CS-29 AMENDMENT 1 - CHANGE INFORMATION

Certification Specifications (CS) are used for establishing the certification basis for applications made after the date of entry into force of a CS including any amendments. Since the complete text of a CS, including any amendments to it, is relevant for establishing the certification basis, the Agency has decided to enact and publish all amendments to CS's as consolidated documents instead of enacting and publishing only the amended text.

Consequently, except for a note "Amdt. 29/1" under the amended paragraph, the consolidated text of CS-29 does not allow readers to see the detailed changes introduced by the new amendment. To allow readers to also see these detailed changes this document has been created. The same format as for publication of Notices of Proposed Amendments has been used to show the changes:

1. text not affected by the new amendment remains the same: unchanged
2. deleted text is shown with a strike through: ~~deleted~~
3. new text is highlighted with grey shading: new
4. ....
   Indicates that remaining text is unchanged in front of or following the reflected amendment.
   ....

1. Amend CS 29.25 to read as follows:

CS 29.25 Weight Limits

(a) ….

(4) For Category B rotorcraft with 9 or less passenger seats, the maximum weight, altitude, and temperature at which the rotorcraft can safely operate near the ground with the maximum wind velocity determined under CS 29.143(c) and may include other demonstrated wind velocities and azimuths. The operating envelopes must be stated in the Limitations section of the Rotorcraft Flight Manual.

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2. Amend CS 29.143 to read as follows:

CS 29.143 Controllability and Manoeuvrability

(a) ….

(2) ….

(v) ~~Glide~~ Autorotation; and

(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with:
(1) Critical weight;
(2) Critical centre of gravity;
(3) Critical rotor rpm; and
(4) Power off, except for helicopters demonstrating compliance with sub-paragraph (~~e~~f), and power on.

(c) ~~A wind velocity of not less than~~ Wind velocities from zero to at least 31 km/h (17 knots), from all azimuths, must be established in which the rotorcraft can be operated without loss of control on or near the ground in any manoeuvre appropriate to the type (such as crosswind take-offs, sideward flight, and rearward flight), with:
(1) Critical Weight;
(2) Critical center of gravity; ~~and~~
(3) Critical rotor rpm; and
(4) Altitude from standard sea-level conditions to the maximum take-off and landing altitude capability of the rotorcraft.

(d) Wind velocities from zero to at least 31 km/h (17 knots), from all azimuths, must be established in which the rotorcraft can be operated without loss of control out-of-ground effect, with:
(1) Weight selected by the applicant;
(2) Critical center of gravity;
(3) Rotor rpm selected by the applicant; and
(4) Altitude, from standard sea-level conditions to the maximum take-off and landing altitude capability of the rotorcraft.

(~~d~~e) ….

(~~e~~f) ….

3. Amend CS 29.173 to read as follows:

CS 29.173 Static Longitudinal Stability

(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain ~~a speed~~ an airspeed less than the trim speed, and a forward movement of the control is necessary to obtain ~~a speed~~ an airspeed more than the trim speed.

(b) Throughout the full range of altitude for which certification is requested, with the throttle and collective pitch held constant during the manoeuvres specified in CS 29.175(a) ~~to (c)~~ through (d), the slope of the control position versus airspeed curve must be positive ~~throughout the full range of altitude for which certification is requested~~. However, in limited flight conditions or modes of operation determined by the Agency to be acceptable, the slope of the control position versus airspeed curve may be neutral or negative if the rotorcraft possesses flight characteristics that

allow the pilot to maintain airspeed within ±9 km/h (±5 knots) of the desired trim airspeed without exceptional piloting skill or alertness.

~~(c) During the manoeuvre specified in CS 29.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10% of total control travel.~~

4. Amend CS 29.175 to read as follows:

CS 29.175 Demonstration of Static Longitudinal Stability

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from ~~0.85 Vy, or 28 km/h (15 knots) below Vy whichever is less, or 1.2 Vy, or 28 km/h (15 knots) above Vy, whichever is greater~~ Vy - 19 km/h (10 knots) to Vy + 19 km/h (10 knots), with:

….

