This annex to the **EASA.A.594** TCDS was created to publish selected Special Conditions (SC) and Equivalent Safety Findings (ESF) that are part of the applicable certification basis.

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Certification Review Items (CRI):

The following special conditions and equivalent level of safety are extracted from the applicable CRIs.

SPECIAL CONDITION:	**B-01 SC: Handling and Performance**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23, CS 25 Amendment 3
ADVISORY MATERIAL:	1. Flight Test Guide NPA 25B-335 2. ICAO Annex 8, Part III 3. EU OPS 1 Subpart G 4. NPA 25B, D, G, - 244 to JAR-25 5. EASA NPA 14/2004 "Operation on Contaminated Runways

BACKGROUND

This CRI is intended to set handling and performance safety standards for light jet aeroplanes by supplementing the CS 23 requirements where appropriate.

The background to each supplemental requirement and the requirement itself are given in 5 separate Special Conditions as follows:

SPECIAL CONDITION - Performance (SC-B23.0045-01)

CERTIFICATION SPECIFICATION: CS (JAR) 23.45, 51, 53, 55, 57, 59, 61, 63, 66, 67, 69, 73, 77

Discussion:

ICAO Annex 8, Part III applies to aircraft above 5730kg, and for all multi-engine aircraft demands a performance capability that guarantees engine failure accountability in all flight phases.

Aircraft 5730 kg and over: EU-OPS 1 Subpart G sets a performance standard for turbo jet powered aircraft which meets the safety intent of ICAO Annex 8. This standard differs slightly from the standard presented in CS 23 for commuter category (multi engine turboprop powered aircraft over 5730 kg). It is considered appropriate that all multi engine jet powered aircraft over 5730 kg, irrespective of intended operation, should meet the EU-OPS 1 standard. As aircraft above this weight are likely to be used for public transport operations, presenting data to this standard will also allow this without further work.

Aircraft under 5730kg: The standard presented in CS 23 for commuter category is considered appropriate. Applicants should be aware, however, that if the aircraft is to be used for public transport operations, additional data will need to be provided in the AFM to allow compliance with EU-OPS 1 Subpart G. Failure to provide this data will restrict the aircraft to private operations only.

Note that speeds referenced to Vs are given, with values referenced to Vsr given in parentheses. Speeds referenced to Vs must be used unless the applicant has elected to use Vsr as the reference stall speeds for performance determination, and in which case the values in parenthesis must be used.

Requirements (Aircraft less than 5730 kg NOT electing to provide EU-OPS1 standard data):

SC CS 23.45, Performance - General

(SC JAR 23.45, Performance - General)

Replace the first sentence of CS 23.45 (h) with the following:

> (h) For Commuter Category or Turbojet or Turbofan powered aeroplanes, the following also apply:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.51 (c) with the following:

> (c) For Commuter Category or Turbojet or Turbofan powered aeroplanes, the following apply:

Add the following to CS 23.51 (c):

> (7) VLOF is the calibrated airspeed at which the aeroplane first becomes airborne.
> (8) VFTO, in terms of calibrated airspeed, is a speed selected by the applicant to provide at least the gradient of climb required by CS 25.67(c)(2), but may not less than –
>
> > (1) 1.25Vs1 (1.18 Vsr1); and
> >
> > (2) A speed that provides adequate manoeuvring capability.

Delete all of CS 23.53 and replace with the following:

> For Commuter Category or Turbojet or Turbofan powered aeroplanes, takeoff performance as required by CS 23.55 to CS 23.59 must be determined with the operating engines within approved operating limitations.

Replace the first sentence of CS 23.55 with the following:

> For each Commuter Category or Turbojet or Turbofan powered aeroplane, the accelerate-stop distance must be determined as follows:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.57 with the following:

> For each Commuter Category or Turbojet or Turbofan powered aeroplane, the takeoff path is as follows:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.59 with the following:

> For each Commuter Category or Turbojet or Turbofan powered aeroplane, the take-off distance must be determined. The determination of the take-off run is optional.

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.61 with the following:

> For each Commuter Category or Turbojet or Turbofan powered aeroplane, the takeoff flight path must be determined as follows:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.63 (d) with the following:

> (d) For Commuter Category or Turbojet or Turbofan powered aeroplanes, compliance must be shown, at weights as a function of aerodrome altitude and ambient temperature within the operational limits established for take-off and landing respectively, with –

The remainder of the paragraph and sub-paragraphs are unchanged.

In CS 23.67 (c), CS 23.66(1) and CS 23.69(b), references to propeller positions should be ignored.

Replace the first sentence of CS 23.67 (c) with the following:

(c) For Commuter Category or Turbojet or Turbofan powered aeroplane, the following apply:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.73 (c) with the following:

(c) For Commuter Category or Turbojet or Turbofan powered aeroplanes, the reference landing approach speed, VREF, must not be less than the greater of 1·05 VMC, determined under CS 23.149 (c), and 1.3Vs1 (1.23 Vsr1).

Replace the first sentence of CS 23.77 (c) with the following:

(c) For each Commuter Category or Turbojet or Turbofan powered aeroplane, the steady gradient of climb must not be less than 3·2% with –

The remainder of the paragraph and sub-paragraphs are unchanged.

Requirements (Aircraft 5730 kg and over, and aircraft less than 5730 kg electing to provide EU-OPS1 standard data):

SC CS 23.45, Performance - General

(SC JAR 23.45, Performance - General)

Replace the first sentence of CS 23.45 (h) with the following:

(h) For Commuter Category or Turbojet or Turbofan powered aeroplanes, the following also apply:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.51 (c) with the following:

(c) For Commuter Category or Turbojet or Turbofan powered aeroplanes, the following apply:

Add the following to CS 23.51 (c):

(7) VLOF is the calibrated airspeed at which the aeroplane first becomes airborne.
(8) VFTO, in terms of calibrated airspeed, must be selected by the applicant to provide at least the gradient of climb required by CS 25.67(c)(2), but may not less than –

(1) 1.25Vs1 (1.18 Vsr1); and

(2) A speed that provides adequate manoeuvring capability.

Delete all of CS 23.53 and replace with the following:

(a) For Commuter Category or Turbojet or Turbofan powered aeroplanes, takeoff performance as required by CS 23.55 to CS 23.59 must be determined with the operating engines within approved operating limitations.

(b) Takeoff performance must be provided for both wet and dry runways.

Replace CS 23.55 with the following:

For Commuter Category or Turbojet or Turbofan powered aeroplanes, the accelerate-stop distance must be determined for both wet and dry runways and, at the option of the applicant, contaminated surfaces or grooved and porous friction course. Unless contaminated runway performance data is provided, a limitation concerning the maximum runway contamination conditions must be included.

The accelerate-stop distance on a dry runway is the greater of the following distances:

(1) The sum of the distances necessary to –

(i) Accelerate the aeroplane from a standing start with all engines operating to VEF for take-off from a dry runway;

(ii) Allow the aeroplane to accelerate from VEF to the highest speed reached during the rejected take-off, assuming the critical engine fails at VEF and the pilot takes the first action to reject the take-off at the V1 for take-off from a dry runway; and

(iii) Come to a full stop on a dry runway from the speed reached as prescribed in sub-paragraph (a)(1)(ii) of this paragraph;

(2) The sum of the distances necessary to –

(i) Accelerate the aeroplane from a standing start with all engines operating to the highest speed reached during the rejected take-off, assuming the pilot takes the first action to reject the take-off at the V1 for take-off from a dry runway; and

(ii) With all engines still operating, come to a full stop on a dry runway from the speed reached as prescribed in subparagraph (a)(2)(i) of this paragraph.

The accelerate-stop distance on surfaces other than dry surfaces is determined similarly but using speeds, frictions coefficients etc appropriate to the particular surface.

Replace the first sentence of CS 23.57 with the following:

For each Commuter Category or Turbojet or Turbofan powered aeroplane, the takeoff path is as follows:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.59 with the following:

> For each Commuter Category or Turbojet or Turbofan powered aeroplane, the take-off distance must be determined. If data to allow account to be taken of clearway is to be published, then take-off run must also be determined.

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.61 with the following:

> For each Commuter Category or Turbojet or Turbofan powered aeroplane, the takeoff flight path must be determined as follows:

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace the first sentence of CS 23.63 (d) with the following:

> (d) For Commuter Category or Turbojet or Turbofan powered aeroplanes, compliance must be shown, at weights as a function of aerodrome altitude and ambient temperature within the operational limits established for take-off and landing respectively, with –

The remainder of the paragraph and sub-paragraphs are unchanged.

In CS 23.67 (c), CS 23.66(1) and CS 23.69(b), references to propeller positions should be ignored.

Replace the first sentence of CS 23.67 (c) with the following:

> (c) For Commuter Category or Turbojet or Turbofan powered aeroplane, the following apply:

Replace CS 23.67 (c)(1)(vi) with the following:

> (vi) A climb speed equal to Vlof.

Replace CS 23.67 (c)(4)(v) with the following:

> (v) A climb speed established in connection with normal landing procedures but not exceeding 1.3Vs1 + 10 knots (1.23Vsr1 + 10 knots) where Vs1 (Vsr1) is the stall reference speed in the landing configuration.

Add to CS 23.69 the following:

> (c) For the en-route configuration, the flight paths prescribed in sub-paragraphs (d) of this paragraph must be determined at each weight, altitude, and ambient temperature, within the operating limits established for the aeroplane. The variation of weight along the flight path, accounting for the progressive consumption of fuel and oil by the operating engines, may be included in the computation. The flight paths must be determined at a selected speed not less than VFTO, with –
>
> > (1) The most unfavourable centre of gravity;

(2) The critical engine inoperative;

(3) The remaining engines at the available maximum continuous power or thrust; and

(4) The means for controlling the engine cooling air supply in the position that provides adequate cooling in the hot-day condition.

(d) The one-engine-inoperative net flight path data must represent the actual climb performance diminished by a gradient of climb of 1·1%.

Replace the first sentence of CS 23.73 (c) with the following:

(c) For Commuter Category or Turbojet or Turbofan powered aeroplanes, the reference landing approach speed, VREF, must not be less than the greater of 1·05 VMC, determined under CS 23.149 (c), and 1.3 Vs1 (1.23 Vsr1).

Replace the first sentence of CS 23.77 (c) with the following:

(c) For each Commuter Category or Turbojet or Turbofan powered aeroplane, the steady gradient of climb must not be less than 3·2% with –

The remainder of the paragraph and sub-paragraphs are unchanged.

Replace CS 23.1583 (p) with:

(p) Types of surface. A statement of the types of surface on which operation may be conducted (see CS 23.45 (g) and CS 23.1587 (a) (4), (c)(2) and (d)(4)). This should include the allowable surface conditions (dry, wet, contaminated etc.)

Add CS 23.1585 (k):

(k) *Landing Distance after System Failures:* Landing distance or factors to be applied to normal landing distances must be provided for possible landing configurations after system failures (such as jammed flaps).

SPECIAL CONDITION - Wings Level Stall (SC-B23.0201-01)

CERTIFICATION SPECIFICATION: CS (JAR) 23.201 (e)

Discussion:

To make the configurations and power settings appropriate to jet aircraft and for consistency with Part 25 aircraft, the stall configurations and trim conditions from CS25 are substituted in lieu of CS23.201(e).

Note that speeds referenced to Vs are given, with values referenced to Vsr given in parentheses. Speeds referenced to Vs must be used unless the applicant has elected to use Vsr as the reference stall speeds for performance determination, and in which case the values in parenthesis must be used.

Requirement:

SC CS 23.201, Wings Level Stall

(SC JAR 23.201, Wings Level Stall)

The aircraft must comply with the following in lieu of CS (JAR) 23.201(d):

(d) During the entry into and the recovery from the manoeuvre, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls except as provided for in paragraph (e) of this section.

The aircraft must comply with the following in lieu of CS (JAR) 23.201(e):

(e) For airplanes approved with a maximum operating altitude at or above 25,000 feet during the entry into and the recovery from stalls performed at or above 25,000 feet, it must be possible to prevent more than 25 degrees of roll or yaw by the normal use of controls.

(f) Compliance with the requirements of this section must be shown under the following conditions:

(1) The flaps, landing gear, and airborne deceleration devices in any likely combination of positions and altitudes appropriate for the various positions.

(2) Thrust-

(i) Idle; and

(ii) The thrust necessary to maintain level flight at 1.6Vs1 (1.5Vsr1) where Vs1 (Vsr1) corresponds to the stalling reference speed with flaps in the approach position, the landing gear retracted, and maximum landing weight.

(3) Trim 1.4Vs1 (1.3Vsr1) or the minimum trim speed, whichever is higher. Alternatively, trimming may also be made at 1.5Vs1 (1.4Vsr1) provided a technical justification is furnished, which, taking account of measured flight test data, shows:

- stalls are not defined by full back stick
- in each normal configuration both with and without icing (assuming normal de-icing procedures are used), characteristics are unchanged or improved by trimming at 1.5Vs1 (1.4Vsr1) for each requirement where the revised trim speed is used.

SPECIAL CONDITION - Turning Flight & Accelerated Turning Stalls (SC-B 23.0203-01)

CERTIFICATION SPECIFICATION: CS (JAR) 23.203 (c)

Discussion:

To make the configurations and power settings appropriate to jet aircraft and for consistency with Part 25 aircraft, the stall configurations and trim conditions from CS25 are substituted in lieu of CS23.201(e).

Note that speeds referenced to Vs are given, with values referenced to Vsr given in parentheses. Speeds referenced to Vs must be used unless the applicant has elected to use Vsr as the reference stall speeds for performance determination, and in which case the values in parenthesis must be used.

Requirement:

SC CS 23.203, Turning Flight and Accelerated Turning Stalls

(SC JAR 23.203, Turning Flight and Accelerated Turning Stalls)

The aircraft must comply with the following in lieu of CS (JAR) 23.203(c):

(c) Compliance with the requirements of this section must be shown under the following conditions:

(1) The flaps, landing gear, and airborne deceleration devices in any likely combination of positions and altitudes appropriate for the various positions.

(2) Thrust-

(i) Idle; and

(ii) The thrust necessary to maintain level flight at 1.6Vs1 (1.5Vsr1) where Vs1 (Vsr1) corresponds to the stalling reference speed with flaps in the approach position, the landing gear retracted, and maximum landing weight.

(3) Trim 1.4Vs1 (1.3Vsr1) or the minimum trim speed, whichever is higher. Alternatively, trimming may also be made at 1.5Vs1 (1.4Vsr1) provided a technical justification is furnished, which, taking account of measured flight test data, shows:

- stalls are not defined by full back stick
- in each normal configuration both with and without icing (assuming normal de-icing procedures are used), characteristics are unchanged or improved by trimming at 1.5Vs1 (1.4Vsr1) for each requirement where the revised trim speed is used.

SPECIAL CONDITION - Airborne Deceleration Devices (SC-B 23.0253-01)

CERTIFICATION SPECIFICATION: CS (JAR) 23.253

Discussion:

CS 23 does not cover airborne deceleration devices such as speed brakes. The CS 25 provisions to prevent large nose down pitching moment on deployment of these is added.

Requirement:

SC CS 23.253, High Speed Characteristics

(SC JAR 23.253, High Speed Characteristics)

In addition to existing CS (JAR) 23.253 the aeroplane must comply with the following:

(d) The following speed increase and recovery characteristics must be met during airborne deceleration device extension:

With the aeroplane trimmed at V_{MO} / M_{MO}, extension of the deceleration device throughout the available range of movements of the pilots control, at all speeds above v_{MO} / M_{MO}, but not so high that VDF/MDF would be exceeded during the manoeuvre, must not result in:

(i) An excessive positive load factor when the pilot does not take action to counteract the effects of extension;

(ii) Buffeting that would impair the pilot's ability to read the instruments or control the aeroplane for recovery; or

(iii) A nose-down pitching moment, unless it is small.

SPECIAL CONDITION - Landing Distance Factors (SC-B 23.1587-01)

CERTIFICATION SPECIFICATION: CS (JAR) 23.1587

Discussion:

Landing Distance Factors – Dry (CS[JAR]23.75 & 1587)

Small jet aeroplanes characteristically exhibit low aerodynamic drag characteristics. Typically, they also have higher residual thrust at idle, and slower engine response times. These factors are likely to result in longer and less predictable landing distances than those achieved by propeller driven aircraft in the same weight band. Commercial operations are safeguarded in this respect by the application of landing distance factors which themselves recognise the differences between jet and propeller aeroplanes. To allow all pilots to use data with an adequate safety margin included, whether they are operating commercially or not, it is considered that landing distances on a dry runway with the EU-OPS 1 factor of 1.67 applied should be available in the AFM for all aircraft.

Landing Distance Factors – Wet (CS[JAR]23.75 & 1587)

For the same reason, the effect of wet runways on landing distance should be also included in the AFM data. Although EU-Ops 1 specifies an additional 15% factor for wet runway landing distances, it should be recognised that this is only adequate if used in conjunction with the baseline dry factor of 1·67, giving a total factor of 1·92 for wet runways.

Requirements:

SC CS 23.1587, Performance Information

(SC JAR 23.1587, Performance Information)

Replace CS 23.1587 (a)(3),(4) and (5) with the following:

(3) The landing distance in dry conditions, determined under CS 23.75 for each aerodrome altitude and standard temperature and the type of surface for which it is valid. It must be possible to directly read gross data factored by 1.67, and for use on wet runways, it must also be possible to directly read gross data factored by 1.92;
(4) The effect on landing distance of operation on other than smooth hard surfaces for which clearance is sought, determined under CS 23.45 (g); and
(5) The effect on landing distance of runway slope and 50% of the headwind component and 150% of the tailwind component.

- END –

SPECIAL CONDITION:	**B-02 SC: High Speed Characteristics**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS (JAR) 23.177, 181, 251, 253, 255, 1505
ADVISORY MATERIAL:	Flight Test Guide NPA 25B-335

BACKGROUND

JAR / CS 23 was written assuming aircraft would not reach speeds, altitudes or Mach numbers where the effects of compressibility would become significant. Potentially hazardous characteristics such as Mach 'tuck' are therefore not considered. This CRI sets a safety standard in this regime by specifying criteria taken from CS 25.

The Static Directional and Lateral Stability requirement is as stated in CS23 except the words 'the maximum allowable speed for the condition being investigated' are replaced by specific speeds. Other paragraphs are based requirements in CS 25.

SPECIAL CONDITION (SC-B 23.0253-01, Issue 4)

23.177 Static Directional and Lateral Stability

Replace CS 23. 177 with the following:

(a) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, may not be negative for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from 1.2 VS1 up to VFE, VLE, or VFC/MFC (as appropriate). The angle of sideslip for these tests must be appropriate to the type of aeroplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in CS 23.143 is reached, whichever occurs first, and at speeds from 1.2 VS1 to VO (as defined in CS23.1507), the rudder pedal force must not reverse.

(b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip with the aileron controls free, may not be negative for any landing gear and flap position. This must be shown with symmetrical power up to 75 percent of maximum continuous power at speeds above 1.2 VS1 in the takeoff configuration(s) and at speeds above 1.3 VS1 in other configurations, up to VFE, VLE, or VFC/MFC (as appropriate) for the configuration being investigated, in the takeoff, climb, cruise, and approach configurations. For the landing configuration, the power must be that necessary to maintain a 3 degree angle of descent in coordinated flight. The static lateral stability must not be negative at 1.2 VS1 in the takeoff configuration, or at 1.3 VS1 in other configurations. The angle of sideslip for these tests must be appropriate to the type of aeroplane, but in no case may the constant heading sideslip angle be less than that obtainable with a 10 degree bank, or if less, the maximum bank angle obtainable with full rudder deflection or a control force limit in CS 23.143 is reached.

(c) (reserved)

(d) In straight, steady slips at 1.2 VS1 for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the type of aeroplane. At larger slip angles, up to the angle at which the full rudder or aileron control is used or a control force limit contained in CS 23.143 is reached, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the aeroplane must not result in uncontrollable flight characteristics.

23.181 Dynamic Stability

Replace CS 23. 181 (b) with the following:

(b) Any combined lateral–directional oscillations ("Dutch roll") occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the aeroplane with the primary controls in both free and fixed position (except when compliance with CS 23.672 is shown) must be damped in:

(1) Seven (7) cycles below 18,000 feet and

(2) Thirteen (13) cycles from 18,000 feet to the certified maximum altitude.

23.251 Vibration and buffeting

Replace CS 23. 251 with the following:

(a) The aeroplane must be demonstrated in flight to be free from any vibration and buffeting that would prevent continued safe flight in any likely operating condition.

(b) Each part of the aeroplane must be demonstrated in flight to be free from excessive vibration under any appropriate speed and power conditions up to VDF/MDF. The maximum speeds shown must be used in establishing the operating limitations of the aeroplane in accordance with 23.1505 in this CRI.

(c) Except as provided in sub-paragraph (d) of this paragraph, there may be no buffeting condition, in normal flight, including configuration changes during cruise, severe enough to interfere with the control of the aeroplane, to cause excessive fatigue to the crew, or to cause structural damage. Stall warning buffeting within these limits is allowable.

