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PIA Technical Standard 100
Parachute Industry Association Publications

January 23, 1984 TS-100

Standardized Nomenclature for Ram-Air Inflated Gliding Parachutes

Introduction

This Technical Standard was adopted by the Parachute Industry Association (PIA) on January 23, 1984. In view of the fact that the member companies of the PIA are responsible for the production of approximately 90% of the ram-air parachutes in the world, it is anticipated that this document will become the de facto standard for the rest of the parachute community as well. Provisions have been made for periodic revisions of this document; inputs concerning revisions and additions are welcome and should be submitted to:

Parachute Industry Association, Inc.
Attention: Technical Committee Chairman
3833 West Oakton Street
Skokie, IL 60076
telephone: 847-674-9742
fax: 847-674-9743

The construction details shown on the accompanying drawing are not intended to imply that the information provided is the only way to manufacture the part.

Definitions

Airfoil Section Area: The cross sectional area of a given rib (airfoil) section; must specify which rib and cut and/or finished area. Used for calculations of pack volume and internal volume of canopy. Figure 3a.

Angle of Attack: The angle formed between the flight path and the chord line. The Greek letter alpha (\(\alpha\)) is used to denote the angle of attack. Figure 5.

Angle of Trim: The angle formed between the reference line and the trim line; or also found as the angle formed between the plumb line and the trim line minus 90 is called the
angle of trim or trim angle. The 90 value is used to rotate the plumb line into an orientation that is equivalent to aircraft usage. Figure 5.

**Angle of Incidence:** The angle formed between the reference line and the chord line; or also found as the angle formed between the plumb line and the chord line minus 90 is called the angle of incidence. The 90 value is used to rotate the plumb line into an orientation that is equivalent to aircraft usage. Figure 5.

**Aspect Ratio:** Standard definition; Span2/area; which for a rectangular planform reduces to span/chord.

**Cascade Line:** A suspension line that joins another line (usually in the same set) below the canopy surface but above the connector link which results in a shorter total line length for the parachute. Figure 1.

**Cell:** The compartment formed by the top and bottom surfaces and two adjacent load bearing ribs. Each cell is usually divided by a non-load bearing rib to form two half cells. Cells are numbered from left-to-right by full-cell number; use left (L) and right (R) to designate the appropriate half cell. Figure 1.

**Chord:** Standard definition: The chord is measured (in a straight line) from the farthest forward point to farthest aft point on the airfoil section. Measured with the canopy laid flat on side with very light tension and as many wrinkles removed as practical. If the chord is not constant, an average chord may be specified or the chord at each loaded rib may be specified; must also specify design (cut dimensions less seam allowance) or finished dimensions. Figure 2.

**Control Lines:** Control Lines (also known as steering or brake lines) are used to steer and modulate the forward speed of the parachute. Control lines are usually fastened to the trailing edge of the canopy, usually in distinct left and right groups, and are commonly constructed as upper and lower sections; the upper section typically consists of two to five lines per side that converge and join to a single lower control line per side. The lower portion of each set of the control lines is usually routed through a guide ring on the back of the corresponding rear riser and fastened to a control toggle. Control lines are named by left or right sets and numbered sequentially from outside to inside and are usually attached to the trailing edge at the intersection of the rib seams which are also numbered sequentially (at the trailing edge only) from the outside to the inside. Note that the seam number and the control line number attached to it do not necessarily have to match: e.g. control lines 1,2,3,4 may be attached to seams 1, 3, 5, 7. Figure 1, 3a.

**Control Line Deflection:** Control inputs should be expressed in inches deflected downward from the full up position. Alternately, control deflections may be expressed as a percentage of the full control stroke required to stall (steady state) the parachute: i.e. 100% = stall, 0% = no deflection. Note that full-flight setting, toggle length, riser length and suspension line lengths (and trim) can affect the available control stroke; any
specifications for control stroke should also include the specifications for the above items. Figure 3a.

Construction, Chordwise: This is the most common type of ram-air parachute construction. The top and bottom surfaces are assembled from panels that run from front to rear (chordwise) and are joined to the ribs and each other using a variety of sewn seams. Listed below are several variations on this method.

