A is not more than 10% of peak position light intensity and the overlap intensity in Area B is not greater than 2·5% of peak position light intensity.

CS 25.1391 Minimum intensities in the horizontal plane of forward and rear position lights

ED Decision 2003/2/RM

Each position light intensity must equal or exceed the applicable values in the following table:

Dihedral angle (light included)	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity candela (candles)
L and R	0° to 10°	41 (40)
(forward red and green)	10° to 20°	31 (30)
	20° to 110°	5
A (rear white)	110° to 180°	20

CS 25.1393 Minimum intensities in any vertical plane of forward and rear position lights

ED Decision 2003/2/RM

Each position light intensity must equal or exceed the applicable values in the following table:

Angle above or below the horizontal plane:	Intensity
0°	1·00 I
0° to 5°	0·90 I
5° to 10°	0·80 I
10° to 15°	0·70 I
15° to 20°	0·50 I
20° to 30°	0·30 I
30° to 40°	0·10 I
40° to 90°	0·05 I

CS 25.1395 Maximum intensities in over-lapping beams of forward and rear position lights

ED Decision 2003/2/RM

No position light intensity may exceed the applicable values in the following table, except as provided in CS 25.1389(b)(3):

Overlaps	Maximum intensity	
	Area A candela (candles)	Area B candela (candles)
Green in dihedral angle L	10	1
Red in dihedral angle R	10	1
Green in dihedral angle A	5	1
Red in dihedral angle A	5	1
Rear white in dihedral angle L	5	1
Rear white in dihedral angle R	5	1

Where –

(a) Area A includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plane at more than 10° but less than 20°; and

(b) Area B includes all directions in the adjacent dihedral angle that pass through the light source and intersect the common boundary plane at more than 20°.

CS 25.1397 Colour specifications

ED Decision 2003/2/RM

Each position light colour must have the applicable International Commission on Illumination chromaticity co-ordinates as follows:

(a) Aviation red –

‘y’ is not greater than 0·335; and

‘z’ is not greater than 0·002.

(b) Aviation green –

‘x’ is not greater than 0·440–0·320y;

‘x’ is not greater than y–0·170; and

‘y’ is not less than 0·390–0·170x.

(c) Aviation white –

‘x’ is not less than 0·300 and not greater than 0·540;

‘y’ is not less than ‘x–0·040’ or ‘y_o–0·010’, whichever is the smaller; and

‘y’ is not greater than ‘x+0·020’ nor ‘0·636–0·400x’; Where ‘y_o’ is the ‘y’ co-ordinate of the Planckian radiator for the value of ‘x’ considered.

CS 25.1401 Anti-collision light system

ED Decision 2003/2/RM

(a) *General*. The aeroplane must have an anticollision light system that –

(1) Consists of one or more approved anti-collision lights located so that their light will not impair the crew’s vision or detract from the conspicuity of the position lights; and

(2) Meets the requirements of sub-paragraphs (b) to (f) of this paragraph.

(b) *Field of coverage*. The system must consist of enough light to illuminate the vital areas around the aeroplane considering the physical configuration and flight characteristics of the aeroplane. The field of coverage must extend in each direction within at least 75° above and 75° below the horizontal plane of the aeroplane, except that a solid angle or angles of obstructed visibility totalling not more than 0·03 steradians is allowable within a solid angle equal to 0·15 steradians centred about the longitudinal axis in the rearward direction.

(c) *Flashing characteristics*. The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor more than 100 cycles per minute. The effective flash frequency is the frequency at which the aeroplane’s complete anti-collision light system is observed from a distance, and applies to each section of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100, but not 180 cycles per minute.

(d) *Colour*. Each anti-collision light must be either aviation red or aviation white and must meet the applicable requirements of CS 25.1397.