(b) *Cruise*. Static longitudinal stability must be shown in the cruise condition at speeds from 0.8 V_{NE} - 19 km/h (10 knots) to 0.8 V_{NE} + 19 km/h (10 knots) or, if V_H is less than 0.8 V_{NE}, from V_H - 19 km/h (10 knots) to V_H + 19 km/h (10 knots) ~~0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less~~, with:

(1) ….

(2) ….

(3) Power for level flight at 0.8 V_{NE} or V_H ~~0.9 V_H or 0.9 V_{NE}~~, whichever is less;

(4) ….

(5) The rotorcraft trimmed at 0.8 V_{NE} or V_H~~0.9 V_H or 0.9 V_{NE}~~, whichever is less.

(c) *V_{NE}*. Static longitudinal stability must be shown at speeds from V_{NE} – 37 km/h (20 knots) to V_{NE} with:

(1) Critical weight;

(2) Critical center of gravity;

(3) Power required for level flight at V_{NE} – 19 km/h (10 knots) or maximum continuous power, whichever is less;

(4) The landing gear retracted; and

(5) The rotorcraft trimmed at V_{NE} – 19 km/h (10 knots).

(~~e~~d) *Autorotation*. Static longitudinal stability must be shown in autorotation at ~~airspeeds from 0.5 times the speed for minimum rate of descent, or 0.5 times the maximum range glide speed for Category A rotorcraft, to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under CS 29.1505 (c), and with:~~

~~(1) Critical weight;~~

~~(2) Critical centre of gravity;~~

~~(3) Power off;~~

~~(4) The landing gear:~~

~~(i) Retracted; and~~

~~(ii) Extended; and~~

~~(5) The rotorcraft trimmed at appropriate speeds found necessary by the Agency to demonstrate stability throughout the prescribed speed range.~~

(1) Airspeeds from the minimum rate of descent airspeed – 19 km/h (10 knots) to the minimum rate of descent airspeed + 19 km/h (10 knots), with:

(i) Critical weight;

(ii) Critical center of gravity;

(iii) The landing gear extended; and

(iv) The rotorcraft trimmed at the minimum rate of descent airspeed.

(2) Airspeeds from the best angle-of-glide airspeed – 19 km/h (10 knots) to the best angle-of-glide airspeed + 19 km/h (10 knots), with:

(i) Critical weight;

(ii) Critical center of gravity;

(i) The landing gear retracted; and

(ii) The rotorcraft trimmed at the best angle-of-glide airspeed.

~~(d) *Hovering*. For helicopters, the longitudinal cyclic control must operate with the sense, direction of~~

~~motion, and position as prescribed in CS 29.173 between the maximum approved rearward speed and a forward speed of 31 km/h (17 knots) with:~~
~~(1) Critical weight;~~
~~(2) Critical centre of gravity;~~
~~(3) Power required to maintain an approximate constant height in ground effect;~~
~~(4) The landing gear extended; and~~
~~(5) The helicopter trimmed for hovering.~~

5. Revise CS 29.177 to read as follows:

CS 29.177 Static Directional Stability

~~Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in CS 29.175(a), (b), and (c). Sideslip angle must increase steadily with directional control deflection for sideslip angles up to ± 10° from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.~~

(a) The directional controls must operate in such a manner that the sense and direction of motion of the rotorcraft following control displacement are in the direction of the pedal motion with throttle and collective controls held constant at the trim conditions specified in CS 29.175 (a), (b), (c) and (d). Sideslip angles must increase with steadily increasing directional control deflection for sideslip angles up to the lesser of:
(1) ±25 degrees from trim at a speed of 28 km/h (15 knots) less than the speed for minimum rate of descent varying linearly to ±10 degrees from trim at V_{NE};
(2) The steady state sideslip angles established by CS 29.351;
(3) A sideslip angle selected by the applicant which corresponds to a sideforce of at least 0.1g; or,
(4) The sideslip angle attained by maximum directional control input.

