii) Is such that exceptional skill is not required to control the aeroplane.

(c) Reserved.

(d) Reserved.

(e) The landing distance data must include correction factors for not more than 50 % of the nominal wind components along the landing path opposite to the direction of landing, and not less than 150 % of the nominal wind components along the landing path in the direction of landing.

(f) If any device is used that depends on the operation of any engine, and if the landing distance would be noticeably increased when a landing is made with that engine assumed to fail during the final stages of an all-engines-operating steep approach, the steep approach landing distance must be determined with that engine inoperative unless the use of compensating means will result in a landing distance not more than that with each engine operating.

[Amdt 25/13]

(SAL) 25.4 Climb: One-engine-inoperative

ED Decision 2013/010/R

In a configuration corresponding to the normal all-engines-operating procedure in which V_{SR} for this configuration does not exceed 110 % of the V_{SR} for the related all-engines-operating steep approach landing configuration, the steady gradient of climb may not be less than 2.1 % for two-engined aeroplanes, 2.4 % for three-engined aeroplanes, and 2.7 % for four-engined aeroplanes, with:

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

(b) The maximum landing weight;

(c) A climb speed of $V_{REF(SAL)}$; and

(d) The landing gear retracted.

[Amdt 25/13]

(SAL) 25.5 Safe operational and flight characteristics

ED Decision 2018/005/R

(a) It must be demonstrated that it is possible to complete a stabilised approach in calm air down to the commencement of the landing flare, followed by a touchdown and landing without displaying any hazardous characteristics for the following conditions (see AMC to Appendix Q, (SAL) 25.5):

(1) The selected approach path angle at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate;

(2) An approach path angle 2° steeper than the selected approach path angle, at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate; and

(3) The selected approach path angle at $V_{REF(SAL)}$ minus 5 knots or $V_{REF(SAL)-1}$ minus 5 knots as appropriate.

(b) For conditions (a)(1), (a)(2), and (a)(3):

(1) The demonstration must be conducted at the most critical weight and centre of gravity, either with all-engines-operating or with the critical engine inoperative, as appropriate;

(2) The rate of descent must be reduced to 3 feet per second or less before touchdown;

(3) Below a height of 200 ft no action shall be taken to increase power or thrust apart from those small changes which are necessary to maintain an accurate approach;

(4) No nose depression by use of longitudinal control shall be made after initiating the flare other than those small changes necessary to maintain a continuous and consistent flare flight path; and

(5) The flare, touchdown and landing may not require exceptional piloting skill or alertness.

(c) For conditions (a)(1) and (a)(3), the flare must not be initiated above the screen height.

(d) For condition (a)(2), it must be possible to achieve an approach path angle 2° steeper than the selected approach path angle in all configurations which exist down to the initiation of the flare, which must not occur above 150 % of the screen height. The flare technique used must be substantially unchanged from that recommended for use at the selected approach path angle.

(e) All-engines-operating steep approach.

It must be demonstrated that the aeroplane can safely transition from the all-engines-operating steep landing approach to:

(1) the all-engines-operating go-around as per standard procedure; and

(2) the one-engine- inoperative approach climb configuration with one engine having been made inoperative, for the following conditions:

(i) The selected steep approach angle;

(ii) An approach speed of $V_{REF(SAL)}$;

(iii) The most critical weight and centre of gravity; and

(iv) For propeller-powered aeroplanes, the propeller of the inoperative engine shall be at the position it automatically assumes following an engine failure at high power.

(f) In addition, for propeller-powered aeroplanes, it must be demonstrated that controllability is maintained following an engine failure at approach power and with the propeller at the position it automatically assumes.

(g) The height loss during the manoeuvre required by subparagraph (SAL) 25.5(e) must be determined.

(h) It must be demonstrated that the aeroplane is safely controllable during a landing with one engine having been made inoperative during the final stages of an all-engines-operating steep approach for the following conditions:

(1) The selected steep approach angle;

(2) An approach speed of $V_{REF(SAL)}$;

(3) The most critical weight and centre of gravity; and

(4) For propeller-powered aeroplanes, the propeller of the inoperative engine shall be at the position it automatically assumes following an engine failure at approach power.

(i) One-engine-inoperative steep approach.

It must be demonstrated that the aeroplane can safely transition from the one-engine-inoperative steep landing approach to the approach climb configuration for the following conditions:

(1) The selected steep approach angle;

(2) An approach speed of $V_{REF(SAL)-1}$;

(3) The most critical weight and centre of gravity; and

(4) For propeller-powered aeroplanes, the propeller of the inoperative engine may be feathered.

[Amdt 25/13]

[Amdt 25/21]

AMC to Appendix Q, (SAL) 25.5 Safe operational and flight characteristics

ED Decision 2016/010/R

(a) For the approach demonstrations required by (SAL) 25.5(a), due account should be taken of:

(1) The systems' aspects of the power/thrust levers being at idle (e.g. arming of ground lift dump);

(2) The most adverse flight idle power/thrust (e.g. effects of engine bleeds or FADEC idle power/thrust control); and

(3) The effects on controllability from the use of auxiliary drag devices such as flight spoilers (e.g. increased stall warning and stall speeds, loss of manoeuvrability).