(d) There may be no perceptible buffeting condition in the cruise configuration in straight flight at any speed up to VMO/MMO, except that the stall warning buffeting is allowable.

(e) For an aeroplane whose Mmo is greater than 0.6 and with a maximum operating altitude greater than 7620 m (25,000 ft), the positive manoeuvring load factors at which the onset of perceptible buffeting occurs must be determined with the aeroplane in the cruise configuration for the ranges of airspeed or Mach number, weight, and altitude for which the aeroplane is to be certificated. The envelopes of load factor, speed, altitude, and weight must provide a sufficient range of speeds and load factors for normal operations. Probable inadvertent excursions beyond the boundaries of the buffet onset envelopes may not result in unsafe conditions.

23.253 High-speed characteristics

Replace CS 23. 253 with the following:

(a) Speed increase and recovery characteristics. The following speed increase and recovery characteristics must be met:

(1) Operating conditions and characteristics likely to cause inadvertent speed increases (including upsets in pitch and roll) must be simulated with the aeroplane trimmed at any likely cruise speed up to VMO/MMO. These conditions and characteristics include gust upsets, inadvertent control movements, low stick force gradient in relation to control friction, passenger movement, levelling off from climb, and descent from Mach to air speed limit altitudes.

(2) Allowing for pilot reaction time after effective inherent or artificial speed warning occurs, it must be shown that the aeroplane can be recovered to a normal attitude and its speed reduced to VMO/MMO, without –

(i) Exceptional piloting strength or skill;

(ii) Exceeding a speed VDF/MDF that is less than or equal to the lower of:

(a) VD/MD, or

(b) The maximum speed shown under 23.251

(iii) Exceeding the structural limitations; and

(iv) Buffeting that would impair the pilot's ability to read the instruments or control the aeroplane for recovery.

(3) With the aeroplane trimmed at any speed up to VFC/MFC, there must be no reversal of the response to control input about any axis at any speed up to VDF/MDF. Any tendency to pitch, roll, or yaw must be mild and readily controllable, using normal piloting techniques. When the aeroplane is trimmed at VFC/MFC, the slope of the elevator control force versus speed curve need not be stable at speeds greater than VFC/MFC, but there must be a push force at all speeds up to VDF/MDF and there must be no sudden or excessive reduction of elevator control force as VDF/MDF is reached.

(4) Adequate roll capability to assure a prompt recovery from a lateral upset condition must be available at any speed up to VDF/MDF.

(5) Extension of deceleration devices (such as speedbrakes). [see Handling and Performance Special Condition]

(6) Reserved

(b) Maximum speed for stability characteristics, VFC/MFC. VFC/MFC is the maximum speed at which the requirements of 23.175(b)(2), 23.177(a) through (c) in this CRI, and 23.181 must be met with wing-flaps and landing gear retracted. Except as noted in 23.253(c) of this CRI, VFC/MFC may not be less than a speed midway between VMO/MMO and VDF/MDF, except that, for altitudes where Mach Number is the limiting factor, MFC need not exceed the Mach Number at which effective speed warning occurs.

23.255 Out-of-trim characteristics

Add the following:

(a) From an initial condition with the aeroplane trimmed at cruise speeds up to VMO/MMO, the aeroplane must have satisfactory manoeuvring stability and controllability with the degree of out-of-trim in both the aeroplane nose-up and nose-down directions, which results from the greater of –

(1) A three-second movement of the longitudinal trim system at its normal rate for the particular flight condition with no aerodynamic load (or an equivalent degree of trim for aeroplanes that do not have a power-operated trim system), except as limited by stops in the trim system, including those required by CS23.655 (b) for adjustable stabilisers; or

(2) The maximum mistrim that can be sustained by the autopilot while maintaining level flight in the high speed cruising condition.

(b) In the out-of-trim condition specified in sub-paragraph (a) of this paragraph, when the normal acceleration is varied from + 1 g to the positive and negative values specified in sub-paragraph (c) of this paragraph –

(1) The stick force vs. g curve must have a positive slope at any speed up to and including VFC/MFC; and

(2) At speeds between VFC/MFC and VDF/MDF, the direction of the primary longitudinal control force may not reverse.

(c) Except as provided in sub-paragraphs (d) and (e) of this paragraph compliance with the provisions of sub-paragraph (a) of this paragraph must be demonstrated in flight over the acceleration range –

(1) –1g to 2·5 g; or

(2) 0 g to 2·0 g, and extrapolating by an acceptable method to – 1 g and 2·5 g.

(d) If the procedure set forth in sub-paragraph (c)(2) of this paragraph is used to demonstrate compliance and marginal conditions exist during flight test with regard to reversal of primary longitudinal control force, flight tests must be accomplished from the normal acceleration at which a marginal condition is found to exist to the applicable limit specified in sub-paragraph (c)(1) of this paragraph.

(e) During flight tests required by subparagraph (a) of this paragraph the limit manoeuvring load factors, and the manoeuvring load factors associated with probable inadvertent excursions beyond the boundaries of the buffet onset envelopes, need not be exceeded. In addition, the entry speeds for flight test demonstrations at normal acceleration values less than 1g must be limited to the extent necessary to accomplish a recovery without exceeding VDF/MDF.

(f) In the out-of-trim condition specified in sub-paragraph (a) of this paragraph, it must be possible from an overspeed condition at VDF/MDF, to produce at least 1·5 g for recovery by applying not more than 556 N (125 lbf) of longitudinal control force using either the primary longitudinal control alone or the primary longitudinal control and the longitudinal trim system. If the longitudinal trim is used to assist in producing the required load factor, it must be shown at VDF/MDF that the longitudinal trim can be actuated in the aeroplane nose-up direction with the primary surface loaded to correspond to the least of the following aeroplane nose-up control forces:

(1) The maximum control forces expected in service as specified in CS 23.301 and 23.397 (or their equivalent).

(2) The control force required to produce 1·5 g.

(3) The control force corresponding to buffeting or other phenomena of such intensity that it is a strong deterrent to further application of primary longitudinal control force.

23.1505 Maximum operating limit speed

Add the following:

The maximum operating limit speed (VMO/MMO, airspeed or Mach number, whichever is critical at a particular altitude) is a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent), unless a higher speed is authorised for flight test or pilot training operations. VMO/MMO must be established so that it is not greater than the design cruising speed VC and so that it is sufficiently below VD/MD or VDF/MDF, to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between VMO/MMO and VD/MD or VDF/MDF may not be less than that determined under CS 23.335(b) (or its equivalent) or found necessary during the flight tests conducted under 23.253 of this CRI.

- END –

SPECIAL CONDITION:	**B-03 SC: Stall Speed Determination**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.49 Stall Speed, CS-23.143 Handling
ADVISORY MATERIAL:	Flight Test Guide NPA 25B-335

BACKGROUND

JAR 23 / CS 23 was developed assuming that all aircraft in the category would be propeller driven. Now that jet propelled aircraft have been designed which are light enough to fall into this category, the requirements need to be amended to take account of the different inherent characteristics. Most jet aeroplanes are designed to be operated at high altitude and high speeds, and there are other differences such as the thrust/drag during stopping on the runway. This CRI is intended to address stall speed definitions, low speed controllability and manoeuvrability and supplements the Handling and Performance CRI.

SPECIAL CONDITION - Stall Speed (SC-B 23.0049-01)

SC 23.0049 Stall Speed to CS 23.49 Stall Speed :

Delete CS 23.49 and replace with the following :-

CS.23.49 Stall Speed :

(a) VS0 and VS1 are the stalling speeds or the minimum steady flight speed (CAS) at which the aeroplane is controllable with –

(1) (Deleted)

(2) For turbine engine-powered aeroplanes, the propulsive thrust may not be greater than zero at the stalling speed, or, if the resultant thrust has no appreciable effect on the stalling speed, with engine(s) idling and throttle(s) closed;

(3) (Deleted)

(4) The aeroplane in the condition existing in the test in which VS0 and VS1 are being used;

(5) Centre of gravity in the position which results in the highest value of VS0 and VS1; and

(6) Weight used when VS0 or VS1 are being used as a factor to determine compliance with a required performance standard.

(b) VS0 and VS1 must be determined by flight tests using the procedure and meeting the flight characteristics specified in CS 23.201.

(c) VS0 at maximum weight must not exceed 113 km/h (61 knots) for –

(1) (Deleted)

(2) Twin-engined aeroplanes of 2 722 kg (6 000 lb) or less maximum weight that cannot meet the minimum rate of climb specified in CS 23.67 (a) (1) with the critical engine inoperative.

(d) For aircraft whose maximum takeoff weight is 5730 kg or above, at the option of the applicant, the following apply in lieu of paragraphs (a) (b) and (c).

(1) VS0 and Vs1 are the stalling speeds in the maximum lift configuration and the configuration under consideration respectively as defined in CS23.201 (b).

(2) The reference stall speed Vsr0 and Vsr1 are calibrated airspeeds defined by the applicant. Vsr may not be less than a 1-g stall speed. Vsr is expressed as:

$$Vsr \geq \frac{V_{CLMAX}}{\sqrt{n_{zw}}}$$

where -

VCLMAX = The calibrated airspeed obtained when the loadfactor-corrected lift coefficient (nzw W)/(qS) is first a maximum during the manoeuvre described in sub-paragraph (4) of this paragraph. In addition, if the stalling manoeuvre is limited by a device that commands an abrupt nose down pitch (e.g. a stick pusher), VCLMAX may not be less than the speed at the instant the device operates; and

Nzw = load factor normal to the flight path at V_{CLMAX};

W = Aeroplane gross weight

S = Aerodynamic reference wing area; and

q = Dynamic pressure

(3) VCLMAX is determined with:

(i) Engines idling, or, if that resultant thrust causes an appreciable decrease in stall speed, not more than zero thrust at the stall speed;

(ii) (not applicable);

(iii) The aeroplane in other respects (such as flaps and landing gear) in the condition existing in the test or performance standard in which Vsr is being used;

(iv) The weight used when Vsr is being used as a factor to determine compliance with a required performance standard;

(v) The centre of gravity position that results in the highest value of reference stall speed; and

(vi) The aeroplane trimmed for straight flight at a speed selected by the applicant, but not less than 1.13 Vsr and not greater than 1.3 Vsr.

Alternatively, trimming may also be made at up to 1.4Vsr provided a technical justification is furnished, which, taking account of measured flight test data, shows:

- stalls are not defined by full back stick
- in each normal configuration both with and without icing (assuming normal de-icing procedures are used), the characteristics had the aircraft been trimmed at 1.3 Vsr would be unchanged or improved relative to those experienced by trimming at 1.4Vsr for each requirement where the revised higher trim speed is used.

(4) Starting from the stabilised trim condition, apply longitudinal control to decelerate the aeroplane so that the speed reduction does not exceed one knot per second. (See clarification below).

(5) In addition to the requirements of sub-paragraph (2) of this paragraph, when a device that abruptly pushes the nose down at a selected angle of attack (e.g. a stick pusher) is installed, the reference stall speed, Vsr, may not be less than 2 kt or 2%, whichever is the greater, above the speed at which the device operates

(6) Apply the following changes in lieu of the original text in CS23 and in Special Conditions modifying that text (other than this Special Condition):-

Special condition	**Original text**	**Change to**
SC23.51 Take-off speeds		
SC23.51(c)(2)(iii)	1.1Vs1	1.08Vsr
SC23.51(c)(4)	1.2Vs1	1.13Vsr
SC23.67 Climb: one-engine-inoperative		
SC23.67(c)(3)(v)	1.2Vs1	1.13Vsr1
SC23.67(c)(4)(iv)	Vs1	Vsr1
SC23.67(c)(4)(v)	1.5Vs1	1.4Vsr1
SC23.69 En-route climb/descent		
SC23.69(a)(4)	1.3Vs1	1.23Vsr1
SC23.69(b)(5)	1.2Vs1	1.13Vsr1
SC23.73 Reference landing approach speed		
SC23.73(c)	1.3Vs0	1.23Vsr1
SC23.145 Longitudinal control		
SC23.145(a)	1.3Vs1	1.23Vsr1
SC23.145(b)(1)	1.4Vs1 1.4Vs0	1.3Vsr1 1.3Vsr0
SC23.145(b)(2)	1.3Vs0 1.3Vs1	1.23Vsr0 1.23Vsr1
SC23.145(b)(3)	1.1Vs0 1.1Vs1	1.08Vsr0 1.08Vsr1
SC23.145(b)(4)	1.4Vs1	1.3Vsr1

SC23.145(b)(5)	1.1Vs0 1.7Vs0	1.08Vsr0 1.6Vsr0
SC23.147 Directional and lateral control		
SC23.147(a)	1.4Vs1	1.3Vsr1
SC23.149 Minimum control speed		
SC23.149(b)	1.2Vs1 Vs1	1.13Vsr1 Vsr1
SC23.157 Rate of roll		
23.157(b)(4)	1.2Vs1	1.13Vsr1
SC23.161 Trim		
SC23.161(b)(2)	1.4Vs1	1.3Vsr1
SC23.161(c)(2)	1.4Vs1	1.3Vsr1
SC23.161(c)(4)(i)	1.4Vs1	1.3Vsr1
SC23.175 Demonstration of static longitudinal stability		
SC23.175(b)(2)(i)	1.4Vs1	1.3Vsr1
SC23.175(c)	1.1Vs1 1.8Vs1	1.08Vsr1 1.7Vsr1
SC23.177 Static directional and lateral stability		
SC23.177(a)	1.2Vs1	1.13Vsr1
SC23.177(b)	1.2Vs1 1.3Vs1	1.13Vsr1 1.23Vsr1
SC23.177(d)	1.2Vs1	1.13Vsr1
SC23.201 Wings level stall		
SC23.201(f)(2)(ii)	1.6Vs1 Vs1	1.5Vsr1 Vsr1
SC23.201(f)(3)	1.4Vs1	1.3Vsr1
SC23.203 Turning flight and accelerated turning flight stalls		
SC23.203(c)(2)(ii)	1.6Vs1 Vs1	1.5Vsr1 Vsr1
SC23.203(c)(3)	1.4Vs1	1.3Vsr1
SC23.233 Directional stability and control		
SC23.233(a)	0.2Vs0	0.2Vsr0

(Note at SC23.73(c), the minimum speed is referenced to Vsr1 to allow for multiple landing flap settings)

SPECIAL CONDITION - Manoeuvre Margin (SC-B 23.143-01)

CS 23.143 (Controllability and Manoeuvrability) General

Add a new sub-paragraph CS 23.143(g) to read :-

(g) The manoeuvring capabilities in a constant speed coordinated turn at forward centre of gravity, as specified in the table below, must be free of stall warning or other characteristics that might interfere with normal manoeuvring.

CONFIGURATION	SPEED	MANOEUVRING BANK ANGLE IN A COORDINATED TURN	THRUST/POWER SETTING
TAKE-OFF	V_2	30°	ASYMMETRIC WAT-LIMITED (1)
TAKE-OFF	V_2 + xx(2)	40°	ALL ENGINES OPERATING CLIMB (3)
EN-ROUTE	V_{FTO}	40°	ASYMMETRIC WAT-LIMITED (1)
LANDING	V_{REF}	40°	SYMMETRIC FOR -3° FLIGHT PATH ANGLE

(1) A combination of weight, altitude and temperature (WAT) such that the thrust or power setting produces the minimum climb gradient specified in CS 23.67 for the flight condition.

(2) Airspeed approved for all-engines initial climb.

(3) That thrust or power setting which, in the event of failure of the critical engine and without any crew action to adjust the thrust or power of the remaining engines, would result in the thrust or power specified for the take-off condition at V2, or any lesser thrust or power setting that is used for all-engines-operating initial climb procedures.

SPECIAL CONDITION - Stall Warning (SC-B 23.207-01)

CS 23.207 (Stalls) Stall Warning

Delete CS 23.207(c) and replace with the following :-

23.207 (c)

When the speed is reduced at rates not exceeding 0.5 m/s2 (one knot per second), stall warning must begin, in each normal configuration, at a speed, VSW, exceeding the speed at which the stall is identified in accordance with CS 23.201 by not less than 9.3 km/h (five knots) or five percent CAS, whichever is greater. Once initiated, stall warning must continue until the angle of attack is reduced to approximately that at which stall warning began. In addition, VSW must exceed the reference stall speed in each configuration by not less than three knots or three percent CAS, whichever is greater.

- END –

SPECIAL CONDITION:	**B-04 SC: Contaminated Runways**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.1587 Performance information
ADVISORY MATERIAL:	

BACKGROUND

A requirement relating to performance on contaminated runways is given at CS23.1587. Since its introduction, further work has been conducted on large aircraft which has led to improved methodology in the CS 25 requirements.

This CRI is intended to take advantage of the methodology applies to CS25 aircraft, to address airworthiness requirements for approval of operations on contaminated runways for CS23 aircraft.

Note that this Special Condition does not require the applicant to provide the data but, if it is not provided, operation on contaminated runways will be prohibited.

SPECIAL CONDITION (SC-B23.1587-01)

Performance Information for Operations with Contaminated Runway Surface Conditions

(a) Supplementary performance information applicable to aeroplanes operated on runways contaminated with standing water, slush, snow or ice may be furnished at the discretion of the applicant.

If supplied, this information must include the expected performance of the aeroplane during take-off and landing on hard-surfaced runways covered by these contaminants.

If information on any one or more of the above contaminated surfaces is not supplied, the AFM must contain a statement prohibiting operation(s) on the contaminated surface(s) for which information is not supplied.

Additional information covering operation on contaminated surfaces other than the above may be provided at the discretion of the applicant.

(b) Performance information furnished by the applicant must be contained in the AFM. The information may be used to assist operators in producing operational data and instructions for use by their flight crews when operating with contaminated runway surface conditions. The information may be established by calculation or by testing.

(c) The AFM must clearly indicate the conditions and the extent of applicability for each contaminant used in establishing the contaminated runway performance information. It must also state that actual conditions that are different from those used for establishing the contaminated runway performance information may lead to different performance.

- END –

SPECIAL CONDITION:	**B-05 SC: Stick Pusher**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.201, 23.203, 23.1309
ADVISORY MATERIAL:	Flight Test Guide NPA 25B-335

BACKGROUND

CS 23 was developed assuming that aerodynamics or control limits would determine the stall speed. Pilatus have proposed a design which incorporates a system to cause the aircraft to pitch nose down when it reaches a given angle of attack (a stick pusher).

Depending on flight test results, the angle of attack at which it activates may be higher than the natural stall (to prevent entry into a deep stall), or may be lower such that it will also serve to define stall speeds.

In either case, it is important that the reliability of the system is such that it does not interfere with normal flight and will not unduly hazard the aircraft should it activate inadvertently. It should also activate with a reliability commensurate with its intended use when necessary.

This CRI defines characteristics which the system must meet in either role.

SPECIAL CONDITION

Special Condition

Artificial Stall Barrier

If the function of an artificial stall barrier, for example, stick pusher, is used to show compliance with CS 23.201 and 23.203 (or the equivalent CRI requirements), the system must comply with the following:

(a) With the system adjusted for operation, the plus and minus airspeeds at which downward pitching control will be provided must be established.

(b) Considering the plus and minus airspeed tolerances established by paragraph (a) of this section, an airspeed must be selected for the activation of the downward pitching control that provides a safe margin above any airspeed at which any unsatisfactory stall characteristics occur.

(c) In addition to the stall warning required by CS 23.207, a warning that is clearly distinguishable to the pilot under all expected flight conditions without requiring the pilot's attention, must be provided for faults that would prevent the system from providing the required pitching motion.

(d) Each system must be designed so that the artificial stall barrier can be quickly and positively disengaged by the pilots to prevent unwanted downward pitching of the airplane by a quick release (emergency) control. In order that the system is not inadvertently disengaged, the way in which it is disengaged should not be the same as that used to disconnect other normal systems, and should be capable of removing any input which has already been applied (whether as a result of failures or normal operation of the system).

(e) An AFM limitation must prohibit flight unless the artificial stall barrier and associated equipment necessary for it to function correctly has been checked and shown to be functioning correctly prior to take-off. Unless the functioning check is automatic and any failure annunciated, any necessary pilot procedure to verify the system functioning must be included in the normal procedures applicable before each flight.

(f) For those airplanes whose design includes an autopilot system:

(1) [reserved]

(2) The pitch servo for that system may be used to provide the stall downward pitching motion.

(g) In showing compliance with CS 23.1309, the system must be evaluated to determine the effect that any announced or unannounced failure may have on the continued safe flight and landing of the airplane or the ability of the crew to cope with any adverse conditions that may result from such failures. This evaluation must consider the hazards that would result from the airplane's flight characteristics if the system was not provided, and the hazard that may result from unwanted downward pitching motion, which could result from a failure at airspeeds above the selected stall speed. The following time delays after pilot recognition are considered appropriate:

(1) Takeoff, approach and landing – 1 second

(2) Climb, cruise, descent – 3 seconds

(h) The system for operating the device should be automatically armed, and remain armed, in each configuration in which operation of the system is necessary to show compliance with the requirements

(i) Normal operation of the artificial stall barrier should not result in the total normal acceleration of the aeroplane becoming negative, nor in the design limit load in any part of the aeroplane structure being exceeded.

