



Designation: F3563 – 22

Standard Specification for Design and Construction of Large Fixed Wing Unmanned Aircraft Systems¹

This standard is issued under the fixed designation F3563; 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 *Applicability:*

1.1.1 This specification identifies the industry standards that have been determined by consensus to demonstrate compliance to the requirements (“the Rules”) for Unmanned Aircraft Systems (UAS).

1.1.2 This specification does not apply to UAS carrying passengers or crew.

1.1.3 The following are outside the scope of this Design and Construction Specification: Vertical Takeoff and Landing (VTOL) or Hybrid Aircraft, Passenger or Crew Carrying UAS, Seaplanes or Amphibians, UAS Certified for Acrobatic Flight, Lightweight UAS that fall under Specification F3298, Recreational UAS (Model Aircraft), Detect and Avoid Systems, Control Station Specifics to Human Factors, Building Codes that apply to Ground Control Stations, and Command and Control Link.

1.1.4 Only standards that are considered mature enough for general application to certification projects and have been found acceptable by committee consensus to propose to the civil aviation authorities (CAAs) for acceptance as a Means of Compliance (MoC) to their Rules are included.

1.1.5 In the event that a particular CAA’s requirements are not harmonized with the other CAA’s requirements, the standards will be written to include the non-harmonized requirements as well as the harmonized requirements with the applicability defined in the standard.

1.2 *Civil Aviation Authorities*—CAAs may accept a specific revision of this specification as an acceptable MoC to their requirements. Acceptance and applicability as an MoC to the CAA’s airworthiness rules remains the decision of the respective CAAs. CAAs may accept this specification, with or without limitations as defined in their specification acceptance document. For information on which CAAs have accepted these standards (in whole or in part) as an acceptable MoC to their Rules, refer to the ASTM Committee F44 (General

Aviation), ASTM Committee F38 (Unmanned Aerial Systems) or ASTM Committee F39 (Aircraft Systems) webpages (www.astm.org/COMMITTEE/F44.htm, www.astm.org/COMMITTEE/F38.htm, www.astm.org/COMMITTEE/F39.htm), which include CAA website links.

1.3 *Applicant Responsibility*—The applicant must seek individual guidance from their respective CAA concerning the use of this specification and any referenced Specifications, Practices, Test Methods, or Guides to show compliance to the CAA rules. Alternatively, an applicant may propose an MoC other than those included in this specification, but it is their responsibility to obtain acceptance of their proposed MoC from their CAA.

1.4 This specification is based heavily on the ASTM Committee F44 General Aviation means of compliance guidelines. Unmanned Aircraft System specific guidance is provided below for areas where considerations specific to the unmanned application of aircraft differs from traditional manned aircraft specification or certification requirements. ASTM F3264–18b, Standard Specification for Normal Category Aeroplanes Certification, from the Committee F44 General Aviation group was used as the starting point with referenced ASTM F44 MoC Specification referenced throughout. The referenced F44 standard is to be used as is except in the areas where UAS-specific changes to standard MoC practices have been identified. These changes are identified in the following manner:

1.4.1 *Unique Addition for UAS*—New UAS-specific MoC added in addition to standard MoC in areas where new UAS functionality is introduced.

1.4.2 *Substitutions for UAS*—Modification of standard MoC to create similar UAS-specific MoCs.

1.4.3 *Not Applicable for UAS*—MoCs not needed for Unmanned Aircraft or Remote Pilot Station.

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.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

¹ This specification is under the jurisdiction of ASTM Committee F38 on Unmanned Aircraft Systems and is the direct responsibility of Subcommittee F38.01 on Airworthiness.

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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

NOTE 1—Referenced ASTM standards are listed in Sections 5 – 12 of this specification.