(b) For the flare, touchdown and landing demonstrations required by (SAL) 25.5(a), there should not be any occurrence of:

(1) Stall warning;

(2) Tail strike; or

(3) Any other characteristic that would interfere with the completion of the landing (e.g. automatic thrust increase).

(c) For the go-around demonstrations required by (SAL) 25.5(e) and (i), due account should be taken of time delays associated with automatic or manual retraction of auxiliary drag devices.

[Amdt No: 25/13]
[Amdt No: 25/18]

(SAL) 25.6 Aeroplane Flight Manual

ED Decision 2013/010/R

For steep approach landing, the AFM shall include the following:

(a) The steep approach landing distance determined in accordance with paragraph (SAL) 25.3 of this Appendix for the selected screen height and aeroplane configuration. The landing distance data may additionally include correction factors for runway slope and temperature other than standard, within the operational limits of the aeroplane, and may provide the required landing field length including the appropriate factors for operational variations prescribed in the relevant operating regulation.

(b) The more limiting of the landing weight, altitude and temperature (WAT) limits derived in accordance with:

(1) CS 25.119, and

(2) The one-engine-inoperative approach climb requirement of paragraph (SAL) 25.4 of this Appendix.

(c) Appropriate limitations and detailed normal, non-normal, and emergency procedures. Where an aeroplane is not approved for deliberate one-engine-inoperative steep approach landings, this limitation shall be stated.

(d) A statement that the presentation of the steep approach limitations, procedures, and performance reflects the capability of the aeroplane to perform steep approach landings but that it does not constitute operational approval.

(e) A statement of headwind and crosswind limitations if they are different from those for non-steep approaches. The tailwind limitation is 5 knots unless test evidence shows that more than 5 knots is acceptable.

(f) The reference steep approach glide slope angle and the screen height used for determination of the landing distance.

(g) The height loss during a go-around from the all-engines-operating steep landing approach to the approach climb configuration with one engine made inoperative, determined in accordance with (SAL) 25.5(g).

[Amdt No: 25/13]

APPENDIX R – HIRF ENVIRONMENTS AND EQUIPMENT HIRF TEST LEVELS

ED Decision 2015/019/R

This Appendix specifies the HIRF environments and equipment HIRF test levels for electrical and electronic systems under CS 25.1317. The field strength values for the HIRF environments and equipment HIRF test levels are expressed in root-mean-square units measured during the peak of the modulation cycle.

(a) HIRF environment I is specified in the following table:

Table 1 — HIRF environment I

FREQUENCY	FIELD STRENGTH (V/m)	
	PEAK	AVERAGE
10 kHz – 2 MHz	50	50
2 MHz – 30 MHz	100	100
30 MHz – 100 MHz	50	50
100 MHz – 400 MHz	100	100
400 MHz – 700 MHz	700	50
700 MHz – 1 GHz	700	100
1 GHz – 2 GHz	2 000	200
2 GHz – 6 GHz	3 000	200
6 GHz – 8 GHz	1 000	200
8 GHz – 12 GHz	3 000	300
12 GHz – 18 GHz	2 000	200
18 GHz – 40 GHz	600	200

In this table, the higher field strength applies to the frequency band edges.

(b) HIRF environment II is specified in the following table:

Table 2 — HIRF environment II

FREQUENCY	FIELD STRENGTH (V/m)	
	PEAK	AVERAGE
10 kHz – 500 kHz	20	20

FREQUENCY	FIELD STRENGTH (V/m)	
	PEAK	AVERAGE
500 kHz – 2 MHz	30	30
2 MHz – 30 MHz	100	100
30 MHz – 100 MHz	10	10
100 MHz – 200 MHz	30	10
200 MHz – 400 MHz	10	10
400 MHz – 1 GHz	700	40
1 GHz – 2 GHz	1 300	160
2 GHz – 4 GHz	3 000	120
4 GHz – 6 GHz	3 000	160
6 GHz – 8 GHz	400	170
8 GHz – 12 GHz	1 230	230
12 GHz – 18 GHz	730	190
18 GHz – 40 GHz	600	150

In this table, the higher field strength applies to the frequency band edges.

(c) Equipment HIRF test level 1.

(1) From 10 kilohertz (kHz) to 400 megahertz (MHz), use conducted susceptibility tests with Continuous Wave (CW) and 1 kHz square wave modulation with 90 % depth or greater. The conducted susceptibility current must start at a minimum of 0.6 milliamperes (mA) at 10 kHz, increasing 20 decibels (dB) per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 40 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 40 MHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 30 mA at 40 MHz, decreasing 20 dB per frequency decade to a minimum of 3 mA at 400 MHz.

(4) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 volts per meter (V/m) peak with CW and 1 kHz square wave modulation with 90 % depth or greater.

(5) From 400 MHz to 8 gigahertz (GHz), use radiated susceptibility tests at a minimum of 150 V/m peak with pulse modulation of 4 % duty cycle with a 1 kHz pulse repetition frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 %.

(d) Equipment HIRF test level 2. Equipment HIRF test level 2 is HIRF environment II in Table II of this Appendix reduced by acceptable aircraft transfer function and attenuation curves. Testing must cover the frequency band of 10 kHz to 8 GHz.