If the function of an artificial stall barrier is fitted but is not used to show compliance with any requirements such as CS23.201 through 23.2017, then the aeroplane and the system for operating the device must comply with the provisions (d) and (i) of this Special Condition.

- END –

SPECIAL CONDITION:	**B-152 SC: Human Factors**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1301, 1309, 1311, 1321, 1322, 1367, 1381, 1523, 1555.
ADVISORY MATERIAL:	FAA AC 23-23, AC 23-26, AC 23.1311-1C, GAMA 10, GAMA 12.

BACKGROUND

Integrated Avionics Systems, complex systems or novel technologies introduce concepts which alter the piloting task and, due to increased automation, alter the monitoring functions of the pilot. Whilst the system may offer safety enhancements through improved situational awareness, it may also have a potential for confusions through the complexity and/or the quantity of the functions and may have an increased potential for human errors.

Consequently, if commonly-held beliefs or conditioned practices (learned procedures) are changed significantly by the introduction of a new technology or concept, then it is clear that a significant amount of demonstration regarding the Human Factors aspects is required. This may simply be done by experience and expert judgment of appropriately qualified staff, but substantial and especially structured and methodic investigations are required for safety-relevant aspects.

For consistency, the requirement applied to European products is included in its entirety in the Special Condition referenced in this CRI. It is recognized that a methodology adopted during the design of an aeroplane may have been significantly different, and therefore, it might be necessary to have confirmation that the actual methods used will have resulted in at least the same level of safety as that applied to European products.

SPECIAL CONDITION (SC-B 23.div-01, Issue 1.2)

a) The design of the integrated flight deck interface in particular and other systems as required, must adequately address the foreseeable performance, capability and limitations of the crew.

b) More specifically, the team must be satisfied with the following aspects of the flight deck interface design:

i. Ease of operation with good intuitivism and with very low level of distraction;

ii. Predictable automation with adequate awareness. Pilot authority over the automation shall be demonstrated;

iii. Effects of pilot errors in managing the aircraft systems, including the potential for error, the possible severity of the consequences, and the provision for recognition and recovery from error;

iv. Workload during normal, abnormal and emergency operation, ensuring that all essential tasks are completed in a timely manner;

v. Adequacy of feedback, including clear and unambiguous:

- presentation of information;
- representation of system condition by display of system status;
- indication of failure cases, including aircraft status;
- indication when pilot input is not accepted or followed by the system;
- indication of prolonged or severe compensatory action by a system when such action could adversely affect aircraft safety.
- indication of reversionary modes and back-up status
- absolute minimum of nuisances alerts or information.

vi. Unambiguous Situational Awareness and clearly identifiable from Primary Flight guidance’s.

- END –

SPECIAL CONDITION:	**C-01 SC: Sonic Fatigue**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.571, 23.573
ADVISORY MATERIAL:	--

BACKGROUND

Acoustic loading from sources such as jet-engine exhaust can induce high frequency random response in airframe structure. Experience has shown that these responses can lead to high-cycle sonic fatigue failure of the affected structural components and therefore this issue needs to be addressed.

Compliance can be shown by analysis, supported by test evidence, or by the service history of aircraft of similar structural design and sonic excitation environment. Established analytical means of compliance to address sonic fatigue are available for conventional designs. If new methods of construction, new materials and/or novel engine lay-outs are introduced the applicability of these methods should be carefully considered.

SPECIAL CONDITION – Sonic Fatigue (SC-C23.0571-01)

It must be shown by analysis, supported by test evidence, or by the service history of aeroplanes of similar structural design and sonic excitation environment, that:

(1) Sonic fatigue cracks are not probable in any part of the flight structure subject to sonic excitation; or:
(2) Catastrophic failure caused by sonic cracks is not probable assuming that the loads prescribed in CS 23.573 are applied to all areas affected by those cracks.

- END –

SPECIAL CONDITION:	**C-02 SC: Pressurisation into Non-Pressurized Areas**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.365
ADVISORY MATERIAL:	--

BACKGROUND

CS 23.365(e) requires that if a pressurised cabin has two or more compartments, separated by bulkheads or a floor, the primary structure must be designed for the effect of sudden release of pressure in any compartment with external doors or windows.

Adverse service experience has shown that decompressions that do not cause a failure of these parts can cause structural failure of other parts. Parts which are not normally subject to pressure loads may become pressure loaded after failure of the other parts. Catastrophic failure of the aircraft must be prevented under these circumstances.

SPECIAL CONDITION - Pressurisation into Non-Pressurised Areas (SC-C23.0365-01)

In addition to the specific requirement of CS 23.365(e), all primary structure, components or parts, both internal and external to the pressurised compartments, must be designed to withstand the differential pressure loads resulting from a sudden release of pressure at any approved operating altitude.

In complying with this requirement, the differential pressure must be combined in a rational and conservative manner with the 1-g level flight loads and any loads arising from the emergency depressurisation conditions. These may be considered as ultimate conditions; however any deformations associated with these conditions must not interfere with continued safe flight and landing.

- END –

SPECIAL CONDITION:	**C-05 SC: Dynamic Response**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.301
ADVISORY MATERIAL:	--

BACKGROUND

There are certain design features (including but not limited to high design speeds, swept wings and stabilisers, large amounts of fuel in wing tanks or tip tanks, wing mounted engines) that make consideration of the dynamic response of the aircraft necessary. The most likely load conditions to be affected are considered to be the gust and landing conditions.

SPECIAL CONDITION – Dynamic Response (SC-C23.0301-01)

The structural flexibility of the aircraft has to be investigated and where it is such that any rate of load application likely to occur in the gust and landing conditions might produce transient stresses appreciably higher than those corresponding to static loads, the effects of this rate of application must be considered.

- END –

SPECIAL CONDITION:	**C-06 SC: Out of Trim Conditions (Structures)**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.333(b), CS 23.423
ADVISORY MATERIAL:	--

BACKGROUND

For aircraft equipped with a movable horizontal stabilizer, miss-trimmed positions should be considered for structural static (steady) load cases according to CS 23.333(b). In addition, unless it can be shown that the probability of the autopilot allowing an extreme out of trim condition to develop in normal operation is extremely improbable the checked and unchecked manoeuvre load cases should also be performed according to CS 23.423 considering the extreme trim positions. In any case, ranges of trim used in normal operation should be addressed.

SPECIAL CONDITION - Out-of-Trim Conditions (SC-C23.0333-01)

The out-of trim characteristics specified in CRI B-02 must be considered in showing compliance with the manoeuvring conditions specified in CS 23.333 (b) (Manoeuvring Envelope) and CS 23.423 (Manoeuvring Loads).

- END –

SPECIAL CONDITION:	**C-07 SC: Round-the-clock Gust**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS (JAR) 23.427
ADVISORY MATERIAL:	--

BACKGROUND

An empennage that has a T-tail arrangement is a design feature that is more susceptible to the combined action of vertical and lateral gust and which may lead to new design conditions. This is currently not addressed in CS-23. In combination with the (speed, altitude) characteristics of the high performance / high altitude aircraft this so-called "round-the-clock" gust conditions needs to be further investigated.

SPECIAL CONDITION - Round-the-Clock Gust (SC-C23.0427-01)

The T-tail empennage and the supporting structure shall be designed to the loading conditions as specified in CS 23.333(c), CS 23.341, CS 23.425 and CS 23.443 with the gust velocities acting in any orientation at right angles to the flight path.

- END –

SPECIAL CONDITION:	**D-01 SC: Take-Off Warning System**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.703
ADVISORY MATERIAL:	--

BACKGROUND

Considering the significant impact of an incorrect configuration on the take-off distances and aeroplane behaviour, a take-off warning system should be included in each high performance aeroplane design unless it can be shown that the aircraft can safely take off with the monitored items in any position.

Based on the aircraft FHA other systems such as speed brakes, wing spoilers, high lift devices or a parking brake may also need to be considered in the take-off warning system.

SPECIAL CONDITION - Take-off warning system (SC 23.703)

For high performance aeroplanes, unless it can be shown on base of a FHA and / or tests that any critical device necessary to be set to a specific position / function for take-off, that affects the take-off performance and behaviour of the aircraft would not give an unsafe take-off configuration when selected out of an approved take-off position, a take-off warning system must be installed and must meet the following requirements:

The system must provide to the pilots an aural warning that is automatically activated during the initial portion of the take-off roll if the aeroplane is in a configuration that would not allow a safe take-off. The warning must continue until –

(1) The configuration is changed to allow safe take-off, or

(2) Action is taken by the pilot to abandon the take-off roll.

(b) The means used to activate the system must function properly for all authorised take-off power settings and procedures and throughout the ranges of take-off weights, altitudes and temperatures for which certification are requested.

(c) For the purpose of this section, an unsafe takeoff configuration is the inability to rotate or the inability to prevent an immediate stall after rotation.

- END –

SPECIAL CONDITION:	**D-02 SC: Extension and Retraction Systems**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.729
ADVISORY MATERIAL:	--

BACKGROUND

Emphasis is placed on the necessity to assess the need for a gear uplock in view of the assessed hazard of the gears and or doors extending unintentionally in flight. (SC SC-D23.0729-01 CS 23.729 (b))

The need for an indication of door position is addressed should the landing gear doors move separately to the gears. (SC SC-D23.0729-01 CS 23.729 (e)).

SPECIAL CONDITION - Extension and Retraction Systems (SC 23.729)

For CS 23.729, the following applies:

Subparagraphs (a), (c), (d), (f) and (g) remain unchanged.

Add to the existing CS 23.729 (b): "There must be positive means to keep the landing gear and doors in the correct retracted position in flight, unless it can be shown that lowering of the landing gear or doors, or flight with the landing gear or doors extended, at any speed, is not hazardous."

Extend existing CS 23.729 (e) with: "If the doors are not attached to the Landing Gear an independent warning must be provided."

For CS 23.729 (g), in addition refer to CRI D-51 (Wheel and Tyre Failure).

- END –

SPECIAL CONDITION:	**D-03 SC: Wheels**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.731
ADVISORY MATERIAL:	--

BACKGROUND

Due to the higher take-off and landing speed the resulting higher centrifugal forces (proportional to the square of the ground speed) may significantly increase the loads and duty cycle of the wheels. To cover this higher risk it became necessary to request wheels to be approved for such types of aeroplanes. This is considered to be standard practice, and should not be an additional burden on the applicant.

SPECIAL CONDITION – Wheels (SC 23.731)

Add to CS 23.731 subparagraph (c) as follows:

(c) Wheels must be approved.

- END –

SPECIAL CONDITION:	**D-04 SC: Brakes and Braking Systems**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.735
ADVISORY MATERIAL:	--

BACKGROUND

The ability of high performance jet aircraft to come to a complete stop after a landing or a rejected take-off is much more dependent on the brakes and braking systems than for classical (propeller driven) part 23 aeroplanes.

To maintain a level of safety consistent with the greater reliance on the brakes & braking system, it must be considered that:

- A parking brake should be required, which should comply with SC23.735 (b). along with additional requirements concerning the control;

- CS 23.735 (e), normally limited to commuter category aeroplanes, should be made applicable;

- The effects of a single failure in the braking system should be minimised, in terms of additional landing stopping distance (new paragraphs (f) and (g));

- Overtemperature burst should be prevented (new paragraph (h));

- The wear state of the brakes can be readily identified on a walk around inspection (new paragraph (i)).

In addition, in CS 23.735 (d) the term "probable" is incompatible with the terminology of CS 23.1309 because a "probable" malfunction cannot be associated with either major or hazardous effects and, if used in the "CS 23.1309 sense", could lead to a requirement that could be seen as less severe than CS 23.1309 for that specific failure condition, with no obvious technical/state of the art reasons. It appears that the terminology (probable and hazardous) used was not "CS 23.1309 related" when the requirement was first introduced. It is then considered that the requirement is adequately covered by CS 23.1309 and that the current CS 23.735 (d) is superfluous and should be replaced by text referring to 23.1309.

SPECIAL CONDITION - Brakes and braking systems (SC 23.735)

Instead of the requirements of CS 23.735, the following applies:

(a): deleted – text merged with SC23.735(e)

(b) The aeroplane must have a parking brake control that, when selected on, will, without further attention, prevent the aeroplane from rolling on a dry and level paved runway with take-off power on the critical engine. The control must be suitably located or be adequately protected to prevent inadvertent operation. There must be indication in the cockpit when the parking brake is not fully released.

(c) No change

(d) If anti skid devices are installed, the devices and associated systems must be designed so that they meet the reliability requirements of 23.1309.

(e) The brake kinetic capacity rating of each mainwheel brake assembly must not be less than the kinetic energy absorption requirements determined under either of the following methods:

> (1) The brake kinetic energy absorption requirements must be based on a conservative rational analysis of the sequence of events expected during either

(i) a rejected take-off at the design take-off weight, or

(ii) a landing stop at the most critical combination of landing weight and speed

(2) Instead of a rational analysis, the kinetic energy absorption requirements for each mainwheel brake assembly may be derived from the following formula:

$KE = \frac{1}{2} MV^2/N$

where:

KE = Kinetic energy per wheel (joules)

M = EITHER Mass at design take-off weight (kg), OR Mass at design landing weight (kg)

(depending on the case being calculated)

V = EITHER Ground speed, in m/s associated with the maximum value of V1 selected in accordance with CS 23.51(c)(1).

OR Aeroplane speed in m/s. V must be not less than Vso, the power off stalling speed of the aeroplane at sea level, at the design landing weight and in the landing configuration

(depending on the case being calculated)

N = Number of main wheels with brakes

It must be substantiated by dynamometer testing that the wheel, brake and tyre assembly is capable of absorbing not less than this level of kinetic energy throughout the defined wear range of the brake.

(f) The brake system, associated systems and components must be designed and constructed so that if any electrical, pneumatic, hydraulic or mechanical connecting or transmitting element fails, or if any single source of hydraulic or other brake operating energy supply is lost, it is possible to bring the aeroplane to rest with a braked roll stopping distance of not more than two times that obtained in determining the landing distance as prescribed in CS 23.75.

(g) If a stored energy system is used to show compliance with paragraph (f) of this special condition, the flight crew must be provided with an indication of the useable stored energy available.

(h) Means must be provided in each braked wheel to prevent wheel failure and tyre burst that may result from elevated brake temperatures.

(i) Means must be provided for each brake assembly to indicate when the heat sink is worn to the permissible limit. The means must be reliable and readily visible.

- END –

SPECIAL CONDITION:	**D-05 SC: Doors**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.783
ADVISORY MATERIAL:	--

BACKGROUND

Part 23 high performance aeroplanes operate at high altitude and speed, with a high cabin differential pressure. Aeroplanes operating under similar conditions have shown, that fuselage doors which did not stay closed and attached to the aeroplane could create catastrophic situation. Because of the smaller fuselage volume, this threat is even higher for smaller aeroplanes.

During a recent harmonisation activity for the equivalent paragraph in CS25, it was found necessary to define the terms used for the different parts of the door mechanism in terms of their function. The definitions currently used in CS23.783 do not correspond with these definitions, which have now become standard through the industry. CS23 currently uses the terms "lock and safeguard" where CS25 uses "latch and lock".

The CS23.783 provides sufficient safety for doors on this class of aircraft providing the definition of the terms and their associated functions are clearly understood. Therefore IM 23.783 for SC-D23.0783-02 now contains the precise definition of the important CS23 terms in order to adequately describe the function of the mechanical parts of a door design and the SC-D23.0783-02 introduces this harmonised terminology into the current existing text.

However, it is not just a case of interchanging words and meanings, so in four cases it has also been necessary to alter the wording for the sake of clarity, i.e. to correct an anomaly that currently exists in CS23.

In paragraph (c)(2) where it says "internal locking mechanism is in the locked position" this must be referring to the entire "latch and lock" mechanism not just one part of it.

In paragraph (c)(3) it is necessary to add "unlatched" so that the meaning of "unlocked, unlatched and opened" is consistent with the function of the mechanism.

In paragraph (e)(2) the direct visual inspection must be of the lock mechanism not the latching mechanism.

Paragraph (e)(3) requires the addition of "latched" so that the phrase "closed, latched and locked" makes sense.

Paragraphs (c)(6) and (d)(3) of the current CS 23.783 refer to "auxiliary locking devices". This terminology cannot be carried forward in this SC, because the meaning of locking has changed. The text is therefore changed to "auxiliary security devices", to mean devices that provide a means to prevent unauthorised access to the aircraft when on the ground.

SPECIAL CONDITION – Doors (SC23.783)

CS 23.783 (d), (e) and (f) are applicable to all Part 23 high performance aeroplanes.

To introduce the new terminology CS 23.783 will be changed as follows:

CS 23.783 Doors (See AMC 23.783 (b) and IM 23.783)

(a) Each closed cabin with passenger accommodations must have at least one adequate and easily accessible external door.

(b) Passenger doors must not be located with respect to any propeller disc or any other potential hazard so as to endanger persons using that door.

(c) Each external passenger or crew door must comply with the following requirements:

(1) There must be means to latch and lock the door against inadvertent opening during flight by persons, by cargo, or as a result of mechanical failure.

(2) The door must be openable from the inside and the outside when the internal latching and locking mechanism is in the locked position.

(3) There must be a means of opening which is simple and obvious and is arranged and marked inside and outside so that the door can be readily located, unlocked, unlatched and opened, even in darkness.

(4) The door must meet the marking requirements of CS 23.811.

(5) The door must be reasonably free from jamming as a result of fuselage deformation in an emergency landing.

(6) Auxiliary security devices that are actuated externally to the aeroplane may be used but such devices must be overridden by the normal internal opening means.

(d) In addition, each external passenger or crew door, for a commuter category aeroplane, must comply with the following requirements:

(1) Each door must be openable from both the inside and outside, even though persons may be crowded against the door on the inside of the aeroplane.

(2) If inward opening doors are used, there must be a means to prevent occupants from crowding against the door to the extent that would interfere with opening the door.

(3) Auxiliary security devices may be used.

(e) Each external door on a commuter category aeroplane, each external door forward of any engine or propeller on a normal, utility, or aerobatic category aeroplane, and each door of the pressure vessel on a pressurised aeroplane must comply with the following requirements:

(1) There must be a means to latch and lock each external door, including cargo and service type doors, against inadvertent opening in flight, by persons, by cargo, or as a result of mechanical failure or failure of a single structural element, either during or after closure.

(2) There must be a provision for direct visual inspection of the locking mechanism to determine if the external door, for which the initial opening movement is not inward, is fully closed, latched and locked. The provisions must be discernible, under operating lighting conditions, by a crew member using a flashlight or an equivalent lighting source.

(3) There must be a visual warning means to signal a flight-crew member if the external door is not fully closed, latched and locked. The means must be designed so that any failure, or combination of failures, that would result in an erroneous closed, latched and locked indication is improbable for doors for which the initial opening movement is not inward.

(f) In addition, for commuter category aeroplanes, the following requirements apply:

(1) Each passenger entry door must qualify as a floor level emergency exit. This exit must have a rectangular opening of not less than 0.61 m (24 in) wide by 1.22 m (48 in) high, with corner radii not greater than one-third the width of the exit.

(2) If an integral stair is installed at a passenger entry door, the stair must be designed so that, when subjected to the inertia loads resulting from the ultimate static load factors

in CS 23.561(b)(2) and following the collapse of one or more legs of the landing gear, it will not reduce the effectiveness of emergency egress through the passenger entry door.

(g) If lavatory doors are installed, they must be designed to preclude an occupant from becoming trapped inside the lavatory. If a locking mechanism is installed, it must be capable of being unlocked from the outside of the lavatory.

- END –

SPECIAL CONDITION:	**D-06 SC: Bird Strike**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.775(h)
ADVISORY MATERIAL:	--

BACKGROUND

The severity of a bird impact is determined by the weight of the bird and the speed of the aircraft (relative to the bird) at the time of a bird strike. Although most bird strikes tend to occur at lower altitudes, bird strikes have been reported at higher altitudes, e.g. up to 20.000 ft. This is recognised in CS-25, where the bird impact condition to be considered is defined as a combination of a 1.82 kg (4 lb) bird at design cruise speed (V_C).

Although CS-23 specifies the bird impact condition relative to maximum approach flap speed, and high performance / high altitude aircraft may have approach flap speeds similar to more conventional CS-23 aircraft, the safety concern associated with the bird strike issue is more related to the increased design and operational speeds at higher altitudes. Operating at these higher speeds puts these aircraft at a higher risk in terms of bird strike threat.

Although these higher design and operational airspeeds may be similar to the ones found on CS-25 aircraft it was not considered reasonable to go beyond the Commuter category requirement of a 0.91 kg (2 lb) bird at maximum approach flap speed.

Based on the above considerations (including possible single pilot operation (when allowed)) the bird impact conditions of a 0.91 kg (2 lb) bird at maximum approach flap speed needs to be considered for the whole airframe, including windshields. A safety assessment should identify the areas to be addressed.

SPECIAL CONDITION – Bird Strike (SC23.631)

For all CS-23 high performance aeroplanes the following applies:

(1) Windshield panes directly in front of the pilot(s) in the normal conduct of their duties, and the supporting structures for these panes must withstand, without penetration, the impact of a 0·91 kg (2 lb) bird when the velocity of the aeroplane relative to the bird along the aeroplane’s flight path is equal to the aeroplane’s maximum approach flap speed.

