Designation: ~~F3228 – 17~~ F3228 – 21

Standard Specification for Flight Data and Voice Recording in Small Aircraft[1]

This standard is issued under the fixed designation F3228; 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 flight recording 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~~ 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 F44 webpage ~~(www.ASTM.org/COMMITTEE/F44.htm)~~(www.ASTM.org/COMMITTEE/F44.htm), which includes CAA website links. Annex A1 maps the Means of Compliance described in this specification to EASA CS-23, amendment 5, or later, and FAA 14 CFR Part 23, amendment 64, or later.

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

1.4 *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 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

F3061/F3061M Specification for Systems and Equipment in Small Aircraft

F3120/F3120M Specification for Ice Protection for General Aviation Aircraft

F3233/F3233M Specification for Flight and Navigation Instrumentation in ~~Small~~ Aircraft

2.3 *EASA Standard:*[3]

CS-23 Normal, Utility, Aerobatic and Commuter Aeroplanes

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[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.

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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~~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.

2.4 *FAA Standard:*[4]
14 CFR Part 23 Airworthiness Standards: Normal Category Airplanes

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.

4. Flight Data and Voice Recording

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 4.1.1, that subsection is applicable to the aircraft.

4.1 *Cockpit Voice Recorders:*

4.1.1 Each cockpit voice recorder required by the operating rules of the governing civil aviation authority must be approved and must be installed so that the requirements of 4.1.1.1 – 4.1.1.6 are met.

4.1.1.1 The device must record voice communications transmitted from or received in the aircraft by radio.

4.1.1.2 The device must record ambient voice communications of flight crew members on the flight deck.

4.1.1.3 The device must record voice communications of flight crew members on the flight deck, using the aircraft's interphone system.

4.1.1.4 The device must record voice or audio signals identifying navigation or approach aids introduced into a headset or speaker.

4.1.1.5 The device must record voice communications of flight crew members using the passenger loudspeaker system, if there is such a system and if the fourth channel is available in accordance with the requirements of 4.1.3.5.

4.1.1.6 If Controller-Pilot-Data-Link-Communications (CPDLC) equipment is installed, the device must record all CPDLC communications, using an approved data message set. CPDLC messages must be recorded as the output signal from the communications unit that translates the signal into usable data.

4.1.2 If required by the provisions of 4.1.1, the recording requirements for ambient voice communications on the flight deck must be met by installing a cockpit-mounted area microphone, located in the best position for recording voice communications originating at the first and second pilot stations and voice communications of other crew members on the flight deck when directed to those stations.

4.1.2.1 The microphone must be so located and, if necessary, the preamplifiers and filters of the recorder must be so adjusted or supplemented, so that the intelligibility of the recorded communications is as high as practicable when recorded under flight cockpit noise conditions and played back. Repeated aural or visual playback of the record may be used in evaluating intelligibility.

4.1.3 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so that the part of the communication or audio signals specified in 4.1.1 obtained from each of the sources is recorded on a separate channel as specified in 4.1.3.1 – 4.1.3.7.

[4] 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																				
4.1.2																				
4.1.2.1																				
4.1.3																				
4.1.3.1																				
4.1.3.2																				
4.1.3.3																				
4.1.3.4																				
4.1.3.5																				
4.1.3.6																				
4.1.3.7																				
4.1.4																				
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4.1.10																				
4.1.11																				
4.1.12																				
4.1.13																				
4.1.14																				
4.1.15																				
4.1.16																				
4.1.17																				
4.1.18																				
4.1.19																				
4.2																				
4.2.1																				
4.2.1.1																				
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4.2.1.4																				
4.2.1.5																				
4.2.1.6																				
4.2.1.7																				
4.2.1.8																				
4.2.2																				
4.2.3																				
4.2.4																				
4.2.5																				
4.2.6																				
4.2.7																				
4.2.8																				

4.1.3.1 For the first channel, record signals from each boom, mask, or handheld microphone, headset, or speaker used at the first pilot station.

4.1.3.2 For the second channel, record signals from each boom, mask, or handheld microphone, headset, or speaker used at the second pilot station.

4.1.3.3 For the third channel, record signals from the cockpit-mounted area microphone.

4.1.3.4 For the fourth channel, unless utilized in accordance with 4.1.3.5, record signals from each boom, mask, or handheld microphone, headset, or speaker used at the station for the third and fourth crew members.

4.1.3.5 If the stations specified in 4.1.3.4 are not required or if the signal at such a station is picked up by another channel, then,

for the fourth channel, record signals from each microphone on the flight deck that is used with the passenger loudspeaker system, if its signals are not picked up by another channel.

4.1.3.6 As far as is practicable, all sounds received by the microphone(s) listed in 4.1.3.1, 4.1.3.2, 4.1.3.4, and 4.1.3.5 must be recorded without interruption irrespective of the position of the interphone-transmitter key switch.

4.1.3.7 The design of the microphone(s) listed in 4.1.3.1, 4.1.3.2, 4.1.3.4, and 4.1.3.5 shall ensure that side tone for the flight crew is produced only when the interphone, public address system, or radio transmitters are in use.

4.1.4 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so it receives its electrical power from the bus that provides the maximum reliability for operation of the cockpit voice recorder without jeopardizing service to essential or emergency loads.

4.1.5 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so that it remains powered for as long as possible without jeopardizing emergency operation of the aircraft.

4.1.6 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so there is an automatic means to simultaneously stop the recorder and prevent each erasure feature from functioning, within 10 min after crash impact.