(e) *Light intensity*. The minimum light intensities in all vertical planes, measured with the red filter (if used) and expressed in terms of 'effective' intensities, must meet the requirements of sub-paragraph (f) of this paragraph. The following relation must be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} I(t)dt}{0 \cdot 2 + (t_2 - t_1)}$$

where:

I_e = effective intensity (candela (candles)

$I(t)$ = instantaneous intensity as a function of time

$t_2 – t_1$ = flash time interval (seconds)

Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1.

(f) *Minimum effective intensities for anticollision lights.* Each anti-collision light effective intensity must equal or exceed the applicable values in the following table:

Angle above or below the horizontal plane:	Effective intensity (candela (candles))
0° to 5°	407 (400)
5° to 10°	244 (240)
10° to 20°	81 (80)
20° to 30°	41 (40)
30° to 75°	20

CS 25.1403 Wing icing detection lights

ED Decision 2015/008/R

(see AMC 25.1403)

Unless operations at night in known or forecast icing conditions are prohibited by an operating limitation, a means must be provided for illuminating or otherwise determining the formation of ice on the parts of the wings that are critical from the standpoint of ice accumulation. Any illumination that is used must be of a type that will not cause glare or reflection that would handicap crewmembers in the performance of their duties.

[Amdt 25/16]

AMC 25.1403 Wing icing detection lights

ED Decision 2016/010/R

Unless operations at night in icing conditions are prohibited by an operating limitation, CS 25.1403 requires that a means be provided, during flight at night, to illuminate or otherwise determine ice formation on parts of the wings that are critical from the standpoint of ice accumulations resulting from Appendix C and Appendix O icing conditions. For showing compliance with the CS-25 certification specifications relative to SLD icing conditions represented by Appendix O, the applicant may use a comparative analysis. AMC 25.1420(f) provides guidance for comparative analysis.

a. If the flight crew cannot see the wings, one acceptable means of compliance with this regulation would be to install an ice evidence probe in a position where the flight crew can observe ice accumulation. The applicant should substantiate that formation of ice on this device precedes formation of ice on the wings or occurs simultaneously with it. Consideration should be given to the need for illuminating the ice evidence probe.

b. Wing icing detection lights should be evaluated both in and out of clouds during night flight to determine that the component of interest is adequately illuminated without excessive glare, reflections, or other distractions to the flight crew. These tests may be accomplished during the aeroplane certification flight tests. Typically, aeroplane-mounted illumination has been used to comply with this regulation. Use of a hand-held flashlight has not been considered acceptable because of the associated workload. The appropriate manual should identify the ice characteristics which the flight crew is expected to observe as well as the action the flight crew must perform if such ice is observed.

[Amdt 25/16]
[Amdt 25/18]

SAFETY EQUIPMENT

CS 25.1411 General

ED Decision 2008/006/R

(a) *Accessibility*. Required safety equipment to be used by the crew in an emergency must be readily accessible.

(b) *Stowage provisions*. Stowage provisions for required emergency equipment must be furnished and must –

(1) Be arranged so that the equipment is directly accessible and its location is obvious; and

(2) Protect the safety equipment from inadvertent damage.

(c) *Emergency exit descent device*. The stowage provisions for the emergency exit descent device required by CS 25.810(a) must be at the exits for which they are intended.

(d) *Liferafts*

(1) The stowage provisions for the liferafts described in CS 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for ditching is requested.

(2) Life rafts must be stowed near exits through which the rafts can be launched during an unplanned ditching.

(3) Rafts automatically or remotely released outside the aeroplane must be attached to the aeroplane by means of the static line prescribed in CS 25.1415.

(4) The stowage provisions for each portable life raft must allow rapid detachment and removal of the raft for use at other than the intended exits.

(e) *Long-range signalling device*. The stowage provisions for the long-range signalling device required by CS 25.1415 must be near an exit available during an unplanned ditching.

(f) *Life-preserver stowage provisions*. The stowage provisions for life preservers described in CS 25.1415 must accommodate one life preserver for each occupant for which certification for ditching is requested. Each life preserver must be within easy reach of each seated occupant.