(2) The windshield panels in front of the pilot(s) must be arranged so that, assuming the loss of vision through any one panel, one or more panels remain available for use by a pilot seated at a pilot station to permit continued safe flight and landing.

(3) Continued safe flight and landing is required after impact of a 0·91 kg (2 lb) bird when the velocity of the aeroplane relative to the bird along the aeroplane’s flight path is equal to the aeroplane’s maximum approach flap speed. This must be shown for any location prone to bird strike where a safety assessment reveals a vulnerable item of concern (e.g. cockpit, fuel tanks, empennage attachments, critical flight systems in the nose or canopy area) either through direct impact or shock wave effects.

- END –

SPECIAL CONDITION:	**D-09 SC: Operation above 41'000 ft**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.831, CS 23.841, CS 23.1441, CS 23.1443, CS 23.1445, CS 23.1447
ADVISORY MATERIAL:	

BACKGROUND

The operation of aeroplanes at altitudes above 41 000 ft involves specific risks for aircraft occupants, and is a kind of operation for which CS 23 does not contain adequate safety standards.

The proposed special condition covers operation above 41 000 feet.

Section D.2 of the proposed Special Condition describes conditions and failures that should be considered in evaluating cabin decompression. Possible modes of failure include tyre burst, loss of antennas or stall warning vanes, or any probable equipment failure that affects pressurisation. The small executive transport aeroplanes special conditions issued in the past did require in addition, evaluation of engine rotor burst. It is EASA opinion that turbine engine installations failures should be assessed against the specific requirement of CS 23.903(b) and should not be part of the present Special Conditions, this is to allow a consistent approach at the aircraft level (keeping in mind that it is accepted that rotor burst case does not need to be considered for other requirements such as 23.1309). The remaining text of the Special Conditions is kept virtually identical to previously applied Special Conditions on small executive jets.

SPECIAL CONDITION (SC CS 23.0831, Ventilation)

A - PRESSURE VESSEL INTEGRITY

For the fail-safe or damage tolerance evaluation, in addition to the damage sizes critical for residual strength, the damage sizes critical for depressurisation decay must be considered, taking also into account the (normal) unflawed pressurised cabin leakage rate that shall be included in the analysis. The resulting leakage rate must not result in the cabin altitude exceeding the cabin altitude time history shown in Figure 4.

B – VENTILATION

1. In lieu of the requirements of CS 23.831(b), the ventilation system must be designed to provide a sufficient amount of uncontaminated air to enable the crew members to perform their duties without undue discomfort and fatigue and to provide reasonable passenger comfort during normal operating conditions and also in the event of any probable failure of any system which could adversely affect the cabin ventilating air. For normal operations, crew members and passengers must be provided with at least 0•55 lb/min of fresh air per person or the equivalent in filtered, recirculated air based on the volume and composition at the corresponding cabin pressure altitude of not more than 8000 ft.
2. The supply of fresh air in the event of the loss of one source, should not be less than 0•4 lb/min per person for any period exceeding five minutes. However, reductions below this flow rate may be accepted provided that the compartment environment can be maintained at a level which is not hazardous to the occupant.

C - AIR CONDITIONNING

In addition to the requirements of CS 23.831, paragraph (b), the cabin cooling system must be designed to meet the following conditions during flight above 15 000 ft mean sea level (MSL):

1. After any probable failure, the cabin temperature-time history may not exceed the values shown in Figure 1.
2. After any improbable failure, the cabin temperature-time history may not exceed the values shown in Figure 2.

Probable and improbable failures in combination with undetected, latent system failure conditions need to be considered.

Other temperatures standards could be accepted by the EASA if they provide an equivalent level of safety.

D – PRESSURISATION

In addition to the requirements of CS 23.841, the following apply:

1. The pressurisation system, which includes for this purpose bleed air, air conditioning and pressure control systems, must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 3 after each of the following :
   a) Any probable double failure in the pressurisation system (CS 23.1309 may be applied).
   b) Any single failure in the pressurisation system combined with the occurrence of a leak produced by a complete loss of a door seal element, or a fuselage leak through an opening having an effective area 2.0 times the effective area which produces the maximum permissible fuselage leak rate approved for normal operation, whichever produces a more severe leak.
2. The cabin altitude-time history may not exceed that shown in Figure 4 after each of the following:
   a) The pressure vessel opening or duct failure resulting from probable damage (failure effect) while under maximum operating cabin pressure differential due to a tyre burst, loss of antennas or stall warning vanes, or any probable equipment failure (bleed air, pressure control, air conditioning, electrical source(s) ...) that affects pressurisation.
   b) Complete loss of thrust from engines.
3. In showing compliance with paragraph D.1 and D.2 of this special condition, it may be assumed that an emergency descent is made by an approved emergency procedure. A 17-seconds crew recognition and reaction time must be applied between cabin altitude warning and the initiation of emergency descent.

   For flight evaluation of the rapid descent, the test article must have the cabin volume representative of what is expected to be normal
4. Engine rotor failures must be assessed according to the requirements of CS 23.903(b)

   In considering paragraph 8.d(2) of AMC 20-128A, consideration must be given to the practicability and feasibility of minimising the depressurisation effects, assessing each aircraft configuration on a case-by-case basis, and taking into account the practices in the industry for each configuration.

E - OXYGEN EQUIPMENT AND SUPPLY

1. A continuous flow oxygen system must be provided for the passengers.
2. In addition to the requirements of CS 23.1445, the following applies: if the flight crew and passengers share a common source of oxygen, a means to separately reserve the minimum supply required by the flight crew must be provided.
3. In addition to the requirements of CS 23.1447, a quick-donning pressure demand mask with mask-mounted regulator must be provided for each pilot. Quick-donning from the stowed position must be demonstrated to show that the mask can be withdrawn from the stowage and donned within 5 seconds.

- END –

SPECIAL CONDITION:	**E-01 SC: Fuel Tank Crashworthiness**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.967 & CS 23.561, CS 23.721, CS 23.994
ADVISORY MATERIAL:	--

BACKGROUND

High performance / high altitude aircraft may have higher landing speeds compared to conventional CS-23 aircraft. In addition these aeroplanes may carry larger amounts of fuel and in locations more vulnerable to rupture or abrasion in an emergency landing.

This necessitates a more thorough investigation of the crashworthiness characteristics to keep the same level of safety compared to conventional aeroplanes.

CS 23.561, CS 23.967 and CS 23.994 already cover wheels-up landings, landings with any one gear not-extended, and pylon and landing gear breakaway. However, there is a lack of guidance on how to comply with these requirements especially in relation to landing gear overloads, impact conditions and subsequent sliding on the ground.

In addition the current CS 23.721 applies landing gear breakaway conditions only to commuter aircraft with 10 passengers or more, whereas CS 23.967(e) requires engine breakaway to be investigated where relevant to all aircraft. Also sideways breakaway of landing gear should be considered as this may occur when an aeroplane departs a runway at high speed.

A Special Condition is therefore needed to ensure a more thorough and consistent compliance with these requirements for those high performance / high altitude aircraft where certain design features give rise to safety concerns related to crashworthiness

SPECIAL CONDITION – Fuel Tank Crashworthiness

In addition to CS 23.967, and CS 23.561, CS 23.721 and CS 23.994 the following applies:

(a) The landing gear system must be designed so that when it fails due to overloads during take-off and landing, the failure mode is not likely to cause spillage of enough fuel to constitute a fire hazard. The overloads must be assumed to act in the upward and aft directions in combination with side loads acting inboard and outboard. In the absence of a more rational analysis, the side loads must be assumed to be up to 20% of the vertical load or 20% of the drag load, whichever is greater.

(b) The aeroplane must be designed to avoid any rupture leading to the spillage of enough fuel to constitute a fire hazard as a result of a wheels-up landing on a paved runway, under the following minor crash landing conditions:

(1) Impact at 1.52 m/s (5 fps) vertical velocity, with the aeroplane under control, at Maximum Design Landing Weight,

- (i) with the landing gear fully retracted and, as separate conditions,
- (ii) with any other combination of landing gear legs not extended.

(2) Sliding on the ground, with

- (i) the landing gear fully retracted and with up to a 20° yaw angle and, as separate conditions,
- (ii) any other combination of landing gear legs not extended and with 0° yaw angle.

(c) For configurations where the engine nacelle is likely to come into contact with the ground, the engine pylon or engine mounting must be designed so that when it fails due to overloads (assuming the overloads to act predominantly in the upward direction and separately predominantly in the aft direction), the failure mode is not likely to cause the spillage of enough fuel to constitute a fire hazard.

- END –

SPECIAL CONDITION:	**E-04 SC: Lines, Fittings and Components**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1183
ADVISORY MATERIAL:	--

BACKGROUND

CS 23.1183 does not define the fire-protection (minimum requirements) applicable for components other than flammable fluid tanks and supports, that when exposed or damaged by fire may add hazards to the aeroplane. In addition in High Performance Aeroplanes the fuel system is typically more complex and the engines are not visible to the crew.

Due to the higher fuel flow, pressure and subsequent fuel capacity required for High Performance Aircraft, as well as the fact that, in Jet Engines, the fuel itself may be used as a cooling/heating and/or hydraulic fluid (e.g. in hydro-mechanical Fuel Control Units (FCUs)), additional requirements are needed to address the higher level of fire hazard as compared to other CS-23 aircraft types.

The increase of fire threat severity as well as the increase of system potentially affected by the fire threat due to the increase of connections/interfaces between turbine engine and aircraft shall not add hazards to the aircraft and/or affect essential systems under an engine fire situation.

SPECIAL CONDITION (SC-E 23.1183-01)

Lines, Fittings and Components

SC 23.1183: Lines, fittings and components

Add a new paragraph to existing CS 23.1183

(c) All components, including ducts, within a designated fire zone must be fireproof if, when exposed to or damaged by fire, they could -

(1) Result in fire spreading to other regions of the aeroplane, or

(2) Cause unintentional operation of, or inability to operate, essential services or equipment.

- END –

SPECIAL CONDITION:	**E-06 SC: Powerplant Fire Extinguishing Systems**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.901, 23.1193, 23.1195, 23.1197, 23.1199,23. 1201
ADVISORY MATERIAL:	--

BACKGROUND

When the powerplant fire protection provisions in CS-23 were initially introduced, it was not foreseen that turbojet engines would be embedded in the fuselage, nor in pylons on the aft fuselage.

CS-23 has historically addressed fire protection through prevention, identification, and containment. Manufacturers have provided prevention through minimizing the potential for ignition of flammable fluids and vapors. Next to that, historically, pilots had been able to see the engines and identify the fire or use the incorporated fire detection systems, or both. The ability to see the engine provided for the rapid detection of a fire, which led to a fire being rapidly extinguished. However, engine(s) embedded in the fuselage or in pylons on the aft fuselage do not allow the pilot to see a fire.

Specifically for airplanes equipped with embedded engines or in pylons on the aft fuselage, the consequences of a fire in an engine are more varied, adverse, and difficult to predict than the engine fire for a typical CS-23 airplane. The ability to extinguish an engine fire becomes extremely critical due to this location. With these configurations, an engine fire could affect both the airplane's fuselage and the empennage structure, which includes the pitch and yaw controls. A sustained fire could result in damage to this primary structure and loss of airplane control before a pilot could make an emergency landing. For a small, simple airplane originally envisioned by CS--23, it is possible to descend the airplane to a suitable landing site within 15 minutes. For the high performance aeroplanes this is not always possible and therefore compliance with additional requirements must be demonstrated.

The availability of the fire extinguishing system during engine fire conditions is of primary importance to ensure continued safe flight and landing. Service history has shown that lack of consideration of the arrangement of the electrical and/or plumbing connections may lead to an unsafe condition. In many cases, plumbing and electrical connections have been arranged such that maintenance personnel could inadvertently reverse the connections during a normal maintenance action. As a result, modifications to these systems (e.g. changing the plumbing fitting sizes, changing the electrical connectors and or changing the lengths of hoses and wires such that an improper connection was not physically possible) have been required. In addition, colour coding of each connection has also been provided to assist in proper connection.

SPECIAL CONDITION –Powerplant Fire Extinguishing Systems (SC-E 23.1195-02, Issue 1)

The design of the Pilatus PC-24 fire extinguishing system shall comply with the requirements of CS 23.901, 23.1193, 23. 1195, 23.1197, 23.1199 and 23.1201, with the following changes:

A. Whenever the term “commuter category airplanes” is used, this must be read as “commuter category airplanes and high performance aeroplanes”.

B. For paragraph CS 23.1195(a)(2) (CS23 amendment 3), the final line “An individual “one shot” system may be used” should be replaced by “An individual “one shot” system may be used, except for engine(s) embedded in the fuselage, where a “two-shot” system is required”.

C. For paragraph CS 23.901, the following paragraph is added:

(g) The fire extinguishing plumbing and electrical connections must be constructed, arranged and installed such that cross connection is not possible during normal maintenance actions (e.g. changing the fire extinguishing bottles or trouble shooting the system).

- END –

SPECIAL CONDITION:	**E-10 SC: Fuel Tank Ignition Prevention**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.901 (b), CS 23.1309, CS 23.1529 (App. G)
ADVISORY MATERIAL:	EASA certification policy statement on fuel tank safety

BACKGROUND

This CRI and associated SC is meant to address the hazard of fuel ignition in Jet Fuel Tanks due to ignition and/or heat sources in High Performances Aircraft, as addressed in 25.981 (Fuel Tank Ignition Prevention for Large Aircraft) and until implementation of similar regulations and approved means of compliance are reflected in CS-23.

SPECIAL CONDITION - Fuel tank ignition prevention (SC 23.0981)

(a) No ignition source may be present at each point in the fuel tank or fuel tank system where catastrophic failure could occur due to ignition of fuel or vapours. This must be shown by:

(1) Determining the highest temperature allowing a safe margin below the lowest expected auto-ignition temperature of the fuel in the fuel tanks.

(2) Demonstrating that no temperature at each place inside each fuel tank where fuel ignition is possible will exceed the temperature determined under paragraph (a)(1) of this section. This must be verified under all probable operating, failure, and malfunction conditions of each component whose operation, failure, or malfunction could increase the temperature inside the tank.

(3) Demonstrating that an ignition source does not result from each single failure and from all combinations of failures is not shown to be extremely improbable, as done under 23.1309.

(b) Based on the evaluations required by this section, critical design configuration control limitations, inspections, or other procedures must be established, as necessary, to prevent development of ignition sources within the fuel tank system and must be included in the Airworthiness Limitations section of the Instructions for Continued Airworthiness required by section 23.1529.

- END –

SPECIAL CONDITION:	**E-11 SC: Induction System Ice Protection - Cold Soaked Fuel**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1098 (b), CS 23.143, CS 23.1419
ADVISORY MATERIAL:	--

BACKGROUND

For engines located aft of the wing, numerous events of engine damage during takeoff have occurred due to wing ice shedding. Simultaneous ice shedding from both wings has resulted in ice ingestion in both engines.

More generally, Ice shedding from the upper wing surface may damage or erode engine or powerplant components as well as lifting, stabilizing, and flight control surface leading edges.

In addition even small amounts of frost, ice, snow or slush on the wing leading edges and wing upper surface may adversely change the stall speeds, stall characteristics and the protection provided by the stall protection system. This may result in loss of control of the airplane.

Undetected Ice accumulation on wing surfaces may occur in non-icing conditions due to the freezing of condensation caused by cold soaked fuel from the previous flight phases or after a prolonged exposure on ground in cold conditions. Undetected ice accumulation is synonymous with unnoticed ice forming and remaining on the wing upper surface in non-icing conditions when ice does not form anywhere else on the airplane.

SPECIAL CONDITION - Induction System Ice Protection (SC CS 23.1093)

The wing upper surfaces must not accumulate undetected hazardous quantities of ice caused by cold soaked fuel.

In demonstrating compliance, it is to be assessed, if potential ice accretion on wing upper surface due to the freezing of condensation caused by cold soaked fuel from the previous flight or after a prolonged exposure on ground in cold environment.

First it shall be determined if the design of the wing is such that cold soak fuel may occur during the above scenario. If it is demonstrated that the design is such that the wing upper surfaces may not accumulate hazardous quantities of ice caused by cold soaked fuel within the proposed airplane operating envelope, no further assessment is required.

If it is determined that hazardous quantities of ice caused by cold soaked fuel may accumulate prior to take off, the following is required:

1. an indication means to warn the flight crew of the presence of hazardous quantities of ice on the wing upper surface or,

2. when Conditions conducive to cold soak fuel exist, an AFM procedures to require that the flight crew perform,

    a. a visual and tactile (hand on surface) check of the wing leading edge and the wing upper surface to ensure the wing is free from frost, ice, snow, or slush or

    b. a de-icing of aircraft

Following 2 (a) above, if frost, ice, snow or slush is present on the wing upper surface, it must be within the acceptable limits provided in the AFM. If it is not within the acceptable limits or if no limits are provided in the AFM, the AFM must require following the ground de-icing /anti-icing procedures.

- END –

EQUIVALENT SAFETY FINDING:	**E-56 ESF: Powerplant System Indications**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.903(b)(2), 1305 (a)(c)(d), 1309(b), 1311, 1322, 1549, 1551, CRI B-152 Special Conditions PC-24 Human Factors.
ADVISORY MATERIAL:	AC 23-1311-1C, AC 20-88A

BACKGROUND

The primary engine displays on turbine engine powered aircraft have traditionally displayed the required engine rotor speeds, oil temperature, oil pressure, EGT and fuel flow required by CS 23.1305 in an analog-only or an analog and digital format. Standby Engine Indicators (SEIs), when provided, have typically displayed these parameters in either analog-only or digital-only format. An increasing demand to conserve primary display space has led to digital-only primary displays for various engine parameters including those rotor speeds not normally used for power setting. This situation may result in a small, cluttered, low-resolution primary display.

EASA generally considers that digital-only displays are less effective than conventional analog displays at providing the flightcrew with discernible indication of the parameter during a rapid transient, and quick intuitive indication of the parameters approximate level, direction and rate of change, proximity to limits, and relationship to other parameters on the same engine or the same parameter on other engines. Normally it is found that "digital indicators are most valuable when integrated with an analog display."

While many of the referenced rules do not require an analog format, CS 23.1549 requires instrument markings which presumes an analog type display format. Therefore, EASA considers that features of the digital format must at least provide a level of safety equivalent to that intended by compliance with CS 23.1549 and CS23.1311.

Some of the relevant requirements, such as the “redline” limit marking requirements of CS 23.1549, presume the flightcrew has the primary responsibility for assuring continued safe engine operation (e.g. operation within the safe operating limits). With the advent of full authority digital engine controls (FADEC), the primary means of assuring operation within some engine safe operating limits has been taken over by automated protection features within these engine controls. Hence the FADEC may provide compensating features that EASA can consider when determining whether or not a digital-only display can provide an equivalent level of safety.

For example, if Pilatus demonstrates and EASA finds that the FADEC will prevent exceedance of an engine operating limit, then the flightcrew would no longer need to be the primary means of doing so. This diminishes the need for flightcrew awareness of proximity to the limit value, which is normally provided by redline markings required by CS23.1549. The design should still provide a means for flightcrew awareness, to the extent practicable, via markings, placards and/or at least airplane flight manual (AFM) information and training. In case the FADEC fails to keep engine operating limits, the design must still make the flightcrew aware of that condition via appropriate flightcrew alerting features (e.g. background or digital color changes, flashing display, aurals, associated messaging, procedures, etc.). Such modern alerting may even be found superior to the colored “arc” or background type markings required by CS 23.1549.

EQUIVALENT SAFETY FINDING

Pilatus current practice for powerplant system indications is to have colored coding of the normal, precautionary and exceedance values/ranges, combined with CAS messages and aural alerts when engine parameters are beyond limit.

To support the Equivalent Safety Finding, Pilatus presented the following comments:

- Pilatus verifies the engine instrument design and demonstrates compliance with CRI F-51 & CRI B-152.

- The engine parameters are sensed by the engine-mounted sensors and transmitted to the UMS and FADEC. The operating limits of engine parameters such as N1/N2 rotor speeds, ITT, oil pressure and oil temperature are also monitored by the FADEC.

- The normal range/exceedance information is transmitted from the FADEC to the APEX avionics, triggering green, amber or red colors on display, as well as CAS messages and aural alerts (chimes).

- The crew is then alerted to abnormal engine operating conditions, thereby being able to take corrective action(s) and avoid overstressing the engine. This implementation reduces the crew workload by relieving them from monitoring those parameters, and aids in minimizing crew errors.

- The fuel flow has no operating limits and, therefore, its value is displayed as white numeral, with no colour changes to amber or red, no CAS messages and no aural alerts.

- The PC-24 flight deck has been developed in compliance with the PC-24 Flight Deck Philosophy Document, which includes anthropometric requirements. Compliance with the CS 23.1321(a) has been shown through HF evaluations in ground/flight tests as presented in Human Factors Certification Programme report.