Construction, Full-Cell Chordwise: Top and bottom surfaces are cut to the full width of the cell (plus seam allowance). There are two basic types of full-cell construction:

I-Beam: Full-cell construction in which the top and bottom surfaces are joined to each other at the seams with the loaded ribs. The non-loaded ribs are typically joined to the top and bottom surfaces between the loaded ribs using a flat rolled seam. Figure 4b.

Interlocking T-Beam: Full-cell construction in which the top surfaces are joined to each other at the seams with the non-loaded ribs and the bottom surfaces are joined to each other at the seams with the loaded ribs. Note that this technique will have a half-cell panel at each end of the top surface. Figure 4c.

Half-Cell Chordwise: Top and bottom surfaces are cut to the width of the half-cells and joined to each other at all rib seams. Figure 4c.

Construction, Spanwise: The top and bottom surfaces are assembled from panels that run from side to side (spanwise) across the full width of the canopy. This usually requires three or four panels each for the top and bottom surfaces. Figure 4d.

Cross-Ports: Small holes (usually 5 to 15" maximum diameter) cut in the rib sections to balance the air pressure within the cells across the full span of the canopy. Cross-ports are not cut in the outboard rib sections on either end. Figure 2.

Deployment Brakes: (D-brakes) Used to prevent canopy surge during opening and to provide more reliable openings. The deployment brakes are usually set by pulling the control lines (and thus the trailing edge of the canopy) down to a predetermined point and temporarily fastening them into place at that point; after opening, the user can either leave the deployment brakes set or release them to allow the canopy to achieve full glide. The deployment brake setting should be referenced to the bottom of the leading edge; such as four inches above the bottom of the leading edge, three inches below, etc. Measurements should be taken from the bottom of the rib seam at the line attachment point to the trailing edge at the control line attachment point, with the trailing edge folded over to the leading edge so that the trailing edge lines lay on top of the leading edge lines. If the upper control lines are not all the same length, the reference line must be specified.

Flares, Suspension Line Attachment: Flares are used on some canopies to eliminate the load tapes on the ribs. The flares usually take the form of a catenary curve between the line attachment locations. Figure 3b.
**Full-Flight Setting:** The setting of the trailing edge with the control toggles in the full up positions should be given as a distance above or below the bottom of the leading edge (same reference method as deployment brakes). Also note that the reference control line must be specified: e.g. upper control line #3 set to 4" above the bottom of the leading edge. Figure 3a.

**Glide Path (Flight Path) Angle:** The angle formed between the glide path of the parachute/payload and the horizon. Note that gliding flight has a negative value by convention. The Greek letter gamma (\( \gamma \)) is used to denote the flight path angle.

**Pilot Chute Controlled Reefing (PCR):** Any of the several types of ram air parachute reefing systems that use the drag of the pilot chute to modulate the opening rate of the canopy. Due to the wide variety of implementations, one should give a brief description of the system and operation when referring to PCR systems.

**Planform:** Defined as the overall shape of the wing using the top view perpendicular to the chord line with the canopy laid flat.

**Planform Area:** Defined as the product of the finished chord times the finished span of the canopy.

**Plumb Line:** The plumb line is the straight line formed by using the quarter chord point and the connector links (all stacked on top of each other) as endpoints. This is equivalent to (but rotated 90°) to the centerline used in aircraft as the reference line. The plumb line is used only to locate a reference system that may be quickly and easily determined for any parachute.

**Projected Area:** The area of the inflated canopy as view from above, perpendicular to the chord line at the centerline of the parachute. Due to canopy curvature and cell inflation bulging the projected area is always smaller than the planform area.

**Quarter Chord Point:** The quarter chord point is located 25% of the distance from the leading edge to the trailing edge along the chord line, which is the straight line between the farthest forward and farthest aft points on the airfoil section.

**Reference Line:** The reference line passes through the quarter chord point at a right angle to the plumb line. Usage is equivalent to aircraft practice of using the aircraft centerline as a reference line.