(g) *Life line stowage provisions.* If certification for ditching under CS 25.801 is requested, there must be provisions to store the lifelines. These provisions must –

(1) Allow one life line to be attached to each side of the fuselage; and

(2) Be arranged to allow the lifelines to be used to enable the occupants to stay on the wing after ditching. This requirement is not applicable to aeroplanes having no over-wing ditching exits.

[Amdt 25/5]

AMC 25.1411(f) Life preserver stowage provisions

ED Decision 2020/024/R

The applicant should demonstrate that the life preserver is within easy reach of, and can be readily removed by, a seated and belted occupant (shoulder strap(s) may be removed prior to the demonstration), for all seat orientations and installations that are intended for use during taxi, take-off and landing. In lieu of an actual life preserver, a representative object (e.g. of the same size and weight) may be utilised for testing. The evaluation to quickly retrieve the preserver is to begin with the occupant moving their hand(s) from the seated position to reach for the preserver and to end with the occupant having the preserver in their hand(s) and fully removed from the stowage container. It does not include the time for the occupant to return to the upright position, to remove a pull strap from the preserver (if used) or to open the preserver package provided by the preserver manufacturer.

The applicant should test the critical configuration(s) to demonstrate retrieval of the life preserver in less than 10 seconds by a minimum of 5 test subjects with a success rate of no less than 75 %. The test should evaluate three anticipated occupant test subject size categories: the 5th, 50th and 95th percentile. At least one occupant from each size category should demonstrate successful retrieval within 10 seconds. No more than 40 % of the overall test subject population should be in the 5th or 95th percentile occupant categories.

1) For passenger seats, the test subjects should be naïve. For the purpose of this test, naïve test subjects should be defined as follows: they should have had no experience within the prior 24 months in retrieving a life preserver. The subjects should receive no retrieval information other than a typical preflight briefing. The occupant size categories to be evaluated should be defined as:
   a. A 5th percentile occupant is no taller than 1.5 m (60 in).
   b. A 50th percentile occupant is at least 1.6 m (63 in) tall but no taller than 1.8 m (70 in).
   c. A 95th percentile occupant weighs at least 110.7 kg (244 lb).
2) For flight attendant and observer seats, the test subjects do not need to be naïve. The occupant size categories to be evaluated should be defined as:
   a. A 5th percentile occupant is no taller than 1.5 m (60 in).
   b. A 50th percentile occupant is at least 1.6 m (63 in) tall but no taller than 1.8 m (70 in).
   c. A 95th percentile occupant weighs at least 110.7 kg (244 lb).
3) For pilot/co-pilot seats, the test subjects do not need to be naïve. The occupant size categories to be evaluated should be defined as:
   a. A 5th percentile occupant is no taller than 1.57 m (62 in).
   b. A 50th percentile occupant is at least 1.6 m (63 in) tall but no taller than 1.8 m (70 in).
   c. A 95th percentile occupant weighs at least 110.7 kg (244 lb).

[Amdt 25/26]

CS 25.1415 Ditching equipment

ED Decision 2003/2/RM

(a) Ditching equipment used in aeroplanes to be certified for ditching under CS 25.801, and required by the Operating Rules, must meet the requirements of this paragraph.

(b) Each liferaft and each life preserver must be approved. In addition –

(1) Unless excess rafts of enough capacity are provided, the buoyancy and seating capacity beyond the rated capacity of the rafts must accommodate all occupants of the aeroplane in the event of a loss of one raft of the largest rated capacity; and

(2) Each raft must have a trailing line, and must have a static line designed to hold the raft near the aeroplane but to release it if the aeroplane becomes totally submerged.

(c) Approved survival equipment must be attached to, or stored adjacent to, each liferaft.

(d) There must be an approved survival type emergency locator transmitter for use in one life raft.

(e) For aeroplanes, not certificated for ditching under CS 25.801 and not having approved life preservers, there must be an approved flotation means for each occupant. This means must be within easy reach of each seated occupant and must be readily removable from the aeroplane.