In conclusion, Pilatus believes that the engine system indications implemented as depicted above, are equal or superior to analogue displays compliant with the marking requirements of CS 23.1549. The color coding of the normal, precautionary and exceedance values/ranges, combined with CAS messages and aural alerts improve the level of safety by alerting the pilot sooner than if the pilot relied on an instrument panel scan.

In addition, due to the automated engine protections assured by the FADEC, the level of safety compared to an all analogue format is further improved as a result of pilot workload reduction, especially in single pilot operations, and in presence of failures.

- END –

SPECIAL CONDITION:	**E-59 SC: Engine Installation (Rain Condition)**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.901
ADVISORY MATERIAL:	--

BACKGROUND

The Certification Basis for operation under rain for turbine engine aircraft on CS-23 aircraft present a discrepancy between the turbine engine installation requirement (CS 23.901(d)(2) and the requirement to be demonstrated during turbine engine certification that is called by CS 23.903(a)(1).

EASA has not updated CS 23, 27 and 29 and has not harmonised with 14CFR Part 23.901 regarding the acceptability of the 3% ingestion capability of the engine induction system as required by CS 23.901. EASA launched an initiative to harmonise CS 23.901(d)(2) with 14 CFR Part 23.901(d)(2) in August 2015, and published the Special Condition for public comments.

SPECIAL CONDITION (SC-E 23.901-01)

Engine installation (rain conditions)

Replace CS 23.901(d)(2) for CS-23 Amdt 1 to 4 with :

GENERAL

CS 23.901 Installation

* * * *

(d) Each turbine engine installation must be constructed and arranged to –

* * * *

(2) Ensure that the capability of the installed engine to withstand the ingestion of rain, hail, ice, and birds into the engine inlet is not less than the capability established for the engine itself under CS 23.903(a)(1).

- END –

SPECIAL CONDITION:	**E-102 SC: Single Point Defueling**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.979, (25.979(e))
ADVISORY MATERIAL:	--

BACKGROUND

The existing Part 23 regulations do not envision pressure defuelling systems. The current CS 25 regulations contain adequate regulations to address pressurized defuelling, therefore CS 25.979(e) will be added to the Model PC-24 Certification Basis as a Special Condition to address the pressure defuelling system.

SPECIAL CONDITION – Pressure fuelling systems (SC-E 23.979, Issue 1)

The following regulation (per CS 25.979(e)) is proposed as a Special Condition to address the defuelling system on the Model PC-24.

Pressure fuelling system.

For pressure fuelling systems, the following is added and apply:

CS23.979

(…)

(e) The airplane defuelling system (not including fuel tanks and fuel tank vents) must withstand an ultimate load that is 2.0 times the load arising from the maximum permissible defuelling pressure (positive or negative) at the airplane fuelling connection.

- END –

SPECIAL CONDITION:	**F-01 SC: Battery Endurance Requirement**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.1353
ADVISORY MATERIAL:	--

BACKGROUND

To comply with CS 23.1353 (h), the system must be capable of providing 30 minutes of electrical power to those loads that are essential for safe flight and landing.

However this does not take into account flying at altitudes up to 41,000 ft. A safe flight (descent) from the maximum operational altitude with a follow on safe landing might take longer than the 30 minutes required by CS 23.1353 (h). Due to that 23.1353 (h) does not adequately address the possibilities for this kind of high performance airplane.

The services which should remain available following the loss of normal generating electrical power systems should be assess using the 23.1309.

SPECIAL CONDITION (SC-F23.1353-01, issue 2)

SC23.1353 Storage battery design and installation

Instead of CS 23.1353 (h) use:

> (h) In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing electrical power to those loads that are essential to continued safe flight and landing (includes any necessary preparation for evacuation of the airplane like emergency lighting, etc.) for the longest of the following durations:
>
> > (1) for aeroplanes with a certificated maximum altitude of 25,000 ft or less
> >
> > > (i) at least 30 minutes; or
> > >
> > > (ii) the time needed (but not more than 60 minutes) for the pilot(s) to:
> > >
> > > - recognise the loss of generated power;
> > >
> > > - take appropriate load shedding action; and
> > >
> > > - continue the flight to a safe landing.
> >
> > (2) at least 60 minutes for aeroplanes with a certificated maximum altitude of more than 25,000 ft

- END –

SPECIAL CONDITION:	**F-03 SC: Interaction of Systems and Structures**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1309, CS 23.1329
ADVISORY MATERIAL:	FAA AC 23.1309, FAA AC 23-17

BACKGROUND

Sophisticated control systems with complex control laws require particular attention to interaction with structures. Flight control systems may be capable of providing automatic response other than pilot input (active flight control). In the event of a (system) failure, the system may manoeuvre the aeroplane to its structural design limit. Flight control system behaviour may affect the response to gust encounters or influence manoeuvre conditions. This problem may increase with altitude (less damping) and speed (higher rate of speed change, shorter reaction time, and therefore higher loads).

Such advanced technology requires a new approach to account for the interaction of systems onto structure, for example in the following areas:

- Automatic / Electronic Flight Control Systems
- Load alleviation systems
- Fuel management systems
- Auto-pilot / yaw dampers
- Stall protection / warning systems, such as stick pusher / shaker
- Artificial feel.

SPECIAL CONDITION (SC-F23.1309-05, Issue 1)

Interaction of Systems and Structures

For aeroplanes equipped with systems that affect structural performance, either directly or as a result of a failure or malfunction, the influence of these systems and their failure conditions must be taken into account when showing compliance with the requirements of Subparts C and D.

This Special Condition is mainly intended to address aeroplanes equipped with systems such as automatic / electronic flight control systems, autopilots, stability augmentation systems, load alleviation systems, flutter control systems, and fuel management systems. If applied to other systems, it may be necessary to adapt the criteria to the specific system.

When showing compliance to the requirements of Subpart C and D, the applicant should consider, as separate conditions, the system fully operative and the system in the failure condition (at the time of occurrence and for the continuation of the flight). Failure indications (before or during the flight) and dispatch with known failure conditions should also be addressed.

When the applicant is seeking reduced safety factors and flutter margins as a function of probability of occurrence of the failure condition and the time spent in the failure condition, Appendix K of CS-25 is an acceptable means of showing compliance. It may be necessary to adapt these criteria to the probabilities and severity of failure conditions as specified in FAA AC 23.1309 (at a revision level acceptable to EASA).

- END –

EQUIVALENT SAFETY FINDING:	**F-05 ESF: IMA Individual Circuit Protection**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1357, 1309
ADVISORY MATERIAL:	AC 23.1309-1E

BACKGROUND

The CS23 rule requires that a protective device for a circuit essential to flight safety may not protect any other circuit. It is today for modern integrated systems difficult or impossible to show compliance to this rule even if the level of safety often exceeds those of legacy federated systems.

The FAA added the FAR 23.1357(b) in 1977 with the amendment 23-20 when only federated equipment were installed in aircraft. Safety analysis came along in 1990 with the amendment 23-41 of the FAR 23.1309. Guidance material AC-23.1309-1A had been provided 2 years later in 1992. Since then, technology has evolved and large integration of functions is available in today's IMA avionics.

This Equivalent Safety Finding is necessary to cover this technological evolution.

EQUIVALENT SAFETY FINDING

The only true IMA system installed on the PC-24 is the Primus APEX system. However, the UMS, although not classified as an IMA does integrate several functions. These two systems are fully assessed through the application of the safety methodology proposed for the PC-24 certification.

An equivalent level of safety intended by the regulation can be demonstrated considering the following:

1. "Essential to flight safety" is related to those whose failure conditions are classified as "major," "hazardous," or "catastrophic".

2. The applicant shall demonstrate through a design analysis that each function or combination of functions (i.e. COM-NAV) at the aircraft level is equivalent (or exceed) in safety to a federated architecture that complies with §23.1357(b).

3. The analysis reflects the design isn't subject to single point of failure or common causes.

4. The failure of each circuit breaker that powers a component of IMA cabinets is analyzed for their impact on aircraft safety in case of failure (i.e. including cooling fans).

- END –

SPECIAL CONDITION:	**F-07 SC: Data Link Services Recording**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23, CS 25 Amendment 3
ADVISORY MATERIAL:	FAA AC 20-160

BACKGROUND

The intent of CS 2x.1457 was to allow accident investigators to have, as far as practicable, a recording of all communications received or sent by each crew member.

As of today, it must be noted that these requirements are optional and are dictated by the operational rules. In General Aviation and for private operation, there is usually no mandate to carry Cockpit Voice or Flight Data Recorders (CVFDR). On the other hand, these DLS messages are recorded by ATC centers on ground.

The new ICAO Annex 6 Operations, dated 15.11.2012, Part II for General Aviation, §2.4.16.3.1.2, requires:

> "All aeroplanes which are modified on or after 1 January 2016 to install and utilize any of the data link communications applications listed in 5.1.2 of Appendix 2.3 and are required to carry a CVR shall record on a flight recorder the data link communications message".

The "are required to carry a CVR" is interpreted as "as required by the operational rules". This concerns today either commercial operation (CAT) or larger aircraft.

With the introduction of Data Link technology, much of the information which was previously transmitted by voice communications will be replaced by Data Link messages. With the requirement to provide DLS capability, the original content of CS 2x.1457/1459 are not sufficient to define the conditions and performances in recording these DLS messages.

SPECIAL CONDITION

Each Cockpit or Flight Data Recorders required by the operating rules must be approved and must be installed so that they will record the following additional Data Link information:

(a) Data Link communications related to air traffic services (ATS Communications*) to and from the aeroplane.

(b) All messages whereby the flight path of the aircraft is authorized, directed or controlled, and which are relayed over a digital Data Link rather than by voice communication.

(c) The minimum recording duration shall be equal to the duration of the Cockpit Voice Recorder, and the recorded data shall be time correlated to the recorded cockpit audio.

(d) To enable an aircraft operator to meet the intent of European Commission Regulation (EU) No 965/2012, Annex IV, Part CAT, Subpart D, Section 1, CAT.IDE.A.195, information shall be provided explaining how the recorded data can be converted back to the format of the original Data Link messages in order to determine an accurate sequence of events for the aircraft and the cockpit operation.

** ATS communications (ATSC) are defined by ICAO as communications related to air traffic services including air traffic control, aeronautical and meteorological information, position reporting and services related to safety and regularity of flight.*

- END –

SPECIAL CONDITION:	**F-15 SC: Airworthiness Info Security**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1309
ADVISORY MATERIAL:	ED 202A, ED-203A, ED 204 ED-79A/ARP-4754A, ED-135/ARP-4761

BACKGROUND

The development of widespread informatics attacks necessitates countermeasures also in the aviation domains.

The Airborne Systems introduced at least an Aspen Wireless interface in the PC-24 that introduce a potential for unauthorised electronic access to Aircraft Systems. It may contain security vulnerabilities due to the possible introduction of intentionally forged malware, intentional alteration of critical data, aircraft networks, systems or databases.

SPECIAL CONDITION

a) The applicant shall ensure security protection of the systems and networks of the aircraft from any remote or local access by unauthorized sources if corruption of these systems and networks (including hardware, software, data) by an inadvertent or intentional attack would impair safety, and

b) The applicant shall ensure that the security threats to the aircraft, including those possibly caused by maintenance activity or by any unprotected connecting equipment/devices inside or outside the A/C, are identified, assessed and risk mitigation strategies are implemented to protect the aircraft systems from all adverse impacts on safety, and

c) Appropriate procedures shall be established to ensure that the approved security protection of the aircraft's systems and networks is maintained following future changes to the Type Certificated design.

- END –

SPECIAL CONDITION:	**F-52 SC: Protection from effect of HIRF**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1309, 23.1431(a)
ADVISORY MATERIAL:	--

BACKGROUND

The basic concern for better identification and protection from High Intensity Radiated Fields, has arisen for the following reasons:

- Operation of modern aeroplanes is increasingly dependent upon electrical/electronic systems, which can be responsive to external and internal emitters for electromagnetic interference.
- Those emitters are increasing in number and in power. They include ground based systems (communication, television, radio, radars and satellite uplink transmitters), as well emitters on ships or other aircraft.

JAA have developed in co-operation with the FAA, a regulatory project for HIRF. This project was co-ordinated by the FAA/ JAA Electromagnetic Effects Harmonisation Working Group and relied heavily on work conducted by EUROCAE WG 33, in co-operation with SAE-AE4R.

The objective of the project was the issuance of an NPA (Notice of Proposed Amendment) in parallel with an FAA NPRM leading to a final rule and associated advisory material (Advisory Material Joint, and Users Guide).

The Electromagnetic Effects Harmonisation Working Group adopted a set of HIRF environment levels in November 1998 together with a proposed NPA/NPRM, which were agreed upon by FAA, JAA and industry working group participants. The environment levels recommended by this working group are included in JAA Interim Policy INT/POL/23/1 issue 1.

EASA has not yet incorporated the recommendations of the EEHWG in the relevant CSs. In the meantime, EASA is using the INT/POL/23/1 as a basis for Special Condition for HIRF.

SPECIAL CONDITION (SC-F23.1309-02, Issue 1)

Pilatus will comply with the Special Condition SC-F23.1309-02 with some exceptions on Appendix 1. With these exceptions the requirements of SC-F23.1309-02 are identical to FAA FAR paragraph 23.1308, to paragraph CS 23.1308 proposed in EASA NPA 2014-16 and to the equipment test levels of RTCA DO-160G & EUROCAE ED-14G.

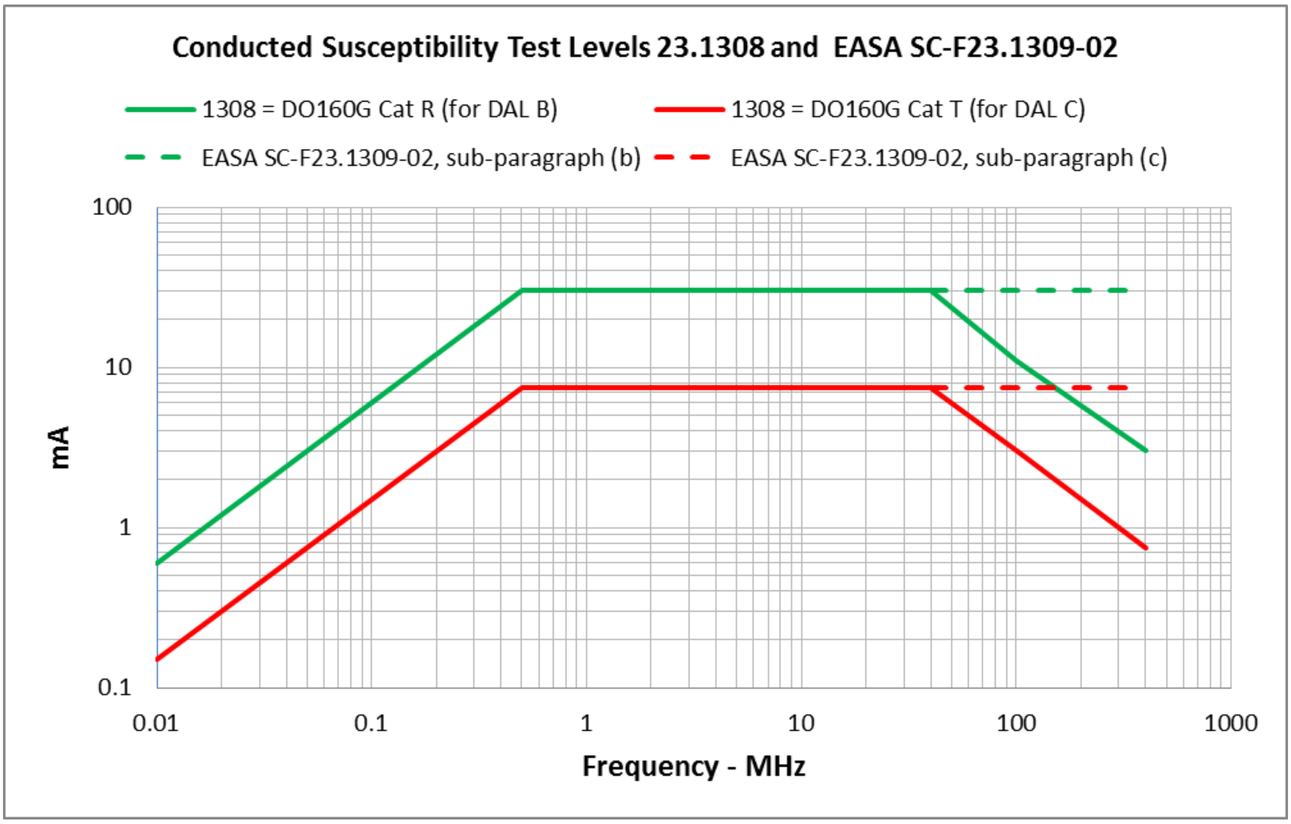
Appendix 1 a), HIRF environments required for sub-paragraph (a): SC-F23.1309-02 will be followed without exceptions.

Appendix 1 b), Test levels for sub-paragraph (b): Option 2 of SC-F23.1309-02 will be followed with the following differences *(in Italic letters*) on the conducted susceptibility tests:

From 10 kHz to 400 MHz, use conducted susceptibility tests with CW and 1 kHz square wave modulation of depth greater than 90 percent. The conducted susceptibility current shall start at 0.6 mA at 10 kHz, increasing 20 dB per frequency decade to 30 mA at 500 kHz. From 500 kHz to ~~*400 MHz*~~ *40 MHz*, the conducted susceptibility current shall be 30 mA. *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.* From 100 MHz to 400 MHz, use radiated susceptibility tests at 20 V/m peak, with CW and 1 kHz square wave modulation of depth greater than 90 percent. From 400 MHz to 8 GHz, use radiated susceptibility tests at 150 V/m peak with pulse modulation of 4 percent duty cycle with a 1 kHz pulse repetition frequency. This signal should be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent with a duty cycle of 50 percent.

Appendix 1 c), Test levels for sub-paragraph (c): SC-F23.1309-02 will be followed with the following differences *(in Italic letters*) on the conducted susceptibility tests:

From 10 kHz to *500 kHz*, use conducted susceptibility tests, starting at 0.15 mA at 10 kHz, increasing 20 dB per frequency decade to 7.5 mA at 500 kHz. From 500 kHz to *40 MHz*, use conducted susceptibility tests at 7.5 mA. *From 40 MHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 7.5 mA at 40 MHz, decreasing 20 dB per frequency decade to a minimum of 0.75 mA at 400 MHz.* From 100 MHz to 8 GHz, use radiated susceptibility tests at 5 V/m. See graphic below for difference between SC-F23.1309-02 and paragraph 1308.



EASA agrees to the Pilatus position. The position of Pilatus regarding CRI F-52 on HIRF protection is acceptable for EASA. The HIRF compliance finding will be according the NPA 2014-16 (or current CS 23 amendment 4, 23.1308 and CS 23,1309, and AMC 20-158), which was discussed with Pilatus before.

- END –

SPECIAL CONDITION:	**F-54 SC: Protection from the effects to lightning strike, indirect effects**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.867; 23.954, 23.1309
ADVISORY MATERIAL:	EUROCAE ED-81, amendment 1, dated 26-Aug-1999 ; EUROCAE ED-84, amendment 1, dated 06-Sep-1999 ; EUROCAE ED-91, amendment 1, dated 06-Sep-1999

BACKGROUND

If certification is applied for an aeroplane with high integrated avionics (PFD, MFD, FMS, VHF, XPDR-S, TCAS, TAWS, ILS, VOR, etc.) and other electronic systems (three-axis A/P, FADECs, etc.) as standard equipment, those systems contain essential functions required for continued safe flight and landing.

Atmospheric electricity interaction with an aircraft can result in numerous problems. For the case of lightning strikes, physical damage (direct effects) can result from a lightning attachment to the aircraft. Also the fast changing electromagnetic fields produced couple voltage and current transients into the electrical/electronic equipment or components. These transients can be produced by electromagnetic fields penetration into the aircraft interior or by structural IR (current times resistance) voltage rises due to current flow on the aircraft, and are referred to as indirect effects.

The applicable CS-23 requirements give insufficient protection against the indirect effects of lightning strike.

In addition the lightning strike models of original FAA AC20-136 used for system justification do not line up with latest models specified by internationally agreed EUROCAE/SAE documents and the zoning definitions of FAA AC20-53A which has been traditionally used, need to be updated to reflect current state of the art.

JAA have developed in co-operation with the FAA, a regulatory project for lightning protection. This project has been co-ordinated by the FAA/JAA Electromagnetic Effects Harmonisation Working Group (EEHWG) based on work conducted by EUROCAE WG31, in co-operation with SAE-AE2.

The Special Condition, lightning environment, zoning definitions and acceptable means of compliance defined in INT/POL/23/3 reflect the recommendations from the EEHWG.

EASA has not yet incorporated those recommendations in the relevant CSs. In the meantime, EASA is using the INT/POL/23/3 as a basis for Special Condition for lightning indirect effects protection.

SPECIAL CONDITION – Electrical and electronic system lightning protection (SC-F23.1309-03)

Pilatus will show compliance with Special Condition SC-F23.1309-03 without any differences or exceptions. The requirements of this SC are identical to FAA FAR paragraph 23.1306 and to paragraph CS 23.1306 proposed in EASA NPA 2014-16.

