



Designation: F3231/F3231M – 17

Standard Specification for Electrical Systems in Small Aircraft¹

This standard is issued under the fixed designation F3231/F3231M; 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 international standards for the electrical systems aspects of airworthiness and design for “small” aircraft.

1.2 The applicant for a design approval must seek the individual guidance of their respective 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 F44 webpage (www.ASTM.org/COMMITTEE/F44.htm) which includes CAA website links.

1.3 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 non-conformance with the standard.

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

2. Referenced Documents

2.1 Following is a list of external standards referenced throughout this specification; the earliest revision acceptable for use is indicated. In all cases later document revisions are acceptable if shown to be equivalent to the listed revision, or if otherwise formally accepted by the governing civil aviation authority; earlier revisions are not acceptable.

2.2 *ASTM Standards:*²
[F3060 Terminology for Aircraft](#)

¹ This specification is under the jurisdiction of ASTM Committee F44 on General Aviation Aircraft and is the direct responsibility of Subcommittee F44.50 on Systems and Equipment.

Current edition approved Feb. 15, 2017. Published March 2017. DOI: 10.1520/F3231_F3231M-17.

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.

[F3061/F3061M Specification for Systems and Equipment in Small Aircraft](#)

[F3066/F3066M Specification for Powerplant Systems Specific Hazard Mitigation](#)

[F3117/F3117M Specification for Crew Interface in Aircraft](#)

[F3235 Specification for Electrical Storage Batteries in Small Aircraft](#)

2.3 *FAA Standard:*

[DOT/FAA/AR-00/12 Aircraft Materials Fire Test Handbook³](#)

3. Terminology

3.1 Terminology specific to this specification is provided below. For general terminology, refer to Terminology [F3060](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aircraft type code, n*—an Aircraft Type Code (ATC) is defined by considering both the technical considerations regarding the design of the aircraft and the airworthiness level established based upon risk-based criteria; the method of defining an ATC applicable to this specification is defined in Specification [F3061/F3061M](#).

3.2.2 *continued safe flight and landing, n*—continued safe flight and landing as applicable to this specification is defined in Specification [F3061/F3061M](#).

4. Electrical Systems

NOTE 1—[Table 1](#) provides correlation between various Aircraft Type Codes and the individual requirements contained within this section; refer to [3.2.1](#). For each subsection, an indicator can be found under each ATC character field; three indicators are used:

An empty cell () in all applicable ATC character field columns indicates that an aircraft must meet the requirements of that subsection.

A white circle (○) in multiple columns indicates that the requirements of that subsection are not applicable to an aircraft *only* if all such ATC character fields are applicable.

A mark-out (×) in any of the applicable ATC character field columns indicates that the requirements of that subsection are not applicable to an aircraft if that ATC character field is applicable.

Example—An aircraft with an ATC of 1SRLLDLN is being considered. Since all applicable columns are empty for [4.2.1](#), that subsection is applicable to the aircraft. Since both the “L” stall speed column and the “D” meteorological column for [4.1.1](#) contain white circles, then that subsection is not applicable; however, for an aircraft with an ATC of

³ Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.



TABLE 1 ATC Compliance Matrix, Section 4

Section	Airworthiness Level				Number of Engines		Type of Engine(s)		Stall Speed			Cruise Speed		Meteorological Conditions			Altitude		Maneuvers	
	1	2	3	4	S	M	R	T	L	M	H	L	H	D	N	I	L	H	N	A
4																				
4.1																				
4.1.1																				
4.1.1.1																				
4.1.1.2																				
4.1.1.3																				
4.1.1.4																				
4.1.1.5																				
4.1.1.6																				
4.2																				
4.2.1																				
4.2.1.1				x																
4.2.1.2	x	x	x																	
4.2.2																				
4.2.3																				
4.2.4																				
4.2.5																				
4.2.6																				
4.2.7	x	x	x																	
4.2.8	x	x	x																	
4.2.9	x	x	x																	
4.2.10	x	x	x																	
4.2.11	x	x	x																	
4.2.12																				
4.2.12.1																				
4.2.12.2																				
4.2.12.3																				
4.2.12.4																				
4.2.12.5																				
4.2.12.6																				
4.2.12.7																				
4.2.13																				
4.2.13.1																				
4.2.13.2	x	x	x																	
4.2.14																				
4.2.15																				
4.2.16																				
4.2.17																				
4.2.17.1																				
4.2.17.2																				
4.3																				
4.3.1																				
4.3.1.1																				
4.3.1.2																				
4.3.1.3																				
4.3.2																				
4.3.3																				
4.3.4																				
4.3.5																				
4.3.6																				
4.3.7																				
4.4																				
4.4.1																				
4.4.1.1																				
4.4.1.2																				
4.4.2																				
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4.5.4.1																				
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4.6																				
4.6.1																				
4.6.2																				
4.7																				
4.7.1																				