- F2490 Guide for Aircraft Electrical Load and Power Source Capacity Analysis
- F3060 Terminology for Aircraft
- F3061/F3061M Specification for Systems and Equipment in Aircraft
- F3062/F3062M Specification for Aircraft Powerplant Installation
- F3063/F3063M Specification for Aircraft Fuel Storage and Delivery
- F3064/F3064M Specification for Aircraft Powerplant Control, Operation, and Indication
- F3065/F3065M Specification for Aircraft Propeller System Installation
- F3066/F3066M Specification for Aircraft Powerplant Installation Hazard Mitigation
- F3082/F3082M Specification for Weights and Centers of Gravity of Aircraft
- F3083/F3083M Specification for Emergency Conditions, Occupant Safety and Accommodations
- F3093/F3093M Specification for Aeroelasticity Requirements
- F3114 Specification for Structures
- F3115/F3115M Specification for Structural Durability for Small Aeroplanes
- F3116/F3116M Specification for Design Loads and Conditions
- F3117/F3117M Specification for Crew Interface in Aircraft
- F3120/F3120M Specification for Ice Protection for General Aviation Aircraft
- F3173/F3173M Specification for Aircraft Handling Characteristics
- F3174/F3174M Specification for Establishing Operating Limitations and Information for Aeroplanes
- F3179/F3179M Specification for Performance of Aircraft
- F3180/F3180M Specification for Low-Speed Flight Characteristics of Aircraft
- F3227/F3227M Specification for Environmental Systems in Aircraft
- F3228 Specification for Flight Data and Voice Recording in Small Aircraft
- F3229/F3229M Practice for Static Pressure System Tests in Small Aircraft
- F3230 Practice for Safety Assessment of Systems and Equipment in Small Aircraft
- F3231/F3231M Specification for Electrical Systems for Air-

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.

- craft with Combustion Engine Electrical Power Generation
- F3232/F3232M Specification for Flight Controls in Small Aircraft
- F3233/F3233M Specification for Flight and Navigation Instrumentation in Aircraft
- F3234/F3234M Specification for Exterior Lighting in Small Aircraft
- F3235 Specification for Aircraft Storage Batteries
- F3236 Specification for High Intensity Radiated Field (HIRF) Protection in Small Aircraft
- F3239 Specification for Aircraft Electric Propulsion Systems
- F3254 Specification for Aircraft Interaction of Systems and Structures
- F3264 Specification for Normal Category Aeroplanes Certification
- F3298 Specification for Design, Construction, and Verification of Lightweight Unmanned Aircraft Systems (UAS)
- F3309/F3309M Practice for Simplified Safety Assessment of Systems and Equipment in Small Aircraft
- F3316/F3316M Specification for Electrical Systems for Aircraft with Electric or Hybrid-Electric Propulsion
- F3331 Practice for Aircraft Water Loads
- F3341/F3341M Terminology for Unmanned Aircraft Systems
- F3367 Practice for Simplified Methods for Addressing High-Intensity Radiated Fields (HIRF) and Indirect Effects of Lightning on Aircraft

2.2 *European Aviation Safety Agency (EASA) Regulations:*³
CS 23, Amendment 5 Certification Specifications for Normal Category Aeroplanes

2.3 *Federal Aviation Administration (FAA) Regulations:*
14 CFR 23, Amendment 64 Airworthiness Standards: Normal Category Airplanes⁴
DOT/FAA/AR-00 Aircraft Materials Fire Test Handbook⁵

NOTE 2—The above regulations and requirements are not directly referenced in the specification but are the “relevant applicable regulations” referred to in the *Rules* definition in 3.2.2.

3. Terminology

3.1 *Unique and Common Terminology*—Terminology used in multiple standards is defined in F3341/F3341M, UAS Terminology Standard, and F3060, Aircraft Terminology Standard. Terminology that is unique to this specification is defined in this section.

3.2 Definitions:

3.2.1 *Means of Compliance (MoC), n*—a method or process that is used to show that a rule has been complied with through either design, analysis, test, or a combination of design, analysis, and test.

³ Available from European Union Aviation Safety Agency (EASA), Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, <https://www.easa.europa.eu/document-library/certification-specifications/cs-23-amendment-5>.

⁴ Available from U.S. Government Publishing Office (GPO), 732 N. Capitol St., NW, Washington, DC 20401, <http://www.gpo.gov>.

⁵ Available from <https://www.regulations.gov/>.

3.2.2 *Rules, n*—universal reference to the relevant applicable regulations or standards governing airworthiness requirements for Normal Category Aeroplanes issued by the CAAs.

3.3 Abbreviations:

3.3.1 *CAA, n*—Civil Aviation Authority

3.3.2 *MoC, n*—Means of Compliance

3.3.3 *UA, n*—Unmanned Aircraft

3.3.4 *UAS, n*—Unmanned Aircraft System

3.3.5 *RPS, n*—Remote Pilot Station

4. General

4.1 Regulatory Applicability and Definitions:

4.1.1 See the applicable CAA Rules for specific CAA's Applicability and Definitions. There are currently no standards written or anticipated for these requirements.