CS 23.1306 Electrical and electronic system lightning protection (See AMC 20-136)

(a) Each electrical and electronic system that performs a function for which failure would prevent the continued safe flight and landing of the aeroplane must be designed and installed so that:

(1) the function is not adversely affected during and after the time the aeroplane is exposed to lightning; and

(2) the system automatically recovers normal operation of that function in a timely manner after the aeroplane is exposed to lightning, unless the system's recovery conflicts with

other operational or functional requirements of the system that would prevent continued safe flight and landing of the aeroplane.

(b) For aeroplanes approved for instrument flight rules operation, each electrical and electronic system that performs a function for which failure would reduce the capability of the aeroplane or the ability of the flight crew to respond to an adverse operating condition, must be designed and installed so that the function recovers normal operation in a timely manner after the aeroplane is exposed to lightning.

- END –

SPECIAL CONDITION:	**F-58 SC: LI Battery Installations**
APPLICABILITY:	PC-24
REQUIREMENTS:	23.1353, 23.863, 23.601
ADVISORY MATERIAL:	--

BACKGROUND

Lithium-Ion (Li-Ion) / Lithium Polymer (Li-Po) batteries, intended to be used for storage on the PC-24, have specific failure and operational characteristics, and maintenance requirements that differ significantly from that of the nickel cadmium (Ni-Cd) and lead acid rechargeable batteries currently covered by CS-23.

The current requirements governing the installation of batteries in small aeroplanes are covered under (CS) 23.1353(c). Requirements from (CS) 23.1353(c) are essentially unchanged from initial JAR code. An increase in incidents involving battery fires and failures that accompanied the increased use of Nickel-Cadmium (Ni-Cd) batteries in small aeroplanes resulted in additional rulemaking affecting the requirements for small aeroplanes and large aeroplanes. The result of these rulemaking activities on the battery requirements for large aeroplanes was the addition of (CS) 23.1353(f) and (g)(1) to (g)(4) which apply only to Ni-Cd battery installations.

SPECIAL CONDITION - Li Batteries (SC CS-F23.1353-02, Issue 1)

In lieu of the requirements of CS 23.1353(a) through (g) the following applies:

(a) Lithium batteries and battery installations must be designed and installed as follows:

(1) Safe cell temperatures and pressures must be maintained during any probable charging or discharging condition, or during any failure of the charging or battery monitoring system not shown to be extremely remote. The Li battery installation must be designed to preclude explosion in the event of those failures.

(2) Li batteries must be designed to preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

(3) No explosive or toxic gasses emitted by any Li battery in normal operation or as the result of any failure of the battery charging or monitoring system, or battery installation not shown to be extremely remote, may accumulate in hazardous quantities within the aeroplane.

(4) Li battery installations must meet the requirements of CS 23.863(a) through (d).

(5) No corrosive fluids or gasses that may escape from any Li battery may damage surrounding aeroplane structures or adjacent essential equipment.

(6) Each Li battery installation must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

(7) Li battery installations must have a system to control the charging rate of the battery automatically so as to prevent battery overheating or overcharging, and,

(i) A battery temperature sensing and over-temperature warning system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition or,

(ii) A battery failure sensing and warning system with a means for automatically disconnecting the battery from its charging source in the event of battery failure.

(8) Any Li battery installation whose function is required for safe operation of the aeroplane, must incorporate a monitoring and warning feature that will provide an indication to the appropriate flight crewmembers, whenever the capacity and SOC of the batteries have fallen below levels considered acceptable for dispatch of the aeroplane.

(9) The Instructions for Continued Airworthiness must contain maintenance procedures for Lithium-ion batteries in spares storage to prevent the replacement of batteries whose function is required for safe operation of the aeroplane, with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at low SOC.

(b) Compliance with the requirements of this Special Condition must be shown by test or, with the concurrence of EASA, by analysis.

- END –

SPECIAL CONDITION:	**F-62 SC: Flight Instrument External Probes - Qualification in extended Icing Conditions**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1323(d), 23.1326
ADVISORY MATERIAL:	CS 25 Appendix C

BACKGROUND

Icing conditions related contamination of Flight Instrument External Probes is currently regulated through requirement CS 23.1323 (d) for airspeed indicating system and CS 23.1325(b)(3) for static pressure system as follows:

CS 23.1323 (d)

If certification for instrument flight rules or flight in icing conditions is requested, each airspeed system must have a heated pitot tube or an equivalent means of preventing malfunction due to icing.

CS 23.1325(b)(3)

If a static pressure system is provided for any instrument, device, or system required by the operating rules, each static pressure port must be designed or located in such a manner that the correlation between air pressure in the static pressure system and true ambient atmospheric static pressure is not altered when the aeroplane encounters icing conditions. An anti-icing means or an alternate source of static pressure may be used in showing compliance with this requirement

In addition, the CS-Definitions / CS 25 Appendix C define maximum icing conditions within stratiform (continuous) and cumuliform (intermittent) clouds upon which approval of airplane operations in icing conditions is based. Considering clouds containing only supercooled liquid droplet characteristics, CS-Definitions / CS 25 Appendix C provides relationship between mean effective drop diameters, liquid water content and temperature, of the droplets as well as the definition of the icing cloud envelope in terms of horizontal and vertical extent, and altitude w.r.t. temperature.

A significant number of in service events have been reported in relation to flight instrument external probes operation in icing conditions. Even though most of the incident reports involved airspeed fluctuation while in severe atmospheric conditions, temporary loss of airspeed indications has also been experienced. Analysis of the available atmospheric conditions at the time of the incidents showed icing conditions at an unusually high altitude and at a very low temperature. Such events have been reported up to 45000ft and -70°C of Static Air Temperature. It is therefore likely that some of these incidents were due to the presence of ice crystals in the atmosphere. These conditions are outside the environment of CS-Definitions / CS 25 Appendix C.

Pitot tubes are mounted such that they typically are high efficiency collectors of ice crystals.

Encountering high concentrations of ice crystals can lead to the blockage of Pitot probes as the energy required to melt the ice crystals can exceed CS-Definitions / CS 25 Appendix C icing conditions design requirements. Recent incidents evidenced that some failures of the Pitot probe heating resistance may not be seen by the low current detection system on aircraft. In some conditions, an out of tolerance resistance, failing to provide a proper Pitot probe ice protection could not be detected.

A number of events of malfunctioning and/or damage to temperature probes have also been reported and attributed to severe adverse environment encounters and EASA is aware of events due to ice crystal accumulations on angle of attack probes, or other angle of attack sensors.

CS-Definitions / CS 25 Appendix C has been in use since 1964 for selecting values of icing-related cloud variables for the design of in-flight ice protection systems for aircraft. However, glaciated conditions (icing conditions totally composed of ice crystals without supercooled liquid water) and mixed phase icing conditions (condition containing both supercooled liquid water and ice crystals) are not included in the current Appendix C / CS 25 or the CS-Definitions. The ARAC joint Engine and Power Plant Installation Harmonization Working Groups, hereafter referred to as EHWG, drafted a proposed rules addressing FAA 14 CFR Part 25 aircraft turbofan engine installation icing and propeller requirements and Part 33 turbofan engine icing requirements. Included in the EHWG draft rules is a proposed Appendix D to FAA 14 CFR Part 33 defining high ice water content environments in mixed phase and glaciated conditions. The proposed Appendix D to 14 CFR Part 33 has been developed using the history of engine ice crystal in-service events, theoretical models of the atmosphere and atmospheric flight test results (McNaughton FTs). It is intended to be a more representative characterization of the icing conditions that lead to engine events and, based on the recent evidence, appear to cause Pitot probe icing issues.

The Agency followed this proposed regulatory evolution by publishing the NPA 2011-03 which proposes to update large aeroplanes Certification Specifications (CS-25) for flight in icing conditions and in particular a new CS 25.1324 proposing the high ice water content environments in mixed phase and glaciated conditions in a new Appendix P of the CS 25

It should also be noted that compliance to the ETSO qualification standard for electrically heated Pitot and Pitot-static tubes (ETSO-C16a) and for stall warning instruments (ETSO-C54) is not sufficient in itself in demonstrating compliance to the installation requirements of CS 23.1309(a), 23.1323(d), 23.1325(b)(3) and 23.1326. The ETSO C16a specifies free-stream conditions and do not consider the potential installation effects. Depending on the probe design and aircraft installation these installation effects can lead to the Liquid Water Content (LWC) at the probe location being several times greater than the free-stream conditions.

CS-Definitions / CS 25 Appendix C conditions and ETSO C16a / ETSO C54 does not include mixed phase and ice crystal icing conditions and the operating rules do not prohibit operations in such environment.

There are no specific icing regulations for angle of attack probes, or other angle of attack sensors. CS 23.1309 has been used to address icing of angle of attack probes under some conditions. Section 23.1309(b) requires that equipment perform its intended function under all foreseeable operating conditions. Thus, compliance with CS 23.1309(b) has been used to assess whether the angle of attack systems function properly in the icing conditions for which the aircraft is certificated. Those certifications only include the icing conditions in CS-Definitions / CS 25 Appendix C.

SPECIAL CONDITION (SC-F-62, Issue 1)

1. Replace CS 23.1323(d) and 23.1326 by SC 2 & 3 here below.

2. Flight Instrument External Probes Heating Systems

   Each Flight Instrument External Probes Systems must be heated or have an equivalent means of preventing malfunction due to icing conditions specified in CS-Definitions / CS 25 Appendix C and mixed phase / ice crystal conditions as defined in Appendix 1 of this Special Condition. Additional guidance is contained in Appendix 2 of this SC.

3. Flight Instrument External Probes heat alerting systems

   If a flight instrument external probe heating system is installed, an alerting system must be provided to alert the flight crew when the flight instrument external probe heating system is not operating or not functioning normally. The alerting system must comply with the following requirements:

(a) The alert provided must conform to the Caution alert indications.

(b) The alert provided must be triggered if either of the following conditions exists:

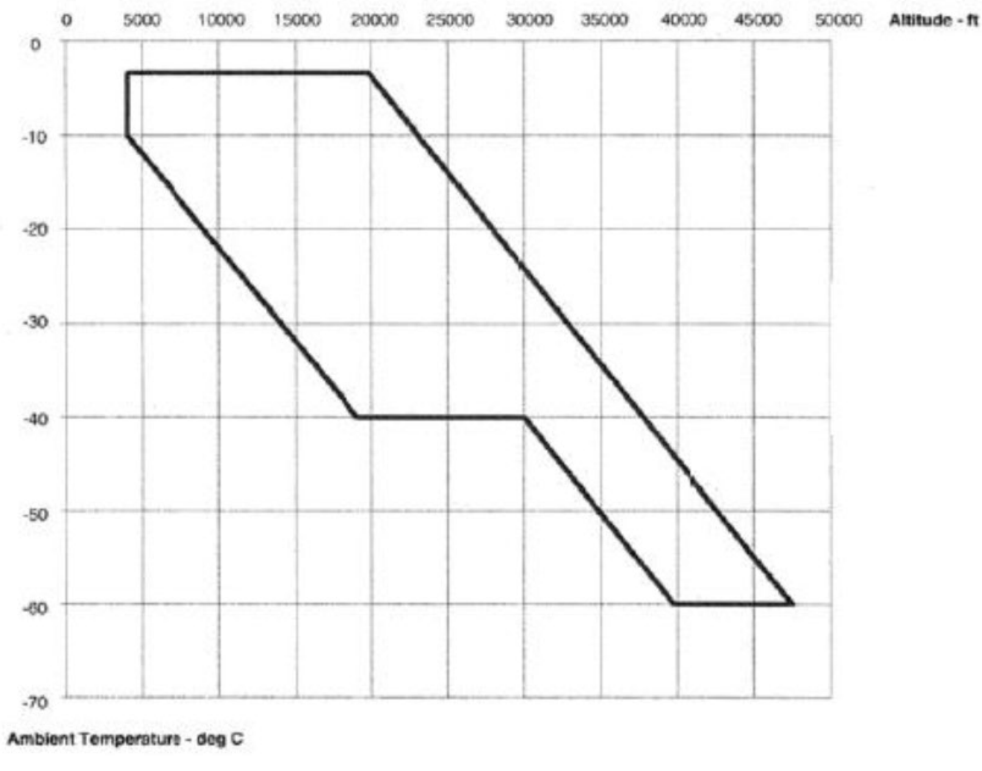
(1) The flight instrument external probe heating system is switched 'off'.

(2) The flight instrument external probe heating system is switched 'on' and any flight instrument external probe heating element is not functioning normally.

Mixed Phase and Ice Crystal Icing Envelope (Deep Convective Clouds)

This ice crystal icing envelope is depicted in the Figure 1.

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.

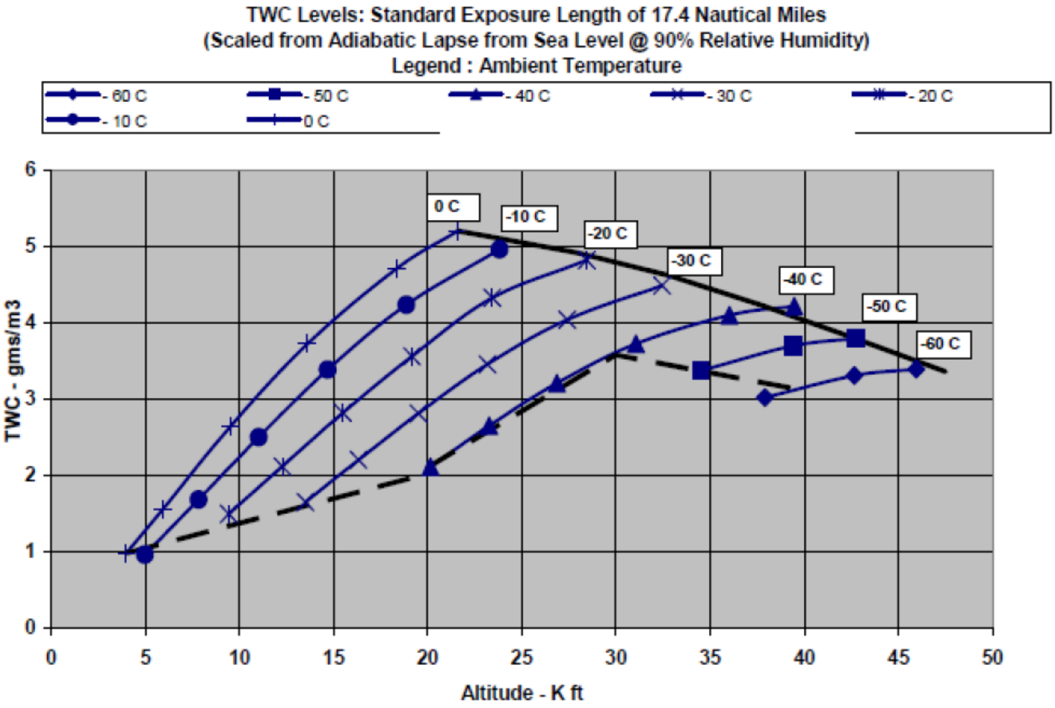


Figure 2 Total Water Content

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 except as noted in the Table 1.

Temperature Range in ° C	Horizontal Cloud Length	LWC – g/m3
0 to -20	</= 50 miles	</=1.0
0 to -20	Indefinite	</=0.5
< -20		0

Table 1 Supercooled Liquid Portion of TWC

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 (see Figure 3).

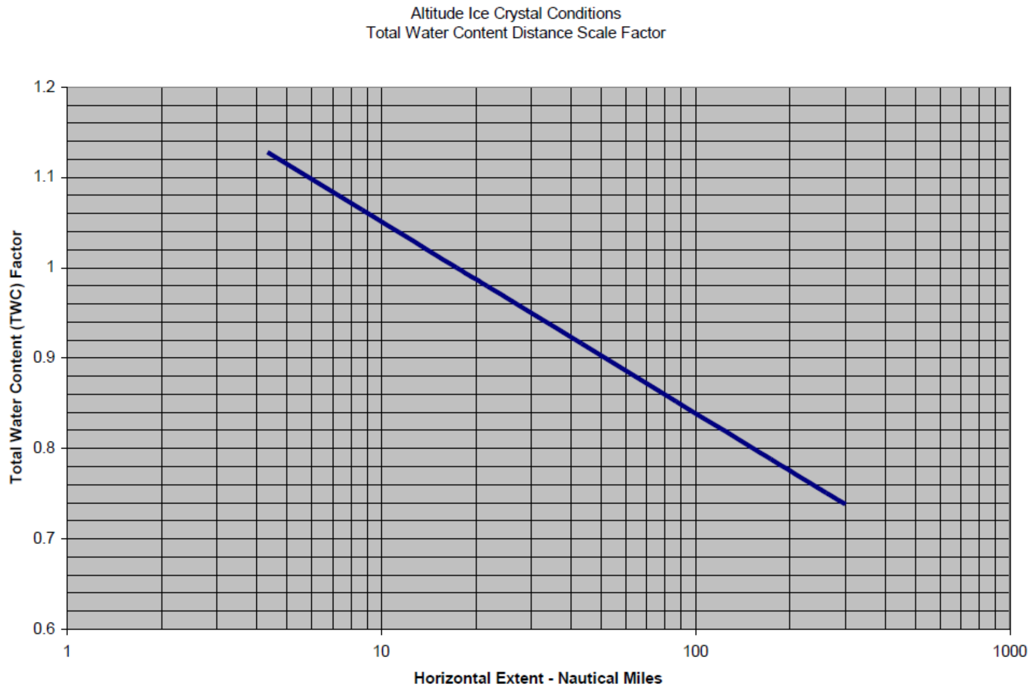


Figure 3 Exposure Length Influence on TWC

- END –

EQUIVALENT SAFETY FINDING:	**F-90 ESF: ASI Flaps Markings on PFD**
APPLICABILITY:	PC-24
REQUIREMENTS:	23.1311 (a)(7) 23.1545 (b)(4)
ADVISORY MATERIAL:	AC 23.1311-1C

BACKGROUND

The Airspeed indicator as described in the previous section does not comply with requirements CS 23.1311(a)(7) and 23.1545 (b)(4), which states the following:

23.1311 (a)(7) Airspeed indicator.

Incorporate visual display of instrument markings required by 23.1545 or visual display that alerts the pilot [..].

23.1545 (b)(4) Airspeed indicator.

(b) The following markings must be made:

(3) For the normal operating range a green arc [..]

(4) For the flap operating range, a white arc with the lower limit at VS0 at the maximum weight, and the upper limit at the flaps extended speed VFE established under 23.1511.

AC 23.1311-1C (17.11.2011 - aligned with FAR 23 Amdt 23-62).

§ 17.7.2 [..] incorporate the following awareness cues [..]:

a. Red band from Vso to 0

b. Red band from Vmo to top of airspeed tape

c. Green arc [..] is not required [..]

d. Yellow band between Vs0 to Vs1 is optional [..]

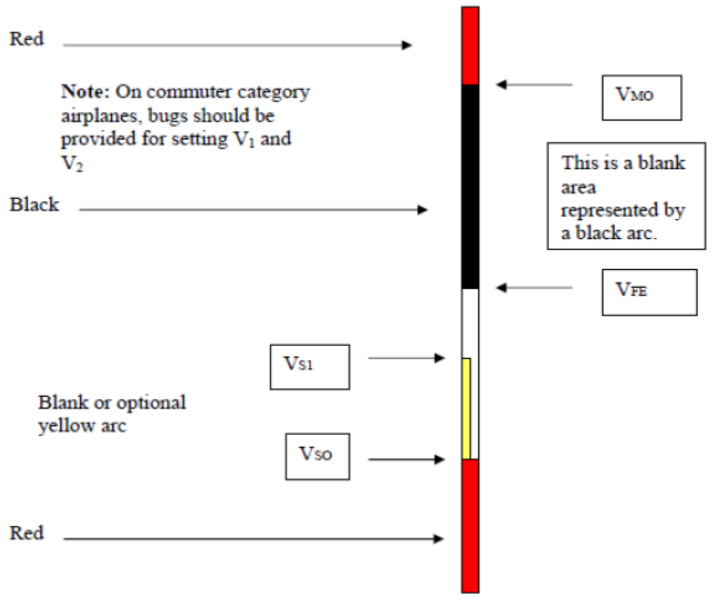


Figure 3. Low-Speed and High Speed Awareness for V_{MO} Airplanes

EQUIVALENT SAFETY FINDING

The PC-24 is a commuter twin turbojet that incorporates the Honeywell Primus ApexTM, an integrated "all-glass" avionics suite, and an electronic standby ESIS.

PFD

Primary flight information is indicated to the crew on the pilot's Primary Flight Display (PFD) and optionally the copilot's PFD. Airspeed is indicated to the crew by means of a moving vertical tape in combination with a rolling digit indicator on the left hand side of the ADI section of each pilot's PFD.