4.1.7 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so there is a means of ensuring proper operation during preflight checking.

4.1.8 If separate or individual cockpit voice recorder and flight data recorder units are required by the provisions of 4.1.1 or 4.2.1, or both, each cockpit voice recorder so required must be installed so any single electrical failure external to the recorder does not disable both the cockpit voice recorder(s) and the flight data recorder(s).

4.1.9 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so it has an independent power source that provides ~~10~~10 min ± 1 min of electrical power to operate both the cockpit voice recorder and cockpit-mounted area microphone.

4.1.10 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so it has an independent power source that is located as close as practicable to the cockpit voice recorder.

4.1.11 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so it has an independent power source to which the cockpit voice recorder and cockpit-mounted area microphone are switched automatically in the event that all other power to the cockpit voice recorder is interrupted either by normal shutdown or by any other loss of power to the electrical power bus.

4.1.12 Each cockpit voice recorder required by the provisions of 4.1.1 must be installed so it is in a separate container from the flight data recorder when both are required. If used to comply with only the cockpit voice recorder requirements, a combination unit may be installed.

4.1.13 For each cockpit voice recorder required by the provisions of 4.1.1, the recorder container must be located and mounted to minimize the probability of rupture of the container as a result of crash impact and consequent heat damage to the recorder from fire.

4.1.14 Except as provided in 4.1.15, for each cockpit voice recorder required by the provisions of 4.1.1, the recorder container must be located as far aft as practicable, but need not be outside of the pressurized compartment, and may not be located where aft-mounted engines may crush the container during impact.

4.1.15 For each cockpit voice recorder required by the provisions of 4.1.1, if two separate combination digital flight data recorder and cockpit voice recorder units are installed instead of one cockpit voice recorder and one digital flight data recorder, the combination unit that is installed to comply with the cockpit voice recorder requirements may be located near the cockpit.

4.1.16 For each cockpit voice recorder required by the provisions of 4.1.1, if the cockpit voice recorder has a bulk erasure device, the installation must be designed to minimize the probability of inadvertent operation and actuation of the device during crash impact.

4.1.17 For each cockpit voice recorder required by the provisions of 4.1.1, each recorder container must be either bright orange or bright yellow.

4.1.18 For each cockpit voice recorder required by the provisions of 4.1.1, each recorder container must have reflective tape affixed to its external surface to facilitate its location under water.

4.1.19 For each cockpit voice recorder required by the provisions of 4.1.1, each recorder container must have an underwater locating device, when required by the operating rules of the governing civil aviation authority, on or adjacent to the container which is secured in such manner that they are not likely to be separated during crash impact.

4.2 *Flight Data Recorders:*

4.2.1 Each flight recorder required by the operating rules of the governing civil aviation authority must be installed so to meet the requirements of 4.2.1.1 – 4.2.1.8.

4.2.1.1 Each flight recorder must be supplied with airspeed, altitude, and directional data obtained from sources that meet the accuracy requirements of Specifications F3120/F3120M and F3233/F3233M as appropriate.

4.2.1.2 Each flight recorder must be installed so that the vertical acceleration sensor is rigidly attached, and located longitudinally either within the approved center of gravity limits of the aircraft, or at a distance forward or aft of these limits that does not exceed 25 % of the aircraft's mean aerodynamic chord.

4.2.1.3 Each flight recorder must receive its electrical power from the bus that provides the maximum reliability for operation of the flight data recorder without jeopardizing service to essential or emergency loads.

4.2.1.4 Each flight recorder must remain powered for as long as possible without jeopardizing emergency operation of the aircraft.

4.2.1.5 There must be an aural or visual means for preflight checking of the recorder for proper recording of data in the storage medium.

4.2.1.6 Except for recorders powered solely by the engine-driven electrical generator system, there must be an automatic means to simultaneously stop a recorder that has a data erasure feature and prevent each erasure feature from functioning, within 10 min after crash impact.

4.2.1.7 Each flight recorder must be installed so that it is in a separate container from the cockpit voice recorder when individual units are required. If used to comply with only the flight data recorder requirements, a combination unit may be installed.

4.2.1.8 If a combination unit is installed as a cockpit voice recorder to comply with 4.1.15, a combination unit must be used to comply with this flight data recorder requirement.

4.2.2 If separate or individual cockpit voice recorder and flight data recorder units are required by the provisions of 4.1.1 or 4.2.1, or both, each flight data recorder so required must be installed so that any single electrical failure external to the recorder does not disable both the cockpit voice recorder(s) and the flight data recorder(s).

4.2.3 For each flight data recorder required by the provisions of 4.2.1, each nonejectable record container must be located and mounted so as to minimize the probability of container rupture resulting from crash impact and subsequent damage to the record from fire. In meeting this requirement the record container must be located as far aft as practicable, but need not be aft of the pressurized compartment, and may not be where aft-mounted engines may crush the container upon impact.

4.2.4 For each flight data recorder required by the provisions of 4.2.1, a correlation must be established between the flight recorder readings of airspeed, altitude, and heading and the corresponding readings (taking into account correction factors) of the first pilot's instruments. The correlation must cover the airspeed range over which the aircraft is to be operated, the range of altitude to which the aircraft is limited, and 360° of heading. Correlation may be established on the ground as appropriate.

4.2.5 For each flight data recorder required by the provisions of 4.2.1, each recorder container must be either bright orange or bright yellow.