



Designation: F2316 – 08

# Standard Specification for Airframe Emergency Parachutes for Light Sport Aircraft<sup>1</sup>

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## 1. Scope

1.1 This specification covers minimum requirements for the design, manufacture, and installation of parachutes for light sport aircraft.

1.2 The values stated in SI units are to be regarded as standard. There may be values given in parentheses that are mathematical conversions to inch-pound units. Values in parentheses are provided for information only and are not considered standard.

1.2.1 Note that within the aviation community mixed units are appropriate in accordance with International Civil Aviation Organization (ICAO) agreements. While the values stated in SI units are regarded as standard, certain values such as airspeeds in knots and altitude in feet are also accepted as standard.

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

## 2. Referenced Documents

### 2.1 FAA Document:<sup>2</sup>

FAA Special Conditions 23-ACE-76 (Docket No. 118C), Ballistic Recovery Systems, Modified for Small General Aviation Aircraft

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *armed or arming, v*—the next action activates the system.

3.1.1.1 *Discussion*—Armed or arming is not simply removing a safety pin.

## 4. Materials and Manufacture

4.1 *Materials*—Materials used for parts and assemblies, the failure of which could adversely affect safety, must meet the following conditions:

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F37 on Light Sport Aircraft and is the direct responsibility of Subcommittee F37.70 on Cross Cutting.

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<sup>2</sup> Available from Ballistic Recovery Systems, Inc., 380 Airport Rd., South St. Paul, MN 55075.

4.1.1 The suitability and durability must be established by experience or tests.

4.1.2 The strength and other properties assumed in the design data must meet approved specifications.

4.1.3 The effects of environmental conditions, such as temperature and humidity, expected in service must be taken into account.

## 5. Parachute Model Designations

5.1 *Parachute System Parts List*—A parts list is required for each parachute system for each airframe model in accordance with this specification.

5.2 *New Parachute Model Designations*—Each new parachute system model must be qualified in accordance with this specification.

5.3 *Design Changes*—Design or configuration changes that impact the parachute installation, performance, or operability require a new parachute model designation. Each design change of a part or component of a parachute system qualified by this specification must be evaluated relative to the requirements of this specification.

5.4 *Installation Design Changes*—Any airframe manufacturer, builder, or owner changing the design of their aircraft under this specification shall, as soon as possible, inform the parachute manufacturer about changes that may affect the mounting, attaching, deployment, egress, or specifications of the parachute system.

## 6. Parachute System Design Requirements

### 6.1 Strength Requirements:

6.1.1 Strength requirements are specified in terms of limit loads (the maximum loads to be expected in service) and ultimate loads (loads that are experienced while performing parachute strength tests according to 6.2.1 to gain a safety factor (ultimate load factor) of 1.5). Compliance with strength requirements for components other than the parachute assembly may be demonstrated by analysis or testing.

6.1.2 System evaluation by analysis must use an accepted computational method that has been verified through testing. In other cases, load testing must be conducted.

6.1.3 System evaluation by testing must be supported with instrument calibration verified by an applicable weights and measures regulatory body, for example, state and federal governments.

6.2 *System Design*—The following minimum performance standards for the basic parachute system shall be met.

6.2.1 *Parachute Strength Test*—A minimum of three successful drop tests of the parachute assembly shall be conducted under ultimate load conditions to demonstrate the parachute's strength. A new parachute assembly may be used for each test. Data acquisition shall include recordings of inflation loads as a function of time. A test under ultimate load condition is meant to achieve a safety factor (ultimate load factor) of 1.5 by applying the Energy Method represented by  $E = \frac{1}{2} mv^2$ . Based on the assumption that the parachute opening force correlates to the kinetic energy present, the ultimate load factor of 1.5 is achieved by: (1) increasing the limit load test mass by 1.25 and (2) increasing the limit load test speed by 1.1. Therefore, the Ultimate Load Factor =  $(1.25) \times (1.1)^2 = 1.5$  and a parachute strength test under ultimate load conditions shall be conducted as follows:

Min. Test weight =  $1.25 \times$  Aircraft Gross Takeoff Weight  
 Min. Test Speed =  $1.1 \times$  Aircraft's Maximum Intended Parachute Deployment Speed

6.2.2 *Rate of Descent*—Rate of descent data shall be recorded for all tests in 6.2.1. This data may be corrected for the increase in test vehicle weight to determine the rate of descent at the gross weight of the specific aircraft. Descent rate data from parachute canopies shall be corrected to 1500-m (5000-ft) density altitude and standard temperature.