CS 25.1419 Ice Protection

ED Decision 2009/013/R

(See AMC 25.1419)

If the applicant seeks certification for flight in icing conditions, the aeroplane must be able to safely operate in the continuous maximum and intermittent maximum icing conditions of Appendix C. To establish this–

(a) An analysis must be performed to establish that the ice protection for the various components of the aeroplane is adequate, taking into account the various aeroplane operational configurations; and

(b) To verify the ice protection analysis, to check for icing anomalies, and to demonstrate that the ice protection system and its components are effective, the aeroplane or its components must be flight tested in the various operational configurations, in measured natural atmospheric icing conditions, and as found necessary, by one or more of the following means:

(1) Laboratory dry air or simulated icing tests, or a combination of both, of the components or models of the components.

(2) Flight dry air tests of the ice protection system as a whole, or of its individual components.

(3) Flight tests of the aeroplane or its components in measured simulated icing conditions.

(c) Caution information, such as an amber caution light or equivalent, must be provided to alert the flight crew when the anti-ice or de-ice system is not functioning normally.

(d) For turbine engine powered aeroplanes, the ice protection provisions of this paragraph are considered to be applicable primarily to the airframe. For the powerplant installation, certain additional provisions of Subpart E may be found applicable.

(e) One of the following methods of icing detection and activation of the airframe ice protection system must be provided:

(1) A primary ice detection system that automatically activates or alerts the flight crew to activate the airframe ice protection system; or

(2) A definition of visual cues for recognition of the first sign of ice accretion on a specified surface combined with an advisory ice detection system that alerts the flight crew to activate the airframe ice protection system; or

(3) Identification of conditions conducive to airframe icing as defined by an appropriate static or total air temperature and visible moisture for use by the flight crew to activate the airframe ice protection system.

(f) Unless the applicant shows that the airframe ice protection system need not be operated during specific phases of flight, the requirements of paragraph (e) of this section are applicable to all phases of flight.

(g) After the initial activation of the airframe ice protection system:

(1) The ice protection system must be designed to operate continuously; or

(2) The aeroplane must be equipped with a system that automatically cycles the ice protection system; or

(3) An ice detection system must be provided to alert the flight crew each time the ice protection system must be cycled.

(h) Procedures for operation of the ice protection system, including activation and deactivation, must be established and documented in the Aeroplane Flight Manual.

[Amdt 25/3]
[Amdt 25/7]

AMC 25.1419 Ice Protection

ED Decision 2015/008/R

If certification for flight in icing conditions is desired, the aeroplane must be able to safely operate throughout the icing envelope defined in Appendix C.

In the context of this AMC, the wording "relevant icing environment" means the Appendix C icing conditions.

CS 25.1419 provides specific airframe requirements for certification for flight in the icing conditions defined in Appendix C. Additionally, for other parts of the aeroplane (i.e., engine, engine inlet, propeller, flight instrument external probes, windshield) there are more specific icing related CS-25 specifications and associated acceptable means of compliance.

Other icing related specifications must be complied with, even if the aeroplane is not certificated for flight in icing:

CS 25.629(d)(3)

CS 25.975(a)(1)

CS 25.1093(b)

CS 25.1324

CS 25.1325(b)

CS 25.1326

CS 25J1093(b)

Additional information for showing compliance with the aeroplane performance and handling qualities requirements for icing certification may be found in AMC 25.21(g)

(a) CS 25.1419(a) Analysis

The applicant should prepare analysis to substantiate the choice of ice protection equipment for the aeroplane. Such analysis should clearly state the basic protection required and the assumptions made, and delineate methods of analysis used. All analysis tools and methods should be validated by tests or should have been validated by the applicant on a previous certification program. The applicant who uses a previously validated method should substantiate why that method is applicable to the new program.

