



Designation: F3173/F3173M – 23

Standard Specification for Aircraft Handling Characteristics¹

This standard is issued under the fixed designation F3173/F3173M; 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 addresses the airworthiness requirements for aeroplane handling characteristics in flight and on ground and water.

1.2 The material was developed through open consensus of international experts in general aviation. This information was created by focusing on Normal Category aeroplanes; however, the content may be more broadly applicable, and should not be unduly limited. The topics covered within this specification are: Flight Characteristics, Controllability, Trim, Stability, Ground and Water Handling Characteristics, and Vibration, Buffet, and High-speed Characteristics.

1.3 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 specification (in whole or in part) as an acceptable Means of Compliance to their regulatory requirements (hereinafter “the Rules”), refer to the ASTM Committee F44 web page (www.astm.org/COMMITTEE/F44.htm). **Annex A1** maps the Means of Compliance of the ASTM standards to EASA CS-23, amendment 5, or later, and FAA 14 CFR Part 23, amendment 64, or later, rules.

1.4 *Units*—This specification 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.

1.5 *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.

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1.6 *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 Aircraft

F3116/F3116M Specification for Design Loads and Conditions

F3174/F3174M Specification for Establishing Operating Limitations and Information for Aeroplanes

F3179/F3179M Specification for Performance of Aircraft

F3232/F3232M Specification for Flight Controls in Small Aircraft

F3233/F3233M Specification for Flight and Navigation Instrumentation in Aircraft

2.2 EASA Standard:³

EASA CS-23 Normal, Utility, Aerobatic and Commuter Aeroplanes

2.3 FAA Standard:⁴

14 CFR Part 23 Airworthiness Standards: Normal Category Airplanes

3. Terminology

3.1 Refer to Terminology F3060 referenced in Section 2.

4. Flight Characteristics—General

4.1 Unless otherwise specified in a specific requirement, the aeroplane shall meet the requirements of Sections 5 – 8 and 9.1 – 9.4 at all practical loading conditions and operating altitudes for which certification has been requested, not exceeding that

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 European Union Aviation Safety Agency (EASA), Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, <https://www.easa.europa.eu>.

⁴ Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.

established in Specification **F3174/F3174M** *Maximum Operating Altitude* and without requiring exceptional piloting skill, alertness, or strength.

5. Controllability

5.1 General:

5.1.1 The aeroplane shall be safely controllable and maneuverable during all flight phases including:

- 5.1.1.1 Takeoff,
- 5.1.1.2 Climb,
- 5.1.1.3 Level flight,
- 5.1.1.4 Descent,
- 5.1.1.5 Go-around, and

5.1.1.6 Landing (power on and idle power) with the wing flaps extended and retracted.

5.1.2 It shall be possible to make a smooth transition from one flight condition to another (including turns and slips) without danger of exceeding the limit load factor under any probable operating condition (including, for multiengine aeroplanes, those conditions normally encountered in the sudden critical loss of thrust).

5.1.3 If marginal conditions exist with regard to required pilot strength, the control forces necessary shall be determined by quantitative tests. In no case may the control forces under the conditions specified in 5.1.1 and 5.1.2 exceed those prescribed in **Table 1**.

TABLE 1 Control Forces

Level 1 Aeroplanes With $V_{S0} \leq 45$ KCAS			
Control	Longitudinal	Lateral	Directional
(a) For temporary application:	—	—	—
Stick	200 N [45 lbf]	100 N [22 lbf]	—
Wheel	250 N [56 lbf]	200 N [45 lbf]	—
Rudder pedal	—	—	400 N [90 lbf]
(b) For prolonged application:	20 N [4 lbf]	15 N [3 lbf]	100 N [22 lbf]
Level 1 Aeroplanes With $V_{S0} > 45$ KCAS and Level 2, 3 and 4 Aeroplanes			
Control	Longitudinal	Lateral	Directional
(a) For temporary application:			
Stick	267 N [60 lbf]	133 N [30 lbf]	
Wheel (two hands on rim)	334 N [75 lbf]	222 N [50 lbf]	
Wheel (one hand on rim)	222 N [50 lbf]	111 N [25 lbf]	
Rudder pedal	—	—	667 N [150 lbf]
(b) For prolonged application:	44 N [10 lbf]	22 N [5 lbf]	89 N [20 lbf]