In accordance with guidance provided in FAA Advisory Circular AC 23.1311-1B, the APEXTM linear airspeed tape indicator includes airspeed awareness cues that are equivalent or superior to the cues provided by traditional round dial type indicators. These awareness cues include:

- ✓ Altitude dependent VMO/MMO airspeed limitation indication (barber pole bar).
- ✓ Aircraft configuration related airspeed constraints (red bar and speed bugs).
- ✓ Airspeed trend vector, indicating predicted airspeed with 6 seconds look ahead (white bar).
- ✓ Approach speed reference dynamic cue = f(Mass, Accel.) - (green chevron ~ 1.3 VS0 /S1)
- ✓ Aircraft configuration dependent low-speed awareness indication (red bar).

In addition to these awareness cues, the system also includes the following "attention getters" to alert the crew of imminent or actual alert conditions:

- ✓ "STALL" and "OVERSPEED" annunciations displayed on the ADI section of the PFD to alert the pilot of an imminent stall or speed exceedance condition.
- ✓ Color changes or emphasis of display elements (e.g. color change of digital airspeed readout).

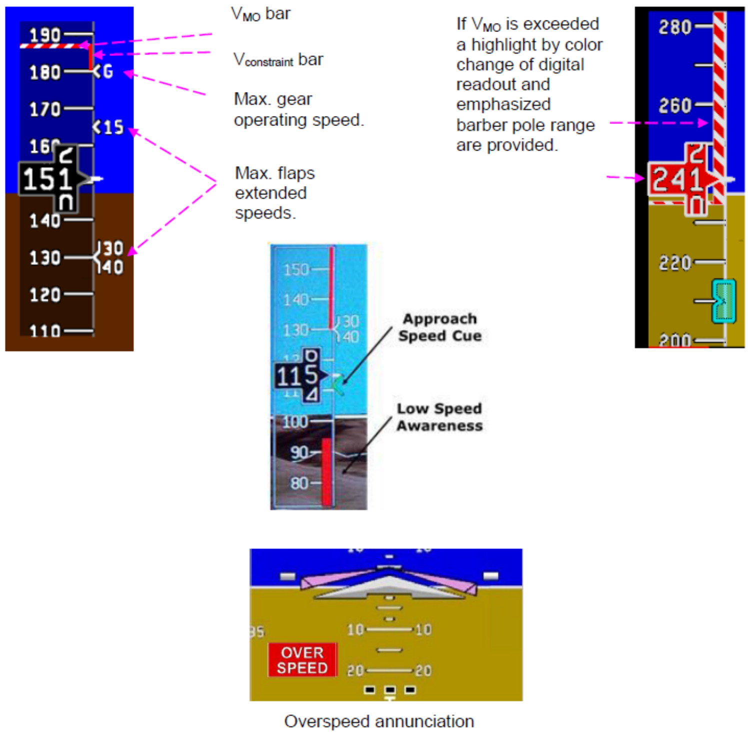
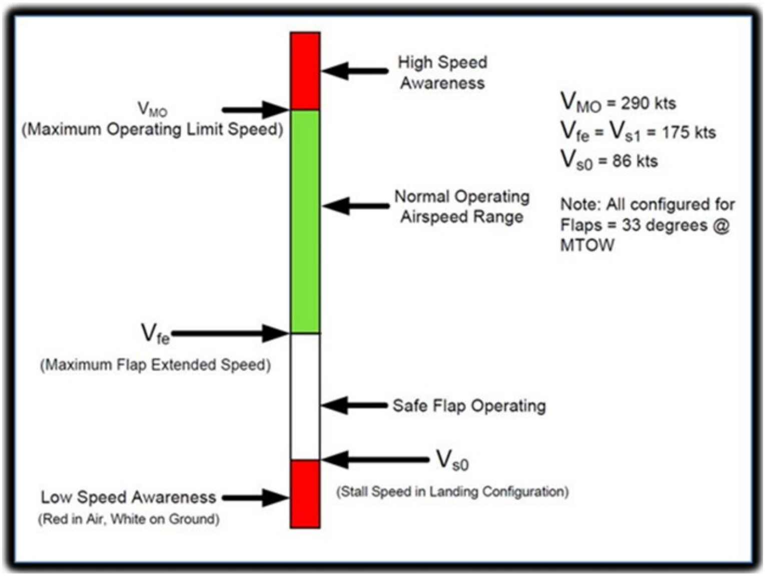


Figure 1 – Examples of airspeed awareness cues on the Apex system.

ESIS

The ESIS design incorporates all of the required airspeed marking and by enabling the red low speed awareness bar (Vs0=86Kts @ MTOM 1g Landing Flap) and the max flap extension speed (Vfe=175Kts). The diagram below reflects the final ESIS configuration.



In conclusion, Pilatus & EASA believes that the design as summarized above is providing an acceptable equivalent level of safety to what is required by CS 23.1545 (b)(4) for the following reasons:

- ✓ The design provides awareness to the crew of the airspeed range (relative to the present airspeed) within which the flaps can be safely extended beyond the 0° setting.
- ✓ The implementation of the airspeed indicator follows the guidance provided in AC 23.1311-1B and provides airspeed awareness cues that are equivalent or superior to the traditional round dial type indicator.
- ✓ The airspeed indicator markings required by the rule are written with a round-dial type indicator in mind. Applying these markings to linear tape style airspeed indicators may under some circumstances lead to conflicts with other symbols. On the ApexTM system, such a conflict would exist between the Flaps operating range marking required by 14 CFR, Part 23, § 23.1545 (b)(4) and the airspeed trend vector, both of which have the appearance of a white bar alongside the airspeed tape.
- ✓ The ApexTM system displays speed constraints associated with flap and gear status configuration.

In addition, the following aircraft configuration dependent speed constraint symbols are displayed on the airspeed tape:

Condition	Speed constraint symbols
Landing gear in transit (extending or retracting).	Red speed constraint bar from V_{MO} down to the landing gear operation speed bug.
Flaps extended position nn °.	Red speed constraint bar from V_{MO} down to the flap extended position speed bug (xxx KCAS).

If the current airspeed exceeds a speed limit (as marked by the red speed constraint bar or the VMO barber pole), the Primus ApexTM system will alert the crew by changing the color of the digital airspeed readout.

An equivalent level of safety is demonstrated by the design detailed above and through the Human Factors ground and flight test evaluations, where the awareness of speed, speed dynamic behaviour in relation to the setting of the Flaps is ensured for all phase of flight under adverse flight conditions is also demonstrated.

- END –

EQUIVALENT SAFETY FINDING:	**F-108 ESF: Third Attitude Instrument Loss, Electronic Standby Instrument System (ESIS)**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1303(g)(3)(i) , CS 23.1303(g)(3)(ii), CS 23.1303(g)(3)(iv)
ADVISORY MATERIAL:	--

BACKGROUND

The PC-24 is a commuter category airplane, with capacity for 10 or more passengers, capable of IFR operations. Per CS 23.1303(g)(3), the PC-24 must have a third attitude instrument that meets specific requirements.

The Electronic Standby Instrument System (ESIS) installed in the PC-24 is considered to be the third attitude indicator; however, it isn't fully in compliance with the regulation. The regulation requires a third attitude instrument to be operative after total failure of the electrical generating system.

It was shown that the ESIS failed to be operative after losing the electrical generating systems. Pilatus's electrical system is designed to exclude the ESIS from being powered by the emergency power supply. And, the ESIS doesn't have a backup battery in it to remain operational after losing electrical power.

This Equivalent safety Finding (ESF) is based on the Certification Action Item that records the discussion on the loss of the ESIS instrument in case of dual generator failure.
The PC-24 architecture and the electrical system design don't have the designated third attitude instrument, ESIS, included as part of the essential load (i.e., avionics equipment) to be powered for continued safe flight and landing.
Due to past experiences with the complex avionics system, the PC-24 design raised the following concerns:

Not having an independent ESIS to rely on during critical flight phases when encountering blanking displays, which the APEX system exhibited on other previous installations.

1) Not able to mitigate unforeseen failure modes without independent ESIS when cockpit is equipped with highly complex, integrated system.

More importantly, the design is deemed non-compliant with the specific regulatory requirements (see referenced regulation), per PC-24 certification basis.

EQUIVALENT SAFETY FINDING

The PC-24 design includes three independent sources and displays of Attitude as required by FAR 23.1303(g). These are the IRS/PPFD, AHRS/CPPFD and Electronic Standby Instrument, all three of these sources and displays operate independently.

In case of the PC-24, the ESIS does not have an internal battery. However, the PC-24 ESIS not having an internal battery does not undermine the intent of 23.1303(g)(3)(i) rule because safety equivalency to the rule is shown by having a different 3rd attitude system that is powered from an independent source.

In fact, the advancement of technology in Display systems, electronically regulated power generation systems, inertial reference systems and AHRS systems with MEMs gyros has made it possible for these systems to be powered from a battery source and meet the regulatory requirements for duration;

in the case of the PC-24, a 60 minute duration as imposed by EASA through a special condition CRI instead of the 30 minute duration in the 23.1303(g)(3)(ii).

The Pilatus PC-24 architecture does not power the ESIS in the event of a dual generator failure; Pilatus has chosen to power the pilot’s primary sensors and displays from the battery for this failure event providing an equivalent level of safety to the requirement 23.1303(g)(3)(i). In regards to Display of Attitude, the Pilot PFD and Upper MFD are powered as well as MAU1a and the IRS. This combination of equipment constitutes an attitude system and is available without any pilot action after total failure of the power generating system and equivalent to the requirement of 23.1303(g)(3)(iv).
The ESIS is powered and available in all electrical failure cases with the exception of loss both generators.

In conclusion, Pilatus mitigates the risk of PC-24 ESIS not having an independent power source and has a superior level of safety to that required by FAR 23.1303(g)(3)(i), (g)(3)(ii) and (g)(3)(iv) for the 3rd attitude sensor.

The compensating factors for risk mitigation are described below:

- ✓ the continued use of the primary displays and sensors for a 60 minute duration after losing electrical generating power;
- ✓ the availability of the autopilot;
- ✓ PFI in the same format and location as in normal operation;
- ✓ Pilot does not have to re-orient to a new display format; eliminating delays in the pilot having to transition to a standby instrument
- ✓ The availability of the a second full PFD format on the upper MFD (PFD reversion) that can be used by the right seat pilot within their primary field of view;
- ✓ The design also has a higher availability and reliability rate compared to the stand-alone ESIS.
- ✓ Availability of FMS and Radio Navigation.
- ✓ These features greatly reduce pilot workload and fatigue.

- END –

SPECIAL CONDITION:	**F-110 SC: Auto-throttle**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 25.1329 Amdt 25/4, CS 23.143 Amdt 23/4, PC-24 CRI F-03, EASA SC-F23.1329-01.
ADVISORY MATERIAL:	AMC 25.1329 Amdt 25/17, PC-24 CRI F-51, CRI F-59

BACKGROUND

The PC-24 engines are controlled by dual-channel FADECs and operated by twin Thrust Control Levers located on the Centre Console between the two pilots. The thrust control levers are equipped with auto-throttle function.

SPECIAL CONDITION – Auto-Throttle for CS-23 Aircraft (SC-F23.1329-01, Issue 4)

The following special conditions, quoted from CS 25.1329 and modified with part 23 references, are proposed for the Pilatus PC-24 airplane.

(a) Quick disengagement controls for the Auto-Thrust functions must be provided for each pilot. The Auto-Thrust quick disengagement controls must be located on the thrust control levers. Quick disengagement controls must be readily accessible to each pilot while operating the control wheel and the thrust control levers.

(b) The effects of a failure of the system to disengage the Auto-Thrust functions when manually commanded by the pilot must be assessed in accordance with the requirements of CS 23.1309.

(c) Engagement or switching of the Auto-Thrust system, a mode, or a sensor must not produce a transient response affecting the control or flight path of the airplane any greater than a minor transient, as defined in paragraph (l)(1) of this section.

(d) Under normal conditions, the disengagement of any automatic control function of a flight guidance system may not produce a transient response of the airplane's flight path of the aeroplane any greater than a minor transient.

(e) Under rare-normal or non-normal conditions, the disengagement of any automatic control functions of a flight guidance system must not produce a transient response affecting the control or flight path of the aeroplane any greater than a significant transient, as defined in paragraph (l)(2) of this section.

(f) The function and direction of motion of each command reference control (e.g. heading select, <u>speed select, N1 select or Auto-Thrust modes (i.e. De-rated TKF, FLEX, MAX TKF, MAX CONT, TOGA, ANTI-ICE IDLE, etc.)</u> must be readily apparent or plainly indicated on, or adjacent to, each control if necessary to prevent inappropriate use or confusion.

(g) Under any condition of flight appropriate to its use, the flight guidance system must not:
1) produce unacceptable loads on the aeroplane (in accordance with the dedicated project special conditions CRI that addresses CS 25.302 requirements), or
2) create hazardous deviations in the flight path.

This applies to both fault-free operation and in the event of a malfunction, and assumes that the pilot begins corrective action within a reasonable period of time.

(h) When the flight guidance system is in use, a means must be provided to avoid excursions beyond an acceptable margin from the speed range of the normal flight envelope. If the aircraft experiences an excursion outside this range, the flight guidance system must not provide guidance or control to an unsafe speed.

(i) The flight guidance system functions, controls, indications, and alerts must be designed to minimize flight crew errors and confusion concerning the behaviour and operation of the flight guidance system. Means must be provided to indicate the current mode of operation, including any armed, transitions, reversions modes, specific levers positions (motorized or not) and engine automatically targeted setting (Thrust Director). Selector switch position is not an acceptable means of indication. The controls and indications must be grouped and presented in a logical and consistent manner. The indications must be visible to each pilot under all expected lighting conditions.

(j) Following disengagement of the Auto-Thrust, a caution (visual and aural) must be provided to each pilot.

(k) During Auto-Thrust operation, it must be possible for the flight crew to move the thrust levers without requiring excessive forces. Depending on the design, the ATS system may disconnect or the levers return to ATS setting position once Human forces are removed. The Auto-Thrust may not create an unsafe condition when the flight crew applies an override force to the thrust levers.

(l) For purposes of this section, a transient is a disturbance in the control or flight path of the airplane that is not consistent with response to flight crew inputs or environmental conditions.
1) A minor transient would not significantly reduce safety margins and would involve flight crew actions that are well within their capabilities. A minor transient may involve a slight increase in flight crew workload or some physical discomfort to passengers or cabin crew.
2) A significant transient may lead to a significant reduction in safety margins, an increase in flight crew workload, discomfort to the flight crew, or physical distress to the passengers or cabin crew, possibly including non-fatal injuries. Significant transients do not require, in order to remain within or recover to the normal flight envelope, any of the following:
   (i) Exceptional piloting skill, alertness, or strength.
   (ii) Forces applied by the pilot which are greater than those specified in CS 23.143(c).
   (iii) Accelerations or attitudes in the airplane that might result in further hazard to secured or non-secured occupants.

The applicant must also functionally demonstrate independence between the left and right Auto-Thrust system installation to prove they cannot have a single point failure that is not extremely improbable that inadvertently leads to a loss of thrust, or to substantial uncommanded thrust changes & transients, in both engines simultaneously.

- END –

EQUIVALENT SAFETY FINDING:	**F-111 ESF: Mechanical Magnetic Compass - Flight Deck without Whisky Compass**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1303(c) Amdt 3
ADVISORY MATERIAL:	AC 23.1311-1C

BACKGROUND

The PC-24 design does not include a traditional Mechanical Magnetic Compass. The standby function is taken over by the ESIS L3 ESI-1000 interfaced with an L3 MAG-3100 magnetometer.

"Whiskey" compasses had the advantage to be the last independent defence barrier because they are not connected to any electrical system except for very low power night lighting. Their disadvantages are their sensitivity to electromagnetic fields (i.e. generated by windshield heaters, radio transmissions), their sensitivity to accelerations or their limited accuracy.

Traditionally, a non-stabilized compass used for direction indication requires no electrical power. The use of an electric-only direction indicator places a premium on availability of electrical power. So whiskey compass are not subject to the same failure modes.

CS 23.1303(c) at Amdt 3 requires "non-stabilized magnetic direction indicator". This is interpreted as being a "Whisky" compass. FAR 23.1303(c) Amendment 23-62 removed this prescriptive requirement and offers the potential to remove completely Mechanical Magnetic Compass and replace them with electronic magnetometers.

However CS 23.1311(a)(5) requires an "independent magnetic direction indicator" as backup for electronic displays (PFDs, MFDs). Here, the word "independent" is of interest to the authority.

Therefore, an Equivalent Level of Safety is necessary against the CS 23.1303(c) Amdt 3.

EQUIVALENT SAFETY FINDING

An Equivalent level of safety to CS 23.1303(c) Amdt 3 can be demonstrated through the use of a magnetic direction indicator that meets the accuracy requirement of AC 23.1311-1C instead of CS 23.1547.

A stabilized standby magnetic direction indicator installed considering the following elements discussed below is considered equivalently safe to a non-stabilized magnetic direction indicator:

- It must provide a reliability commensurate with its intended backup function. The electrical power independence against other main circuits must be demonstrated. It is normally expected that magnetometer and displays are powered by a standby battery pack providing electrical power supply in case of total electrical system breakdown. It shall meet the time requirement of the PC-24 special conditions, EASA SC-F23.1353-01 issue 2, as described in the PC-24 CRI F-01.

- It must be installed as per CS 23.1327. Unlike the typical non-stabilized magnetic direction indicator ("whiskey compass"), the standby electronic display, which utilizes a remote-mounted magnetic flux detector and gimballed stabilized should have residual, uncompensated errors so small that a calibration placard would provide insignificant value to the flight crew.

Note: the discussion on "power independence" is addressed in the Equivalent safety Finding CRI F-108

- END –

EQUIVALENT SAFETY FINDING:	**F-112 ESF: Pressurization and Pneumatic systems – bleed air level compliance**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.1438 Amdt 3
ADVISORY MATERIAL:	FAA AC 23-17C

BACKGROUND

The PC-24 is a Part 23 commuter Jet with a relatively complex combined Pneumatic, Ice Protection and Environmental Control System located in the rear part of the fuselage and RH over-wing fairing. Per CS 23.1438 (b) Amdt 3, all pneumatic system elements must be burst pressure tested to 3 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure, while all pressurization system elements must be burst pressure tested to 2 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure as per CS23.1438 (a). CS23.1438(c) also allows the use of analysis or combination of analysis and test to show compliance to CS23.1438(a) and (b).

The design architecture of the PC-24 is such that compliance to 23.1438 (b) is literally not directly met for some of the components in the bleed air system. Indeed, these components were demonstrated to withstand a burst pressure of 2.0 times instead of 3.0 times the maximum normal operating pressure. However, a redundant means is provided to ensure that these components will not be exposed to steady state pressure higher than the proof pressure of 1.5 times the maximum normal operating pressure.

Therefore, an Equivalent Safety Finding was requested against the CS 23.1438 (b) Amdt 3 and an equivalent level of safety shown by design.

EQUIVALENT SAFETY FINDING

Engine extracted bleed air serves three different aircraft systems, namely the Pneumatic System (PS), the Ice Protection System (IPS) and the Environmental Control System (ECS). Pressure and temperature in the systems are regulated by dedicated valves and monitored in such manner that, should the regulating device drift, the anomaly is detected and the faulty line automatically isolated before critical thresholds are reached.

Since abnormal pressure transients could be potentially very fast, a pressure relief device (i.e. burst disk) is also installed in the pneumatic system, immediately downstream of the pressure regulating valve. The pressure regulation function of the pneumatic system is independent from its shut off function. This burst disk is designed to rupture and release the system pressure at a threshold equal (or below) the proof pressure of all the components located downstream.

In case of fast abnormal pressure rise through the pressure regulating function, the burst disk assembly rupture will not only open & relief the pressure but will also contribute to the isolation of the affecting line by commanding the shut off function. With such design, the components installed downstream of the burst disk will not be exposed to steady-state pressure in excess of the proof pressure that the components were demonstrated to withstand without distortion. Testing on the burst disk demonstrated that the disk rupture pressure range is maintained until end of life is reached

This ensures that all the components located downstream will not be exposed to steady state pressure higher than 1.5 times the maximum normal operating pressure. This pressure is the minimum pressure for which the components are qualified through proof pressure testing. There is a sufficient margin to a burst pressure of 2.0 times the maximal operating margin.

The release of hot bleed air through the burst disk into the rear fuselage is not hazardous, since the assembly is designed to avoid direct impingement on surrounding structure/components. The time necessary to isolate the line, in addition to the pressure relief, varies from 3 to 4 seconds depending on the system pressure. Therefore, the presence of the burst disk therefore protects the

PS, ECS and IPS components from exposure to pressures that may impair their correct functionality.

The automatic command of the shut off function, in addition to the burst disc rupture, also prevents the engine from excessive bleed air extraction and adverse effect on engine handling.

The burst disks design will follow the EN ISO 4126-2:2003 standard specifying the requirements for bursting disc safety devices, including the requirements for the design, manufacture, inspection, testing (i.e. minimum number of units to be burst tested depending on the total number of units produced in a batch) , certification, marking, and packaging.

Among the environmental testing performed on the Burst Disk assembly, Vibration, Operational Shock (DO160F sections 7 and 8) and Endurance will be considered and these tests will be performed on the same unit in order to demonstrate that the end of life performance is maintained

Hence in summary, the components installed upstream of the burst disk were tested to three (3) times the Maximum Normal Operating Pressure. All the components installed downstream of the burst disk are exposed to steady state pressures not in excess of the proof pressure the components were demonstrated to withstand.