1. Analytical Simulation Methods

Analytical simulation methods for icing include impingement and accretion models based on computational fluid dynamics. The applicant will typically use these methods to evaluate protected as well as unprotected areas for potential ice accretions. Analytical simulation provides a way to account for the variability in drop distributions. It also makes it possible to examine impingement in relation to visual icing cues and to analyse the location of detection devices for detrimental local flow effects.

2. Analysis of areas and components to be protected

In evaluating the aeroplane's ability to operate safely in the relevant icing environment, and in determining which components will be protected, the applicant should examine relevant areas to determine the degree of protection required. An applicant may determine that protection is not required for one or more of these areas or components. If so, the applicant's analysis should include the supporting data and rationale for allowing those areas or components to remain unprotected.

The applicant should show that:

— the lack of protection does not adversely affect handling characteristics or performance of the aeroplane, as required by CS 25.21(g),

— the lack of protection does not cause unacceptable affects upon the operation and functioning of affected systems and equipment,

— the lack of protection does not affect the flight instrument external probes systems, and

— shedding of ice accreting on unprotected areas will not create unacceptable damages to the engines or the surrounding components which would prevent continued safe flight and landing.

3. Impingement Limit Analysis

The applicant should prepare a drop trajectory and impingement analysis of:

— wings,

— horizontal and vertical stabilizers,

— engine air intakes,

— propellers,

— any means used to detect ice accretion (ice detector, visual cues) and

— all other critical surfaces upon which ice may accrete.

This analysis should consider the various aeroplane operational configurations, phases of flight, and associated angles of attack.

The impingement limit analysis should establish upper and lower aft drop impingement limits that can then be used to establish the aft ice formation limit and its relationship to the Ice Protection Systems (IPS) coverage.

Water content versus drop size relationships defined in Appendix C, Figures 1 and 4 are defined in terms of mean effective drop diameter. CS-25 does not require consideration of specific distributions for Appendix C icing conditions.

In determining the rates of catch, the full spectrum of the droplet sizes should be considered but in determining impingement areas, a maximum droplet size of 50 µm need only be considered for compliance to CS 25.1419.

4. Ice Shedding Analysis

For critical ice shedding surfaces an analysis must be performed to show that ice shed from these surfaces will not create unacceptable damages which would prevent continued safe flight and landing.

Airframe ice shedding may damage or erode engine or powerplant components as well as lifting, stabilizing, and flight control surface leading edges. Fan and compressor blades, impeller vanes, inlet screens and ducts, and propellers are examples of powerplant components subject to damage from shedding ice. For fuselage-mounted turbojet engines (and pusher propellers that are very close to the fuselage and well aft of the aeroplane's nose), ice shedding from the forward fuselage and from the wings may cause significant damage. Ice shedding from components of the aeroplane, including antennas, should not cause damage to engines and propellers that would adversely affect engine operation or cause an unacceptable loss of power or thrust (compliance with CS 25.1093(b)).

The applicant should also consider aeroplane damage that can be caused by ice shedding from the propellers.

Control surfaces such as elevators, ailerons, flaps, and spoilers, especially those constructed of thin metallic, non-metallic, or composite materials, are also subject to damage.

Currently available trajectory and impingement analysis may not adequately predict such damage. Unpredictable ice shedding paths from forward areas such as radomes and forward wings (canards) have been found to negate the results of these analysis.

For this reason, a damage analysis should consider that the most critical ice shapes will shed and impact the areas of concern.

5. Thermal Analysis and Runback Ice

An analysis shall be performed to predict the effectiveness of the thermal IPS (hot air or electrical). Design objectives (fully evaporative or running wet) shall be assessed against the relevant icing environment.

Water not evaporated by thermal ice protection systems and unfrozen water in near-freezing conditions (or in conditions when the freezing fraction is less than one) may run aft and form runback ice. This runback ice can then accumulate additional mass from direct impingement.

Runback ice should be determined and should be considered when determining critical ice shapes. Simulated runback ice shapes may be used when evaluating effects of critical ice shapes. Computer codes may be unable to estimate the characteristics of the runback