CS-27 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. 27/1" under the amended paragraph, the consolidated text of CS-27 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 27.25 as follows:

CS 27.25 Weight Limits

(a) ….

(1) Not more than:

(i) The highest weight selected by the applicant;

(ii) The design maximum weight (the highest weight at which compliance with each applicable structural loading condition of this CS-27 is shown); ~~or~~

(iii) The highest weight at which compliance with each applicable flight requirement of this CS-27 is shown; ~~and~~ or

(iv) The highest weight, as a function of altitude and temperature, in which the provisions of CS 27.79 and/or CS 27.143(c)(1) are demonstrated if the operating conditions (altitude and temperature) prescribed by those requirements can not be met; and

….

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2. Re-designate CS 27.73 as new CS 27.49 and revise to read as follows:

CS 27.~~73~~49 Performance at Minimum Operating Speed

(a) For helicopters:

(1) The hovering ceiling must be determined over the ranges of weight, altitude, and temperature for which certification is requested, with:

(i) Take-off power;

(ii) The landing gear extended; and

(iii) The helicopter in-ground effect at a height consistent with normal take-off procedures; and

(2) The hovering ceiling determined in sub-paragraph (a)(1) of this paragraph must be at least:

(i) For reciprocating engine powered helicopters, 1219m (4,000 ft) at maximum weight with a standard atmosphere; or

(ii) For turbine engine powered helicopters, 762m (2,500 ft) pressure altitude at maximum weight at a temperature of standard +22°C (+40°F).

(3) The out-of-ground effect hovering performance must be determined over the ranges of weight, altitude, and temperature for which certification is requested, using take-off power.

(b) For rotorcraft other than helicopters, the steady rate of climb at the minimum operating speed must be determined over the ranges of weight, altitude, and temperature for which certification is requested, with:

(1) Take-off power; and

(2) The landing gear extended.

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3. Revise CS 27.51 to read as follows:

CS 27.51 Take-off

~~(a)~~The take-off, with take-off power and r.p.m. at the most critical center of gravity, and with ~~the extreme forward centre of gravity~~ weight from the maximum weight at sea-level to the weight for which take-off certification is requested for each altitude covered by this paragraph:

(~~1~~a) May not require exceptional piloting skill or exceptionally favorable conditions throughout the ranges of altitude from standard sea-level conditions to the maximum altitude for which take-off and landing certification is requested, and

(~~2~~b) Must be made in such a manner that a landing can be made safely at any point along the flight path if an engine fails. This must be demonstrated up to the maximum altitude for which take-off and landing certification is requested or 2134m (7,000 ft) density altitude, whichever is less.

~~(b) Sub-paragraph (a) must be met throughout the ranges of:~~
~~(1) Altitude, from standard sea-level conditions to the maximum altitude capability of the rotorcraft, or 2134 m (7000 ft), whichever is less.~~
~~(2) Weight, from the maximum weight (at sea level) to each lesser weight selected by the applicant for each altitude covered by subparagraph (b)(1).~~

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4. Revise CS 27.75(a) to read as follows:

CS 27.75 Landing

(a) The rotorcraft must be able to be landed with no excessive vertical acceleration, no tendency to bounce, nose over, ground loop, porpoise, or water loop, and without exceptional piloting skill or exceptionally favorable conditions, with:
(1) Approach or ~~glide~~ autorotation speeds appropriate to the type of rotorcraft and selected by the applicant;
(2) The approach and landing made with:
(i) Power off, for single engine rotorcraft and entered from steady state autorotation; or
(ii) One-engine inoperative (OEI) for multi-engine rotorcraft, ~~One-engine-inoperative (OEI)~~ ~~and~~ with each operating engine within approved operating limitations, and entered from an established OEI approach. ~~; and~~
~~(3) The approach and landing entered from steady autorotation.~~
….

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5. Revise CS 27.79(a)(1), (a)(2) and (b)(2) to read as follows:

CS 27.79 Limiting Height-Speed Envelope

(a) ….
(1) Altitude, from standard sea-level conditions to the maximum altitude capability of the rotorcraft, or 2134m (7000 ft) density altitude, whichever is less; and
(2) Weight, from the maximum weight at sea-level to the ~~lesser~~ weight selected by the applicant for each altitude covered by sub-paragraph (a)(1) of this paragraph. For helicopters, the weight at altitudes above sea-level may not be less than the maximum weight or the highest weight allowing hovering out-of-ground effect, whichever is lower.