5.2 Longitudinal Control:

5.2.1 With the aeroplane as nearly as possible in trim at $1.3 V_{S1}$, it shall be possible, at speeds below the trim speed, to pitch the nose downward so that the rate of increase in airspeed allows prompt acceleration to the trim speed with:

- 5.2.1.1 Maximum continuous power on each engine;
- 5.2.1.2 Idle power; and
- 5.2.1.3 Wing flap and landing gear:

- (1) Retracted and
- (2) Extended.

5.2.2 Unless otherwise required, it shall be possible to carry out the following maneuvers without requiring the application of single-handed control forces exceeding those specified in **Table 1**. The trimming controls shall not be adjusted during the maneuvers.

5.2.2.1 With the landing gear extended, the flaps retracted, and the aeroplane as nearly as possible in trim at $1.4 V_{S1}$, extend the flaps as rapidly as possible and allow the airspeed to transition from $1.4 V_{S1}$ to $1.4 V_{S0}$:

(1) With power idle and

(2) With the power necessary to maintain level flight in the initial condition.

5.2.2.2 With landing gear and flaps extended, idle power, and the aeroplane as nearly as possible in trim at $1.3 V_{S0}$, quickly apply takeoff power and retract the flaps as rapidly as possible to the recommended go around setting and allow the airspeed to transition from $1.3 V_{S0}$ to $1.3 V_{S1}$. Retract the gear when a positive rate of climb is established.

5.2.2.3 With landing gear and flaps extended, power necessary to maintain level flight at $1.1 V_{S0}$ and the aeroplane as nearly as possible in trim, it shall be possible to maintain approximately level flight while retracting the flaps as rapidly as possible with simultaneous application of maximum continuous power. Power must not be reduced during the level acceleration unless a flap speed exceedance (V_{FE} of the initial position) is imminent. The maneuver is completed when the flaps have reached the selected position and the airspeed is not less than $1.3 V_{S1}$. If gated flap positions are provided, the flap retraction may be demonstrated in stages with power and trim reset for level flight at $1.1 V_{S1}$, in the initial configuration for each stage:

(1) From the fully extended position to the most extended gated position;

(2) Between intermediate gated positions, if applicable; and

(3) From the least extended gated position to the fully retracted position.

5.2.2.4 With idle power, flaps and landing gear retracted and the aeroplane as nearly as possible in trim at $1.4 V_{S1}$, apply takeoff power rapidly while maintaining the same airspeed.

5.2.2.5 With idle power, landing gear and flaps extended, and the aeroplane as nearly as possible in trim at V_{REF} , obtain and maintain airspeeds between $1.1 V_{S0}$ and either $1.7 V_{S0}$ or V_{FE} , whichever is lower without requiring the application of two-handed control forces exceeding those specified in **Table 1**.

5.2.2.6 With maximum takeoff power, landing gear retracted, flaps in the takeoff position, and the aeroplane as nearly as possible in trim at V_{FE} appropriate to the takeoff flap position, retract the flaps as rapidly as possible while maintaining constant speed.

5.2.3 At speeds above $V_{MO}/M_{MO}/V_{NE}$, and up to the maximum speed shown under **9.1**:

5.2.3.1 For Level 1 aeroplanes with $V_{S0} \leq 45$ KCAS, it must be possible to raise the nose at all permitted c.g. positions and engine powers.

5.2.3.2 For Level 1 aeroplanes with $V_{S0} > 45$ KCAS and Level 2, 3, and 4 aeroplanes, a maneuvering capability of $1.5 g$ shall be demonstrated to provide a margin to recover from upset or inadvertent speed increase.

5.2.4 For Level 1 aeroplanes with $V_{S0} > 45$ KCAS and Level 2, 3, and 4 aeroplanes, it shall be possible, with a pilot control force of not more than 45 N [10 lbf], to maintain a