6.2.3 *Component Strength Test*—All critical components (such as bridles, lanyards, harnesses, activation cables, and so forth) shall be designed to meet the ultimate load factor defined in 6.1.

6.2.4 *Staged Deployment*—The parachute assembly shall be designed to stage the deployment sequence in an orderly manner to reduce the chances of entanglements or similar malfunctions.

6.2.5 *Environmental Conditions*—The system must be evaluated for operations in temperature conditions of  $-40$  to  $48.9^\circ\text{C}$  ( $-40$  to  $120^\circ\text{F}$ ).

6.3 *Installation Design*—Each manufacturer of an emergency parachute system shall provide a specific Parachute Installation Manual (PIM) for the installation into each pertaining aircraft with the documentation described in S2. The PIM shall be used for all installations with parties referenced in 6.3.1.

6.3.1 *Coordination*—Airframe and parachute manufacturers must coordinate and agree to ensure proper installation. Airframe manufacturers of light sport aircraft—special (fully built) must not alter the installation without consulting the parachute system manufacturer. For light sport aircraft—experimental (kit built), the parachute manufacturer shall work with a new original equipment manufacturer, the aircraft builder, or the aircraft owner to create a proper installation design.

6.3.2 *Weight and Balance*—The installation of the parachute system must not adversely affect the center of gravity of the subject aircraft.

6.3.3 *System Mounting*—The hardware used to install the parachute system shall not become loosened or detached as a result of normal wear and tear.

6.3.4 *Extraction Performance*—It must be shown that the extraction device will cleanly penetrate any covering or re-

move the parachute system's cover, if any, and extract the parachute assembly to full line stretch without inhibiting or damaging the parachute upon egress. Airframe and parachute manufacturers must coordinate to ensure that the extraction device and those components extracted by it have an unobstructed trajectory away from the aircraft. While it is recognized that the aircraft configuration is unpredictable in an emergency situation (for example, broken parts creating debris), all due care must be taken to provide a path of least resistance assuming an extremely rapid rate of departure.

6.3.5 *Parachute Attachment to the Airframe*—The parachute assembly must be attached to the primary structure of the aircraft with an airframe attachment harness that may be composed of a single harness section or a series of harness sections. The airframe and parachute manufacturers must coordinate and agree to ensure that the parachute attachment to the subject airframe complies with the following conditions:

6.3.5.1 Parachute deployments induce unique load distributions to the airframe, largely due to geometric locations of the harness attachment points. The airframe attachment points and airframe attachment harness for each individual aircraft type must comply with the ultimate loads determined in the parachute strength test described in 6.2.1.

6.3.5.2 The harness system and attach points must be configured in a manner that presents the aircraft in a descent and landing attitude that maximizes the ability of the aircraft structure to absorb the anticipated landing loads and minimizes the probability of injury to the occupants.

6.3.5.3 The airframe attachment harness must be routed from the installed parachute to the airframe attachment points and secured in a manner that will prevent it from impacting normal operations. It must also be shown that the harness will be satisfactorily stripped free upon extraction and inflation of the parachute.

6.3.5.4 The airframe attachment harness design must minimize the potential for conflict with the propeller. If conflict with the propeller is unavoidable by installation design or operator instructions such as shutting down the engine, the aircraft attachment harness must be manufactured from materials that yield a reasonable likelihood of surviving a conflict with the propeller.

6.3.6 *Activating Housing Routing*—The parachute system must be designed for activation without difficulty. The airframe and parachute manufacturers must coordinate and agree to insure that the installation of the activation system in the subject airframe complies with the following conditions:

6.3.6.1 The routing of the activation system shall not create friction points or other interruptions that may reduce the occupant's ability to activate the system.

6.3.6.2 The activating system shall be secured along its path such that it will not change during the normal operating life of the parachute system.

6.3.6.3 If dual activating handles are used, they must be of a design that allows activation with one handle, even if the other handle is inoperable. An airframe manufacturer electing to offer dual handle activation must coordinate installation with the manufacturer of the ballistic parachute system.

6.3.6.4 It must be shown that arming and activating the system can only be accomplished in a sequence that makes inadvertent deployment extremely improbable. The system must not be armed before the initiation of activation procedures.