Therefore, the applicant believes that the burst disk installation guarantees sufficient margin to the burst pressure level utilised for some of the components and an equivalent level of safety to the one required by CS 23.1438 (b) Amdt 3 is achieved.

- END –

SPECIAL CONDITION:	**G-02 SC: Approval process of digital AFM**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.1581-1583-1585-1587-1589
ADVISORY MATERIAL:	None.

BACKGROUND

In order to obtain a Type Certificate and to facilitate operational approvals, several documents are provided to EASA, being the primary certification authority, for approval such as the AFM (Airplane Flight Manual).

Today it is technically feasible to produce, release and manage documents by electronic means, and to control the integrity of electronic documents by means of electronic signature.

Therefore, Pilatus intends to provide AFM documents in an electronic format, and to obtain proof of approval and integrity (i.e. ensure that undue modifications further to data transfer or non-intentional modifications of the document are detected or precluded) of the electronic AFM from EASA by means of electronic signature.

This CRI aims at defining the rules and procedures to be followed to ensure completeness and integrity of the approved AFM document under digital format.

SPECIAL CONDITION (SC-B.1581-01)

1. General guidelines to replace AFM paper format by electronic/digital format

The use of electronic documents as an alternative to paper documents in a legal context, and the use of electronic signature as a means of ensuring the integrity and authenticity of an electronic document is recognised and regulated by European Directive 1999/93/CE of the European Parliament and council, issued on 13 December 1999.

Therefore, the EASA considers that the use of an electronic AFM is, in principle, acceptable, provided that the process for producing, approving and distributing the electronic AFM ensure an equivalent (or better) level of control, traceability, and accountability as the current paper based process.

EASA should approve the "envelope" version of the airplane flight manual in a paper format, as well as any subsequent revision of this envelope AFM.

This approval is carried out for the EASA type certification, and in accordance with specific agreements on behalf of other certificating or validating airworthiness authorities.

This envelope AFM contains all the necessary information to cover all possible individual aircraft configurations and the specific requests of other airworthiness authorities having certified/validated the model.

The applicant had then the responsibility, under the Authority of their DOA/POA (Design Organisation Approval/Production Organisation Approval), to define the precise content of each individual aircraft AFM, by selecting the appropriate approved pages from the envelope AFM, according to the known configuration of this individual aircraft, and, if needed, the particular requests of the Authority of the country of registration of the aircraft, and distributed this AFM, in a paper format, to the operator. The operator could then copy the information contained in the AFM to build its own operational documentation. The operator could also add to this AFM information approved by his local Airworthiness Authorities to cover Supplemental Type Certificates (STC) or specific operations.

Changing from a paper format to an electronic format is intended to make it easier to introduce, at any stage of the process, changes in the format and content of the AFM, to enable improved distribution processes and allow the operator greater flexibility in use of the data.

Consequently, there is a need for better control processes to ensure traceability of the changes made, the approvals gained, the integrity of the published document, and any areas of the approved document that could be changed by the operator.

The EASA considers that the approved Electronic AFM should encompass:

- The technical content of the various items composing the AFM (e.g. Limitations, Non- Normal and Normal procedures, performance data, fuel quantity tables);
- The structure of the technical content , i.e. the way the different sections, subsections and items of the AFM are ordered and structured in relation with each other's;
- The presentation format, i.e. the way the technical content and structure of the AFM is displayed on computer screen or printed, e.g. font type and size, relative position of paragraphs and subparagraphs.

EASA is concerned that electronic word processing tools offer wide and easily accessible possibilities of changing the structure and format of an electronic document, and that changing the structure and format could have unintended effects on the interpretation of the AFM document.

The applicant is requested to identify the processes, procedures, and electronic tools that they propose to put in place in order to:

- manage the draft envelope AFM, and subsequent revisions of it, during the period from submittal for review to the EASA team until final EASA approval and application of any electronic signature;
- after approval of the envelope AFM, build an approved AFM adapted to each individual airplane, and distribute it to the operator.

The proposed procedures and tools should ensure that the completeness and integrity of the technical content, structure and presentation format of the approved AFM is maintained throughout the process. The proposed procedures will need to be reviewed by both the EASA certification team and the DOA team and should be documented or referenced in the Applicant Design Organisation Manual.

Any electronic signature of an individual aircraft AFM should allow identifying that the documents conforms to the envelope AFM approved by EASA. Furthermore, the electronic signature should also identify that the particular AFM conforms with any additional requirements from the importing airworthiness authority.

If it is intended to allow operators to modify the approved digital AFM in order to build their own operational documentation, protections means should be put in place such that any modification of the technical content, structure or format of the approved AFM file would automatically and visibly remove the "approved" status of the concerned parts of the document.

The applicant should provide their plan for which digital AFM sections are proposed to be fixed (can't be modified by the operator), which sections the operator will be allowed to modify and provide justification on how the level of control for operator modifiable sections can be considered as equivalent to the current paper based process.

2. Practical implementation of the electronic AFM between the applicant and EASA

Any and all necessary and not already available hardware and software means necessary to receive, read and comment the electronic AFM submitted for approval must be furnished and install by the applicant, at its own expense, at all sites of EASA team members in charge of review and approval of the AFM (including external team members employed by NAAs or qualified entities). The furnishing and installation of all necessary hardware and software means must also conform with any conditions placed by the responsible parties, e.g. EASA, National Airworthiness Authorities, qualified entities etc.

The applicant should update as needed the supporting hardware and software means, in case this is necessitated by changes in the information systems technology.

The applicant should commit to provide means to retrieve the AFM successive revisions throughout the foreseen operational life of the aircraft, to cover the risk of obsolescence of the supporting hardware or software tools.

The applicant should ensure that the airworthiness authorities of all countries, where aircraft of the specific type and model are registered, have a means to access the associated AFM. This may be achieved by an electronic access to the approved and electronically signed AFM, or by provision of a printout of the AFM.

As done in the frame of paper AFM approval process, the EASA expects that only the envelope AFM would be subject of review and approval by the relevant EASA team.

The electronic signature should be applied to the AFM by the applicant under the privileges of their DOA based on and following issuance of the approval letter by EASA.

Unless the applicant considers alternate means and processes to be agreed by EASA, the current EASA approval process (as used for paper AFM) applies; as such, the electronic signature has to be understood as the introduction by the applicant in the AFM, under electronic format, of the EASA approval reference and associated approval date as mentioned in the EASA approval letter

3. Performance computation part of the AFM

The proposed procedures should also identify the handling of the performance computation part of the AFM (performance database, application software, excluding the operating system) in order to ensure that an adequate level of completeness and integrity is insured for this part of the AFM.

The AMC in appendix 2 provides guidance for the use of an approved database and application software to show compliance with applicable regulations concerning the performance information part of an AFM.

With the Interpretative Material in appendix 3 , EASA proposes more precise software certification guidelines when applying paragraph 6 of the AMC in appendix 2 “software integrity development an documentation requirements”. In particular, the guidelines provide more details on the software level to be used when applying DO 178B to this performance application software.

- END –

SPECIAL CONDITION:	**O-01 SC: Steep Approach**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS-23.75 Landing Distance, CS-23.143 Handling
ADVISORY MATERIAL:	

BACKGROUND

The PC-24 is a Part 23 turbojet powered aircraft with performance and flight characteristics that are consistent with the requirements of Part 25 aircraft.

This CRI adds the requirements for steep approach landing capability (SAL) approval.

SPECIAL CONDITION (SC-B 23.0075-01, Issue 1)

(SAL) 23.1 Applicability

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- 23 Subparts B and G They also apply in lieu of CS 23.75 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.

(SAL) 23.2 Definitions

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.

— VREF(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. VREF(SAL) may not be less than 1.3 VSO, 1.05 VMC, or a speed that provides the manoeuvring capability specified in CS 23.143(g) (issued from CRI B-03), whichever is greater and may be different from the VREF used for standard approaches.

— VREF(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. VREF(SAL)-1 may not be less than VREF(SAL).

(SAL) 23.3 Steep Approach Landing Distance

(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 VREF(SAL) or VREF(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 .

(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. 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; 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.

(SAL) 23.4 Climb: One-engine-inoperative

In a configuration corresponding to the normal all-engines-operating procedure in which VSR for this configuration does not exceed 110 % of the VSR 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, 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 VREF(SAL); and

(d) The landing gear retracted.

(SAL) 23.5 Safe operational and flight characteristics

(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) 23.5):

(1) The selected approach path angle at VREF(SAL) or VREF(SAL)-1 as appropriate;

(2) An approach path angle 2° steeper than the selected approach path angle, at VREF(SAL) or VREF(SAL)-1 as appropriate; and

(3) The selected approach path angle at VREF(SAL) minus 5 knots or VREF(SAL)-1 minus 5 knots as appropriate.

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

(i) 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;

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

(iii) 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;

(iv) 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

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

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

(d) For condition (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 the one-engine-inoperative approach climb configuration with one engine having been made inoperative for the following conditions:

(1) The selected steep approach angle;

(2) An approach speed of VREF(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 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 VREF(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 VREF(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.

(SAL) 23.6 Aeroplane Flight Manual

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

(a) The steep approach landing distance determined in accordance with paragraph (SAL) 21.3 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 23.75, and

(2) The one-engine-inoperative approach climb requirement of paragraph (SAL) 23.4 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) 23.5(g).

- END –

SPECIAL CONDITION:	**O-04 SC: Towbarless Towing Loads**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.509, CS 23.574, CS 23.1529
ADVISORY MATERIAL:	

BACKGROUND

If an aeroplane is approved for ground handling operations with towbarless towing vehicles, special attention has to be paid to the consequences for the nose landing gear.

In contrast with more conventional ground handling operations with tow bars, where the loads acting on the nose landing gear are limited by tow bar shear pin provisions or similar features designed to shear at a pre-determined loading level, during towbarless towing operations the braking and acceleration loads of the towing vehicle are transmitted directly to the nose gear.

This system of towing the aeroplane may introduces higher static and fatigue loads into the nose landing gear and its support structure as currently considered in CS 23.509 and CS 23.574. Also, the point of load application may be different between towbarless towing operations and operations with tow bars.

SPECIAL CONDITION (SC-O23.0509-01, Issue 2)

Towbarless Towing

In addition to CS 23.509, 23.574 and 23.1529 the following applies:

1. General

Towbarless towing vehicles are generally considered as ground equipment and are as such not subject to direct approval by the (aircraft) certifying agencies. However these vehicles should be qualified in accordance with the applicable SAE ARP documents and the static and dynamic (including fatigue) loads resulting from these qualification tests should be shared with the aircraft manufacturer to ensure that the nose landing gear and supporting structure is not being overloaded during towbarless towing operations with these vehicles.

Specific combinations of towbarless towing vehicle(s) and aircraft that have been assessed as described above and have been found to be acceptable should be defined in the Aircraft Maintenance Manual and/or in the Aircraft Flight Manual.

2. Limit static load cases

For the limit static load cases, the investigation may be conducted by rational analysis, supported by test evidence. The investigation must take into account the influence on the towing loads of the tractive force of the towing vehicle including consideration of its weight and pavement roughness.

Furthermore, the investigation must include, but may not be limited to, the following towbarless towing operation scenarios:

a. Push-back towing: Moving a fully loaded aircraft (up to Maximum Ramp Weight (MRW)) from the parking position to the taxiway. Movement includes; pushback with turn, a stop, and short tow forward to align aircraft and nose wheels. Engines may or may not be operating.The aircraft movement is similar to a conventional pushback operation with a towbar.

b. Maintenance towing: The movement of an aircraft for maintenance/remote parking purposes (e.g., from the gate to a maintenance hangar). The aircraft is typically unloaded with minimal fuel load.

c. Dispatch (operational) towing: Towing a revenue aircraft (loaded with passengers, fuel, and cargo up to Maximum Ramp Weight (MRW)), from the terminal gate/remote parking area, to a location near the active runway. The movement may cover several kilometers with speeds up to 32 km/h (20 mph), with several starts, stops and turns. Replaces typical taxiing operations prior to takeoff.

Operations that are explicitly prohibited need not be addressed.

3. Fatigue Evaluation

Fatigue evaluation of the impact of towbarless towing on the airframe must be conducted under the provision of CS 23.574 and CS 23.1529.

Specifically, the contribution of the towbarless towing operational loads to the fatigue load spectra for the nose landing gear and its support structure needs to be evaluated. The impact of the towbarless towing on the certified life limits of the landing gear and supporting structure needs to be determined.

The fatigue spectra used in the evaluation should consist of typical service loads encountered during towbarless towing operations, which cover the loading scenarios noted above for static considerations. Furthermore, the spectra should be based on measured statistical data derived from simulated service operation or from applicable industry studies.

4. Other Considerations

a- Specific combinations of towbarless towing vehicle(s) and aircraft that have been assessed as described above and have been found to be acceptable, along with any applicable towing instructions and/or limitations will have to be specified in the Aircraft Maintenance Manual and/or in the Aircraft Flight Manual.

b- Aircraft braking, while the aircraft is under tow, may result in loads exceeding the aircraft’s design load and may result in structural damage and/or nose gear collapse. For these reasons, appropriate steps to preclude aircraft braking during normal towbarless towing should be taken. The aircraft manufacturer must ensure appropriate information is provided in the Maintenance manual and the Aircraft Flight Manual.

- END –

SPECIAL CONDITION:	**AWO-101 SC: CAT II requirements for CS-23 Aeroplane**
APPLICABILITY:	PC-24
REQUIREMENTS:	CS 23.773, 23.1301, 23.1309, 23.1322, 23.1329, 23.1585 amdt 3
ADVISORY MATERIAL:	Flight Test Guide FAA AC 25-7D, AC 120-29A CAT I & II

BACKGROUND

CAT II approach minima are commonly used by commercial and business aviation aircraft around the world that would typically hold a Part 25 aircraft Type Certificate (TC). The CS-AWO refers directly to CS-25. Therefore, the CS-AWO does not repeat certain requirements already covered by CS-25 and provides only the additional requirements deemed necessary to perform approaches down to 100ft Height above touch down elevation (HAT).

At Low Visibility Operation (LVO) on an airport the capacity is drastically reduced to accommodate larger separations between aircraft. This in turn creates a high demand on ATC to provide a strictly organized traffic flow. In LVO, any flow perturbation has a strong impact on the airport capacity. As of today, only aircraft compliant to more stringent airworthiness requirements of Part 25 are participating to LVO. This means acceptable compartment view under heavy rain requesting a good removal capacity and redundancy.

EASA developed and released the Special Condition SC-023-div-08 for CAT II in CS 23. The purpose of this Special Condition is to provide the additional and adapted requirements deemed necessary for a safe CAT II operation with CS-23 aircraft when complying with CS-AWO Subpart 2 (CAT II).

SPECIAL CONDITION (SC-023-div-08, Issue 01)

SC-O23-div-08.01 - Applicability

This special condition is applicable to CS-23 commuter aircraft intended to be certified for CAT II operations in accordance with CS-AWO Subpart 2 complying with CS-23 amendment 3 or later.

The certification basis of the aircraft has to include the Special Condition SC-B23.div-01 'Human Factors', SC-F23.1309-02 (Protection from Effects of HIRF), and SC-F23.1309-03 (Protection from indirect Effects of Lightning Strike) or the certification basis is CS-23 amendment 4.

Note: If this SC has not been addressed during initial certification, it must be addressed to allow the application of this special conditions within the scope of CAT II operations.

SC-O23-div-08.02 - Front windshield protection:

CS-23.773 is replaced by the following:

(a) Both pilot compartment must be –

> (1) Arranged with sufficiently extensive clear and undistorted view to enable the pilot to safely taxi, take-off, approach, land and perform any manoeuvres within the operating limitations of the aeroplane.
>
> (2) Free from glare and reflections that could interfere with the pilot's vision. Compliance must be shown in all operations for which certification is requested.

(b) The aeroplane must have a means to maintain a clear portion of the windshield during precipitation conditions, enough for both pilots to have a sufficiently extensive view along the flight path in normal flight attitudes of the aeroplane. This means must be designed to function, without continuous attention on the part of the crew, in moderate rain considering speeds up to the maximum applicable approach speed for CAT II operation (at the worst case condition, Maximum Landing Mass, for the fastest configuration including system failure cases authorized for CAT II operation) +5kts.

(c) Each pilot compartment must have a means to either remove or prevent the formation of fog or frost on an area of the internal portion of the windshield and side windows sufficiently large to provide the view specified in sub-paragraph (a) (1). Compliance must be shown under all expected external and internal ambient operating conditions. It must be shown that the windshield and side windows can be easily cleared without interruption of normal pilot duties and without any pilot manual removal actions.

(d) No single failure of the systems used to provide the view required by subparagraph (b) of this paragraph must cause the loss of that view by both pilots in the specified precipitation conditions.

(e) Openable windows do not need to be provided if it is shown that an area of transparence surface will remain clear sufficient for one pilot to land the aeroplane safely in the event of any system failure or combination of failures, which is not, extremely improbable in accordance with CS-23.1309.

(f) Fixed Design Eye Reference Point (DERP) or other guides must be installed at each pilot station to enable the pilots to position themselves in their seats for an optimum combination of outside visibility and instrument scan. The visual acquisition of external references and the instruments scanning must be optimal and not masked by glare shield or other cockpit frames.

If lighted markers or guides are used, they must comply with the requirements specified in CS-25.1381.

(g) The means to maintain the clear portion of the windshield during precipitations should be an active rain removal means (e.g. windshield wipers, windshield bleed air). If a passive rain removal means is used (e.g. coating and/or windshield physical/geometrical properties) to achieve the acceptable forward visibility in precipitation conditions, then SC-O23-div-08.03 has to complied with.

SC-O23-div-08.03 – Passive Rain Removal:

SC-O23-div-O8.02 (b) is replaced by the following:

(b) The aeroplane must have a means to maintain a clear portion of the windshield during precipitation conditions, enough for both pilots to have a sufficiently extensive view along the ground or flight path in normal taxi and flight attitudes of the aeroplane. This means must be designed to function, without continuous attention on the part of the crew, in conditions from light misting to moderate rain from fully stopped in still air up to up to the maximum applicable approach speed for CAT II operation (at the worst case condition, Maximum Landing Mass, for the fastest configuration including system failure cases authorized for CAT II operation) +5kts.

SC-O23-div-08.04 Flight Crew Alerting

In addition to CS-23.1322 during CAT II operations the following must be complied with:

(a) Flight crew alerts must:

(1) provide the flight crew with the information needed to:

(i) identify non-normal operation or aeroplane system conditions, and

(ii) determine the appropriate actions, if any;

(2) be readily and easily detectable and intelligible by the flight crew under all foreseeable operating conditions, including conditions where multiple alerts are provided;

(3) be removed when the alerting condition no longer exists.

(b) Warning and Caution alerts must:

(1) be prioritised within each category, when necessary;

(2) provide timely attention-getting cues through at least two different senses by a combination of aural, visual, or tactile indications;

(3) permit each occurrence of the attention-getting cues required by subparagraph (b)(2) to be acknowledged and suppressed, unless they are required to be continuous.

SC-O23-div-08.05 - Flight Guidance System:

Sub-paragraph CS-23.1329 (a)(2) is deleted and replaced by:

The autopilot must not create an unsafe condition when the flight crew applies an override force to the flight controls.

Sub-paragraph CS-23.1329(h) is deleted and replaced by:

The flight guidance system functions, controls, indications, and alerts must be designed to minimise flight crew errors and confusion concerning the behaviour and operation of the flight guidance system. Means must be provided to indicate the current mode of operation, including any armed modes, transitions, and reversions. Selector switch position is not an acceptable means of indication. The controls and indications must be grouped and presented in a logical and consistent manner. The indications must be visible to each pilot under all expected lighting conditions.

The following additional requirements must be fulfilled:

Following disengagement of the autopilot, a warning (visual and aural) must be provided to each pilot and be timely and distinct from all other cockpit warnings.

Following disengagement of the autothrust function, a caution must be provided to each pilot.

SC-O23-div-08.06 – Operating procedures

CS-23.1585 (a) is amended by the following additional point:

(6) The maximum demonstrated precipitation rate (in terms of moderate or heavy rain) pertinent to CAT II operations.

- END –

ACRONYMS AND ABBREVIATIONS

AC	Advisory Circular
AFM	Airplane Flight Manual
AMC	Acceptable Means of Compliance
ATS	Auto-Thrust System
CFR	Code of Federal Regulations
CPDLC	Controller-Pilot Data Link Communications
CRI	Certification Review Item
CVR	Cockpit Voice Recorder
ESF	Equivalent Safety Finding
ESIS	Electronic Standby Instrument System
FDR	Flight Data Recorder
HIRF	High Intensity Radiated Fields
ICAO	International Civil Aviation Organisation
NPA	Notice of Proposal Amendment
NPRM	Notice of Proposed Rulemaking
RTCA	Radio Technical Commission for Aeronautics
SC	Special Condition
TCDS	Type Certificate Data Sheet
UMS	Utility Management System

- END OF DOCUMENT –