Designation: F3180/F3180M – 16

Standard Specification for Low-Speed Flight Characteristics of Aeroplanes[1]

This standard is issued under the fixed designation F3180/F3180M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification will cover the flight characteristics of aeroplanes at low speed and provide standards for departure characteristics, spinning, and stall warning.

1.2 This specification establishes the airworthiness design requirements associated with low-speed aeroplane flight characteristics.

1.3 The applicant for a design approval shall seek the individual guidance to their respective civil aviation authority (CAA) body concerning the use of this specification as part of a certification plan. For information on which CAA regulatory bodies have accepted this specification (in whole or in part) as a means of compliance to their small aircraft airworthiness regulations (hereinafter referred to as "the Rules"), refer to ASTM Committee F44 webpage (www.astm.org/COMMITTEE/F44.htm), which includes CAA website links.

1.4 This specification is applicable to small aeroplanes.

1.5 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F3060 Terminology for Aircraft

F3173/F3173M Specification for Handling Characteristics of Aeroplanes

F3179/F3179M Specification for Performance of Aeroplanes

3. Terminology

3.1 See Terminology F3060 for more definitions and abbreviations.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *ball width*—a displacement on a standardized slip-skip indicator that corresponds to a lateral acceleration of tan (4π/180) = 0.07 G = 0.7 m/s^2 [2.3 ft/s^2].

3.2.2 *directional control*—cockpit control that is intended for, but not necessarily limited to, generation of aircraft yaw motion.

3.2.3 *lateral control*—cockpit control that is intended for, but not necessarily limited to, generation of aircraft roll motion.

3.2.4 *longitudinal control*—cockpit control that is intended for, but not necessarily limited to, generation of aircraft pitch motion.

4. Low-Speed Characteristics

4.1 *Stall:*

4.1.1 *Wings-Level Stall:*

4.1.1.1 *Primary Flight Control Behavior:*

(1) For single engine low-speed Level 1 aeroplanes with $V_{S0} \leq 45$ knots that have interconnected lateral and directional controls, it shall be possible to produce and correct roll by unreversed use of the lateral control without producing excessive yaw, up to the time the aeroplane stalls.

(2) For all other Level 1 aeroplanes, and all Level 2, 3, and 4 aeroplanes, it shall be possible to produce and correct roll by unreversed use of the lateral control and to produce and correct yaw by unreversed use of the directional control up to the time the aeroplane stalls.

4.1.1.2 The wings-level stall characteristics shall be demonstrated in flight as follows. Starting from a speed at least 18.5 km/h [10 knots] above the stall speed, the longitudinal control shall be pulled back so that the rate of speed reduction will not exceed 1.9 (km/h)/s [1 knot/s] until a stall is produced, as shown by either:

(1) An uncontrollable downward pitching motion of the aeroplane,

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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(2) A downward pitching motion of the aeroplane that results from the activation of a stall avoidance device (for example, stick pusher activation), or

(3) The longitudinal control reaching the stop.

4.1.1.3 Normal use of longitudinal control for recovery is allowed after the downward pitching motion from 4.1.1.2(*1*) or 4.1.1.2(*2*) has unmistakably been produced, or the longitudinal control has been held against the stop for not less than the longer of 2 s or the time used in the minimum steady flight speed determination discussed in Specification F3179/F3179M.

4.1.1.4 During the entry into and the recovery from stalls performed below 7620 m [25 000 ft], it shall be possible to prevent more than 15° of roll or yaw by the normal use of controls.

4.1.1.5 For aeroplanes approved for a maximum operating altitude at or above 7620 m [25 000 ft], during the entry into and the recovery from stalls performed at or above 7620 m [25 000 ft], it shall be possible to prevent more than 25° of roll or yaw by the normal use of controls.

4.1.1.6 Compliance with these requirements shall be shown under the following conditions:

(1) Wing Flaps—Retracted, fully extended, and each intermediate normal operating position as appropriate for the phase of flight;

(2) Landing Gear—Retracted and extended as appropriate for the phase of flight and altitude;

(3) Cowl Flaps—Appropriate to configuration;

(4) Spoilers/Speed Brakes—Retracted and extended unless they have no measurable effect at low speeds, or in their appropriate position if they are automatically actuated as part of normal operations;

(5) Power/thrust idle;

(6) Power/Thrust On—Depending on engine type, one of the following applies:

(a) For Reciprocating Engine Powered Aeroplanes—Seventy-five percent of maximum continuous power. However, if the power-to-weight ratio at 75 % of maximum continuous power results in nose-high attitudes exceeding 30°, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{S0}, except that the power may not be less than 50 % of maximum continuous power; or

(b) For Turbine Engine Powered Aeroplanes—At maximum engine thrust, except that it need not exceed the thrust necessary to maintain level flight at 1.5 V_{S1} (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight);

(7) Trim—The aeroplane trimmed at 1.5 V_{S1} or the minimum trim speed, whichever is higher; and

(8) Propeller—Full increase revolutions per minute (rpm) position for the idle condition.

4.1.2 *Turning Flight and Accelerated Turning Stalls:*

4.1.2.1 Turning flight and accelerated turning stalls shall be demonstrated by establishing and maintaining a coordinated turn in a 30° bank. The speed should be steadily reduced while progressively tightening the turn with the longitudinal control until the aeroplane is stalled. The rate of speed reduction shall be constant and:

(1) For a turning flight stall, may not exceed 1.9 (km/h)/s [1 knot/s], and

(2) For an accelerated turning stall, 5.6 to 9.3 (km/h)/s [3 to 5 knots/s] with steadily increasing normal acceleration.

4.1.2.2 After the aeroplane has stalled, as defined in 4.1.1.2, it shall be possible to regain wings-level flight by normal use of the flight controls but without increasing power and without:

(1) Excessive loss of altitude,

(2) Undue pitch-up,

(3) Uncontrollable tendency to spin,

(4) Exceeding a bank angle of 60° in the original direction of the turn or 30° in the opposite direction in the case of turning flight stalls,

(5) Exceeding a bank angle of 90° in the original direction of the turn or 60° in the opposite direction in the case of accelerated turning stalls, and

(6) Exceeding the maximum permissible speed or allowable limit load factor.

4.1.2.3 Compliance with 4.1.2 shall be shown under the following conditions:

(1) Wing Flaps—Retracted, fully extended, and each intermediate normal operating position as appropriate for the phase of flight.

(2) Landing Gear—Retracted and extended as appropriate for the phase of flight and altitude;

(3) Cowl Flaps—Appropriate to configuration;

(4) Spoilers/Speed Brakes—Retracted and extended unless they have no measurable effect at low speeds, or in their appropriate position if they are automatically actuated as part of normal operations;

(5) Power/thrust idle;

(6) Power/Thrust On—Depending on engine type, one of the following applies:

(a) For Reciprocating Engine Powered Aeroplanes—Seventy-five percent of maximum continuous power. However, if the power-to-weight ratio at 75 % of maximum continuous power results in nose-high attitudes exceeding 30°, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{S0}, except that the power may not be less than 50 % of maximum continuous power; or

(b) For Turbine Engine Powered Aeroplanes—At maximum engine thrust, except that it need not exceed the thrust necessary to maintain level flight at 1.5 V_{S1} (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight);

(7) Trim—The aeroplane trimmed at 1.5 V_{S1} or the minimum trim speed, whichever is higher; and

(8) Propeller—Full increase rpm position for the idle condition.

4.2 *Departure Characteristics*—All Level 1, all Level 2, and single engine Level 3 aeroplanes that are not approved for spinning shall meet one of the following alternatives. In all cases, maneuvers can be discontinued, and action taken by

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