(b) Sufficient cues must accompany the sideslip to alert the pilot when approaching sideslip limits.

(c) During the manoeuvre specified in sub-paragraph (a) of this paragraph, the sideslip angle versus directional control position curve may have a negative slope within a small range of angles around trim, provided the desired heading can be maintained without exceptional piloting skill or alertness.

6. Amend CS 29.1587 to read as follows:

CS 29.1587 Performance information

….
(a) ….
(7) ~~Out-of-ground-effect h~~Hover performance determined under CS 29.49 and the maximum ~~safe wind demonstrated under the ambient conditions for data presented.~~ weight for each altitude and temperature condition at which the rotorcraft can safely hover in-ground effect and out-of-ground effect in winds of not less than 31 km/h (17 knots) from all azimuths. This data must be clearly referenced to the appropriate hover charts.

(b) ….
(8) ~~Out-of-ground-effect h~~Hover performance determined under CS 29.49 and the maximum safe wind demonstrated under the ambient conditions for data presented. In addition, the maximum weight for each altitude and temperature condition at which the rotorcraft can safely hover in-ground effect and out-of-ground effect in winds of not less than 31 km/h (17 knots) from all azimuths. This data must be clearly referenced to the appropriate hover charts; and

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7. Amend Appendix B to CS-29 to read as follows:

Appendix B to CS-29--Airworthiness Criteria for Helicopter Instrument Flight

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V. *Static lateral-directional stability*

(a) Static directional stability must be positive throughout the approved ranges of airspeed, power, and vertical speed. In straight~~,~~ and steady sideslips up to ±10° from trim, directional control position must increase ~~in approximately constant proportion to angle of sideslip.~~ without discontinuity with the angle of sideslip, except for a small range of sideslip angles around trim. At greater angles up to the maximum sideslip angle appropriate to the type, increased directional control position must produce an increased angle of sideslip. It must be possible to maintain balanced flight without exceptional pilot skill or alertness.

(b) During sideslips up to ± 10° from trim throughout the approved ranges of airspeed, power, and vertical speed there must be no negative dihedral stability perceptible to the pilot through lateral control motion or force. Longitudinal ~~cycle~~ cyclic movement with sideslip must not be excessive.

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VII. *Stability Augmentation System (SAS)*

(a) If a SAS is used, the reliability of the SAS must be related to the effects of its failure. ~~The occurrence of any failure condition which would prevent continued safe flight and landing must be extremely improbable.~~ Any SAS failure condition that would prevent continued safe flight and landing must be extremely improbable. It must be shown that, for any failure condition of the SAS that is not shown to be extremely improbable:

(1) The helicopter ~~must be~~ is safely controllable ~~and capable of prolonged instrument flight without undue pilot effort. Additional unrelated probable failures affecting the control system must be considered~~ when the failure or malfunction occurs at any speed or altitude within the approved IFR operating limitations; and

(2) ~~The flight characteristics requirements in Subpart B of CS-29 must be met throughout a practical flight envelope.~~

The overall flight characteristics of the helicopter allow for prolonged instrument flight without undue pilot effort. Additional unrelated probable failures affecting the control system must be considered. In addition:

(i) The controllability and manoeuvrability requirements in Subpart B of CS-29 must be met throughout a practical flight envelope;

(ii) The flight control, trim, and dynamic stability characteristics must not be impaired below a level needed to allow continued safe flight and landing;

(iii) For Category A helicopters, the dynamic stability requirements of Subpart B of CS-29 must also be met throughout a practical flight envelope; and

(iv) The static longitudinal and static directional stability requirements of Subpart B of CS-29 must be met throughout a practical flight envelope.

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