(b) ….
(1) ….
(2) For multi-engine helicopters, ~~one-engine-inoperative,~~ OEI, where engine isolation features ensure continued operation of the remaining engines, and the remaining ~~engines at the greatest power for which certification is requested~~ engine(s) within approved limits and at the minimum installed specification power available for the most critical combination of approved ambient temperature and pressure altitude resulting in 2134m (7000 ft) density altitude or the maximum altitude capability of the helicopter, whichever is less, and
(3) ….

….

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6. Amend CS 27.143 as follows:

CS 27.143 Controllability and Manoeuvrability

(a) ….

(2) ….
(v) ~~Glide~~ Autorotation
…

(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) With altitude, from standard sea-level conditions to the maximum take-off and landing altitude capability of the rotorcraft or 2134m (7000 ft) density altitude, whichever is less; with:
(~~1~~i) Critical Weight;
(~~2~~ii) Critical center of gravity;
(~~3~~iii) Critical rotor rpm;
~~(4) Altitude from standards sea level conditions to the maximum altitude capability of the rotorcraft or 2134m (7000 ft), whichever is less.~~
(2) For take-off and landing altitudes above 2134m (7000 ft) density altitude with:
(i) Weight selected by the applicant;
(ii) Critical center of gravity; and
(iii) Critical rotor rpm.

(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) ….

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7. Amend CS 27.173 to read as follows:

CS 27.173 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 27.175(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 27.175(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.~~

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8. Amend CS 27.175 to read as follows:

CS 27.175 Demonstration of Static Longitudinal Stability

(a) *Climb*. Static longitudinal stability must be shown in the climb condition at speeds from ~~0.85 Vy to 1.2 Vy,~~ 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} – 28 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 to V_{NE} or to 1.1 V_{NE} (power off) if V_{NE} (power off) is established under CS 27.1505 (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;
   (iii) The landing gear retracted; and
   (iv) 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 27.173 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.~~

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9. Revise CS 27.177 to read as follows:

CS 27.177 Static Directional Stability

~~Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in CS 27.175(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 27.175 (a), (b), and (c). 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 27.351;

(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 the aircraft is approaching the 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.

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10. Amend CS 27.903 to read as follows:

CS 27.903 Engines

….

(d) Restart capability: A means to restart any engine in flight must be provided.

(1) Except for the in-flight shutdown of all engines, engine restart capability must be demonstrated throughout a flight envelope for the rotorcraft.

(2) Following the in-flight shutdown of all engines, in-flight engine restart capability must be provided.

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11. Amend CS 27.1587 to read as follows:

CS 27.1587 Performance information

(a) The Rotorcraft Flight Manual must ~~be furnished with~~ contain the following information, determined in accordance with CS 27.~~51~~49 ~~to~~ through CS 27.79 and CS 27.143(c) and (d):

(1) ….

(2) ….

(i) ~~The hovering ceilings and the steady rates of climb and descent, as affected by any pertinent factors such as airspeed, temperature and altitude;~~
The steady rates of climb and descent, in-ground effect and out-of-ground effect hovering ceilings, together with the corresponding airspeeds and other pertinent information including the calculated effects of altitude and temperatures;

(ii) ~~The maximum safe wind for operation near the ground.~~ 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. In addition, i~~I~~f there

are other combinations of weight, altitude, and temperature for which performance information is provided and at which the rotorcraft cannot land and take-off safely with the maximum wind value, those portions of the operating envelope and the appropriate safe wind conditions ~~shall be identified in the flight manual~~must be stated in the Rotorcraft Flight Manual;

….

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12. Amend Appendix B to CS-27 to read as follows:

Appendix B to CS-27--Airworthiness Criteria for Helicopter Instrument Flight

….

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 proportions 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.

….

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-27 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-27 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; and

(iii) The static longitudinal and static directional stability requirements of Subpart B of CS-27 must be met throughout a practical flight envelope.

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