



Designation: F3180/F3180M – 21

Standard Specification for Low-Speed Flight Characteristics of Aircraft¹

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 covers the low-speed flight characteristics of fixed-wing aircraft and provides standards for departure characteristics, spinning, and stall warning. The material was developed through open consensus of international experts in general aviation. This information was created by focusing on Normal Category aeroplanes. The content may be more broadly applicable; it is the responsibility of the Applicant to substantiate broader applicability as a specific means of compliance. The topics covered within this specification are: (4.1) Low-Speed Flight Characteristics Score, (4.2) Stall Characteristics, (4.3) Stall Warning, (4.4) Departure Characteristics: Single Engine, (4.5) Departure Characteristics: Multiengine, (4.6) Spinning, and (4.7) Safety-Enhancing Features.

1.2 An applicant intending to propose this information as Means of Compliance for a design approval must seek guidance from their respective oversight authority (for example, published guidance from applicable CAAs) concerning the acceptable use and application thereof. For information on which oversight authorities have accepted this standard (in whole or in part) as an acceptable Means of Compliance to their regulatory requirements (hereinafter “the Rules”), refer to the ASTM Committee F44 webpage (www.astm.org/COMMITTEE/F44.htm).

1.3 *Units*—This standard may present information in either SI units, English Engineering units, or both; the values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

¹ This specification is under the jurisdiction of ASTM Committee F44 on General Aviation Aircraft and is the direct responsibility of Subcommittee F44.20 on Flight.

Current edition approved Aug. 1, 2021. Published November 2021. Originally approved in 2016. Last previous edition approved in 2019 as F3180/F3180M–19. DOI: 10.1520/F3180_F3180M-21.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

F3060 Terminology for Aircraft

F3061/F3061M Specification for Systems and Equipment in Small Aircraft

F3083/F3083M Specification for Emergency Conditions, Occupant Safety and Accommodations

F3117/F3117M Specification for Crew Interface in Aircraft

F3173/F3173M Specification for Aircraft Handling Characteristics

F3179/F3179M Specification for Performance of Aircraft

F3230 Practice for Safety Assessment of Systems and Equipment in Small Aircraft

F3232/F3232M Specification for Flight Controls in Small Aircraft

2.2 Other Standards:

FAA AC 23–15A Small Airplane Certification Compliance Program³

FAA AC 23–8C Flight Test Guide for Certification of Part 23 Airplanes⁴

SAE ARP4102/7 Electronic Displays⁵

3. Terminology

3.1 See Terminology F3060 for more definitions and abbreviations.

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.

³ Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/74398.

⁴ Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1019676.

⁵ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <https://www.sae.org/standards/content/arp4102/7/>.



TABLE 1 Summary of Minimum Requirements for Low-Speed Flight Characteristics

NOTE 1—N/A: Not Applicable; A/R: As Required

Certification Level	1	2, 3, 4	1, 2	3, 4	1, 2, 3, 4
Engine(s)	Single	Single	Multi	Multi	Any
Aerobatic?	No	No	No	No	Yes
4.1 Minimum Low-Speed Flight Characteristics Score (S_{LSC})	150	200	150	50	50
4.2 Stall Characteristics	Pass all	Pass all	Pass all	Pass all	Pass all
4.3 Stall Warning Score (S_{SW})	Min 50 Max 100	Min 50 Max 100	Min 50 Max 100	Min 50	Min 50
4.4 Departure Characteristics Score – Single Engine ($S_{DC,SE}$)	Min 50 ^A Max 100	Min 50 ^A Max 100	N/A	N/A	N/A
4.5 Departure Characteristics Score – Multiengine ($S_{DC,ME}$)	N/A	N/A	Min 50 Max 100	N/A	N/A
4.6 Spinning	N/A	N/A	N/A	N/A	Pass all
4.7 Safety-Enhancing Features Score (S_{SEF})	A/R to meet S_{LSC}	A/R to meet S_{LSC}	A/R to meet S_{LSC}	N/A	N/A

^A $S_{DC,SE}$ may be less than 50 as outlined in 4.4.2.6(3), which requires particular equipment from 4.7.3 be installed.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *ball-width*—a lateral acceleration of $\tan(4\pi/180) = 0.07 \text{ G} = 0.7 \text{ m/s}^2 [2.3 \text{ ft/s}^2]$, which corresponds to a typical unit displacement on a standardized slip-skid indicator.

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.

3.2.5 *thrust control*—cockpit control that is intended for, but not necessarily limited to, modulation of aircraft thrust.

4. Low-Speed Characteristics

4.1 *Low-Speed Flight Characteristics Score*—The applicant shall demonstrate that the aeroplane has acceptable stall characteristics, stall warning, and spinning characteristics, if applicable, by compliance with performance criteria specified for stall characteristics and spinning, as applicable, and by accumulating a number of “points” from stall warning, departure characteristics, and safety-enhancing features.

4.1.1 The sum of the Stall Warning Score (S_{SW}), Departure Characteristics Score ($S_{DC,SE}$ or $S_{DC,ME}$, if required), and the safety-enhancing features score (S_{SEF} , if required) is called the Low-Speed Flight Characteristics Score (S_{LSC}).

NOTE 1—The rationale for the development of the Low-Speed Flight Characteristics Score is provided in Borer’s “Development of a New Departure Aversion Standard for Light Aircraft.”⁶

⁶ Borer, N. K., “Development of a New Departure Aversion Standard for Light Aircraft,” AIAA-2017-3438, 17th AIAA Aviation Technology, Integration, and Operations Conference, Denver Colorado, 2017. Publicly available at: <https://ntrs.nasa.gov/search.jsp?R=20170005881>, accessed 20 December 2017.

4.1.2 The minimum Low-Speed Flight Characteristics Score is dependent on the certification level, number of engines, and whether or not the aeroplane is approved for aerobatics, as summarized in Table 1.

4.2 *Stall Characteristics*—The applicant shall demonstrate that the aeroplane has controllable stall characteristics in straight flight, turning flight, and accelerated turning flight.

4.2.1 Compliance with these requirements shall be shown under the following conditions. An example table of relevant permutations of these conditions are given in Appendix X1.

NOTE 2—The differentiation in conditions between Level 1 and Level 2, Low-Speed, Single-Engine aeroplanes, versus all others, is based off guidance given in AC 23-15A (see 2.2).

(1) *Wing Flaps*—As follows, based on the type of aeroplane:

(a) For Level 1 and Level 2, low-speed, single-engine aeroplanes: Retracted, fully extended, and in the maximum approved extension for the takeoff configuration,

(b) For all other aeroplanes: Retracted, fully extended, and each intermediate normal operating position as appropriate for the phase of flight;

(2) *Landing Gear*—As follows, based on the type of aeroplane:

(a) For Level 1 and Level 2, low-speed, single-engine aeroplanes: Retracted for the configuration in which the wing flaps are retracted, and extended for all other wing flap extensions,

(b) For all other aeroplanes: Retracted and extended as appropriate for the phase of flight and altitude;

(3) *Cowl Flaps*—As follows, based on the type of aeroplane:

(a) For Level 1 and Level 2, low-speed, single-engine aeroplanes: Open for the configuration in which the wing flaps are in the maximum approved extension for the takeoff configuration, otherwise closed,

(b) For all other aeroplanes: Appropriate to configuration;