ASTM Standards
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<https://standards.iteh.ai/catalog/standards/sist/2582894-d1e4-491e-921b-4761169f8316/astm-f3231-f3231m-17>

TABLE 1 *Continued*

Section	Airworthiness Level				Number of Engines		Type of Engine(s)		Stall Speed			Cruise Speed		Meteorological Conditions			Altitude		Maneuvers	
	1	2	3	4	S	M	R	T	L	M	H	L	H	D	N	I	L	H	N	A
4.7.2																				
4.7.3																				
4.7.4																				
4.7.5	x																			
4.7.6																				
4.7.7	x																			
4.7.8	x																			
4.8																				
4.8.1	x																			
4.8.2	x																			
4.8.3	x																			
4.9																				
4.9.1																				
4.9.2																				

ISRM DLN, 4.1.1 would be applicable since the “M” stall speed column does not contain a white circle. 4.2.1.2 would not be applicable to either aircraft, since it contains an x in the “1” airworthiness level column.

NOTE 2—This section provides specifications for the electrical generation and distribution systems used to power various aircraft systems and equipment. It intentionally does not address any electrical power systems that may be employed in electrically-powered aircraft propulsion systems; such power systems are outside the scope of this section.

4.1 Power Source Capacity and Distribution:

4.1.1 Each installation whose functioning is required for type certification or under operating rules and that requires a power supply is an “essential load” on the power supply. The power sources and the system must be able to supply the power loads specified in 4.1.1.1 – 4.1.1.6 in probable operating combinations and for probable durations. The power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operation authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on aircraft with three or more engines.

4.1.1.1 When required by 4.1.1, the power sources and the electrical distribution system, when functioning normally must be able to support all connected loads.

4.1.1.2 When required by 4.1.1, the power sources and the electrical distribution system must be able to support all essential loads after the failure of any one engine.

4.1.1.3 When required by 4.1.1, the power sources and the electrical distribution system must be able to support all essential loads after the failure of any one power converter.

4.1.1.4 When required by 4.1.1, the power sources and the electrical distribution system must be able to support all essential loads after the failure of any one energy storage device.

4.1.1.5 When required by 4.1.1, the power sources and the electrical distribution system must be able to support all essential loads after the failure of any two engines on aircraft with three or more engines.

4.1.1.6 When required by 4.1.1, the power sources and the electrical distribution system must be able to support all essential loads for which an alternate source of power is required, after any failure or malfunction in any one power supply system, any one distribution system, or any other utilization system.

4.2 Electrical Systems and Equipment:

4.2.1 Electric power sources, their transmission cables, and their associated control and protective devices must be able to furnish the required power at the proper voltage to each load circuit essential for safe operation.

4.2.1.1 Compliance with 4.2.1 must be shown by an electrical load analysis or by electrical measurements that account for the electrical loads applied to the electrical system in probable combinations and for probable durations.

4.2.1.2 Compliance with 4.2.1 must be shown by an electrical load analysis that accounts for the electrical loads applied to the electrical system in probable combinations and for probable durations.

4.2.2 Each electrical system, when installed, must be free from hazards in itself, in its method of operation, and in its effects on other parts of the aircraft.

4.2.3 Each electrical system, when installed, must be protected from fuel, oil, water, other detrimental substances, and mechanical damage.

4.2.4 Each electrical system, when installed, must be designed so that the risk of electrical shock to crew, passengers, and ground personnel is reduced to a minimum.

4.2.5 Electric power sources must function properly when connected in combination or independently.

4.2.6 No failure or malfunction of any electric power source may impair the ability of any remaining source to supply load circuits essential for safe operation.

4.2.7 Each system must be designed so that essential load circuits can be supplied in the event of reasonably probable faults or open circuits including faults in heavy current carrying cables.

4.2.8 A means must be accessible in flight to the flight crewmembers for the individual and collective disconnection of the electrical power sources from the system.

4.2.9 The system must be designed so that voltage and frequency, if applicable, at the terminals of all essential load equipment can be maintained within the limits for which the equipment is designed during any probable operating conditions.

4.2.10 If any particular system or item of equipment requires two independent sources of electrical power, their