6.3.6.5 Some means to secure the activation system must be implemented when the aircraft is not in service.

6.3.7 *Occupant Restraint*—Each seat in an airplane modified or fitted with the emergency parachute system must be equipped with a restraint system consisting of a seat belt and shoulder harness that will protect the occupants from head and upper torso injuries during parachute deployment and ground impact at the critical load conditions.

## 7. Workmanship, Finish and Appearance

7.1 Workmanship must be of a high standard and performed in accordance with QA standards as established by industry consensus (possibly stand-alone standards established within the ASTM structure, see S3.1).

## 8. System Function and Operations

8.1 The installation design and location of the extraction device must consider fire hazards associated with the activation of the parachute system and reduce this potential as much as possible without compromising function of the extraction device.

8.2 The parachute system must be labeled to show its identification, function, and operation limitations.

8.3 All components of the parachute system must be protected against deterioration or loss of strength in service as a result of normal wear, weathering, corrosion, and abrasion.

## 9. Inspection and Maintenance

9.1 Owners of parachute system must follow the parachute system manufacturer's maintenance schedule.

9.2 Instructions for continued airworthiness must be prepared for the parachute system and shall state the service cycles for relevant components of the system, including but not limited to:

9.2.1 Parachute canopy inspection and repacking.

9.2.2 Extraction device inspection and refueling or replacement.

9.3 If the maintenance schedule is not followed, the parachute must be marked "Inoperative."

9.4 Adequate means must be provided to permit annual examination of the parachute container and other system components to ensure proper functioning, egress alignment, and security of harness bridles and activating housing.

9.5 Specific climates may require modification to the parachute system's inspection procedures.

## 10. Operating Limitations

10.1 Operating limitations must be prescribed to ensure proper operation of the parachute system.

## 11. Product Marking

11.1 Key components of the parachute system must be marked on the container with the following information:

11.1.1 Manufacturer's identification,

11.1.2 Part number and revision,

11.1.3 Serial number,

11.1.4 Date of manufacture, and

11.1.5 Service interval date.

11.2 The parachute manufacturer or airframe manufacturer must supply placards or labels for placement in unobstructed view of the occupants or anyone near the egress point (exterior). Refer to 10.1 for operating limitations.

11.3 The owner/operator must display placards or labels for the cockpit or exterior such that these placards or labels can be seen by first responders at accident or incident sites.

11.3.1 *Scope*—These placards or labels are to provide a visual warning to rescue or other personnel at the scene of an accident or incident in the event that the aircraft involved is equipped with a ballistically-deployed emergency parachute system. A ballistic device may include rocket motor, mortar, explosive projectile, spring, or other stored energy device.

11.3.2 *Source*—The manufacturer of parachute system or airframe shall supply the required warning placards or labels with the product in accordance with this specification.

11.3.3 *Installation and Size of Placard or Label*—The airframe manufacturer or builder shall permanently install the warning placards or labels in a manner specified by this specification.

11.3.3.1 *Danger Placard*—A 7.62-cm (3-in.) minimum triangular placard or label with the word "Danger" (see proposed placard in Appendix X1) must be placed adjacent to the parachute egress point for enclosed aircraft where the parachute system may not be visible from the exterior.

NOTE 1—Not all ballistically-deployed emergency parachutes egress the upper surface of an aircraft. Some systems egress the underside of the aircraft. Therefore, an aircraft turned upside down in an accident or incident should display a label on the underside (Appendix X1 contains an example of such labeling).

(1) *Danger Placard Text Explanation*—An explanatory box shall be printed next to the "Danger" placard or label (see proposed placard in Appendix X1).

(2) The danger explanatory box shall describe the type of ballistic deployment device and provide contact information for rescue personnel to seek help from the manufacturer of the ballistic device (see proposed placard in Appendix X1).

11.3.3.2 *Danger Placard*—A 5.08 cm (2-in.) minimum triangular placard or label (see proposed placard in Annex; resize to fit this specification) shall be applied directly on any ballistic extraction device on aircraft that do not have the parachute system inside the aircraft enclosure and that therefore should be visible from the exterior. This placard or label will warn rescue personnel in the event the ballistic device may become separated from the aircraft due to high G forces at impact (Appendix X1 contains an example of such labeling).

11.3.3.3 *Identifying Placard*—A label shall be attached to the body of the extraction device (for example, the rocket body itself) so first responders and safety investigators can identify the device should it become separated from the parachute (discharged or live). This placard shall have contact information as well as graphic images (Appendix X1 contains an example of such labeling).