UAS Modification Continued safe flight and landing is a condition whereby a UA is capable of continued controlled flight, and landing at a suitable location, possibly using emergency or abnormal procedures, without requiring exceptional pilot skill. Some UA damage may be associated with a failure condition during flight or upon landing.

UAS Change Due to pilot not being onboard the aircraft and subjected to aerodynamic forces as well the reliance on flight control systems, pilot strength has no correlation to control of vehicle.

NOTE 3—Mentions of pilot strength removed throughout due to pilot not needing to overcome onboard aerodynamic forces.

4.2 Certification of Normal Category UAS:

4.2.1 This specification will identify in Sections 5 – 12 the modifications required to make Committee F44 and the referenced standards that are applicable for certification of a fixed-wing UA of a Part 23 design in the normal category and the RPS that controls it.

4.2.2 UA performance levels are:

4.2.2.1 *Low Speed*—For UA with a V_{NO} and $V_{MO} \leq 250$ Knots Calibrated Airspeed (KCAS) and an $M_{MO} \leq 0.6$.

4.2.2.2 *High Speed*—For UA with a V_{NO} or $V_{MO} > 250$ KCAS or an $M_{MO} > 0.6$.

4.2.3 UA not certified for aerobatics may be used to perform any maneuver incident to normal flying, including:

4.2.3.1 Stalls (except whip stalls); and

4.2.3.2 Lazy eights, chandelles, and steep turns in which the angle of bank is not more than 60 degrees.

4.2.4 This specification will identify in Sections 11 and 12 the modifications required to make Committee F44 and the referenced standards applicable for the design and construction of a Remote Pilot Station.

4.2.5 This specification will identify in Appendix X1 other considerations applicable to UAS that an applicant will be expected to address.

5. Flight

5.1 Weight/Mass and Center of Gravity:

5.1.1 **F3082/F3082M**—17 Standard Specification for Weights and Centers of Gravity of Aircraft

Unique Additions for UAS—Add the following UAS-specific considerations to Specification **F3082/F3082M**:

4.1.1.3 Where appropriate and agreed upon by the Certification Authority, simulations (physical or computer) done upon the type and configuration of the aircraft. Note: 4.1.1.3 is added in addition to 4.1.1.1 and 4.1.1.2 [AND].

4.4.1.4 The payload or load configuration specified by the Applicant and agreed to by the Certifying Authority.

Substitutions for UAS—Replace the existing 4.4.1.3 with the following:

4.4.1.3(3) Other fluids required for normal operation of UA systems and water intended for injection in the engines.

Not Applicable for UAS—None

5.1.2 **F3114**—19 Standard Specification for Structures

5.2 Performance Data:

5.2.1 **F3179/F3179M**—18 Standard Specification for Performance of Aircraft

Unique Additions for UAS—None

Substitutions for UAS:

4.8 For High-Speed multiengine UAS over 6000 lb, the following also apply:

4.8.5.3 Include allowance for any reasonably expected time delays in the execution of the procedures, including but not limited to datalink latencies.

Not Applicable for UAS:

4.8.5.1 Descriptions of actions being made in atmospheric conditions experienced by assumed onboard pilot removed.

5.3 Stall Speed:

5.3.1 **F3179/F3179M**—18 Standard Specification for Performance of Aircraft

Unique Additions for UAS:

Note—Due to Flight Envelope Protection Systems, Minimum Steady Flight Speed is used universally in place of stall speed due to limitations on UA flight envelopes.

Substitutions for UAS:

5.1.1 The propulsive thrust not greater than zero at the minimum steady flight speed, or, if the resultant thrust has no appreciable effect on the minimum steady flight speed, with engine(s) at minimum flight thrust and throttle(s) closed with:

5.2 V_{S1} shall be determined by flight tests using the procedure and meeting the flight characteristics specified in the appropriate minimum steady flight speed handling characteristics testing.

Not Applicable for UAS—None

5.4 Takeoff Performance:

5.4.1 **F3179/F3179M**—18 Standard Specification for Performance of Aircraft

Unique Additions for UAS—None

Substitutions for UAS:

6.1 For UA, the rotation speed, V_R , is the speed at which the autopilot makes a control input with the intention of lifting the UA out of contact with the runway.

Not Applicable for UAS—6.1.3

5.5 Climb Requirements:

5.5.1 **F3179/F3179M**—18 Standard Specification for Performance of Aircraft

5.6 Climb Information:

5.6.1 **F3179/F3179M**—18 Standard Specification for Performance of Aircraft