**Ribs:** The sections of fabric installed between the top and bottom surfaces of the canopy and used to establish the airfoil shaped of the canopy. Most canopies have both loaded and non-loaded ribs. The suspension lines are attached to the loaded ribs at the line attachment points. Loaded ribs are numbered from left- to-right to correspond to the suspension line number; non-loaded ribs are numbered from left-to-right to correspond to full-cell number. Figure 2.
Riser Specifications: Should include overall length (specify finished or cut), type of webbing, type of connector links to be used, stitch patterns, thread, riser release mechanism, etc. The normal position for the control line guide ring is on the back side of the rear risers; the top of the control ring should be located 4" (1/16) from the canopy end of the riser. Risers using Velcro to hold the control toggles in place should use the hook Velcro on the riser and the loop Velcro on the toggle; the hook Velcro should be 1" x 5" and should start 1" below the bottom of the guide ring, centered under the ring. Figure 1.

Slider (Sail Slider): Used as areefing device on ram-air parachutes. During deployment, the canopy is reefed as the spreading force of the canopy is resisted by the slider which is held up against the lower surface of the canopy by the airflow. Usually consists of a rectangular section of canopy cloth reinforced on the edges with lightweight webbing or tape with a large grommet or D-ring installed at each corner. Suspension lines (and control lines) from the individual riser groups are routed through the corresponding grommet in the slider. During packing, the slider is pulled up against the bottom of the canopy. Figure 1.

Slider Stops: Small pieces of rigid material (plastic, phenolic, etc.) that are installed on the lower edges of the stabilizer panels to prevent the grommets on the slider from riding up over the stabilizer material and damaging the stabilizers or the slider. A corresponding item known as a slider bumper is installed at the lower end of the suspension lines to prevent damage to the slider grommets caused by the slider contacting the connector links.

Stabilizer Panels: Stabilizer panels are installed on the ends of the canopy and act much as an end plate on an aircraft wing; stabilizers typically run from near the leading edge to near the trailing edge of the canopy; on many canopies the stabilizer is rolled into the outside lower rib seam during construction. Figure 2.

Span: Measured parallel to the leading edge of the top surface, 6" behind the leading edge, with minimal tension (5 lb. or less); if the length of the trailing edge is not the same as the length of the leading edge, an average span or separate leading and trailing edge dimensions may be given and must be specified. Measurements shall be made with 10 pounds-force (or less) tension on the area being measured; at standard atmospheric conditions. Figure 2.

Suspension Lines: Carry the load from the canopy surface to the risers. The lines are numbered by set number from left-to-right and by row letter from front to rear. For example, a canopy with seven cells will normally have eight sets of (usually) three or four rows; thus:

- **Line 1A** is the left front suspension line.
- **Line 8A** is the right front suspension line.
- **Line 1D** is the left rear suspension line (with four rows).
- **Line 8B** is in the second row on the right side.
Note that some canopies may have cascaded lines in order to reduce bulk; i.e. B cascade to A; D cascade to C. The names of the lines are the same.

Suspension Line Lengths: May be given as a leading edge line length and trim dimensions or as a complete set of dimensions. Trim dimensions should be given as a difference in length between one row of lines and the next; A to B, B to C, C to D, etc. For canopies that do not have all the lines in a given row set to the same length the trim dimensions should be given as a complete set of lengths for the line set. Normally all the lines in a given row are the same length; thus, a specification giving leading edge line length, trim dimensions, cascade lengths (as required), deployment brake setting, full flight setting, and upper/lower control line lengths is sufficient to determine all the line lengths on the parachute. Specifications for trim/length dimensions should also include a total overall tolerance for the trim dimensions to avoid accumulation of tolerances. Note that the trim measurements should be taken from the bottom of the rib seam at the line attachment point in order to avoid problems due to differences in the length of the line attachment tapes, type or knot, etc. Figures 1, 2, 3a.

Tapes, Reinforcement: Different types of tape may be used in each of the locations described below (all Figure 2):

- **Load Tapes**: Also known as V-tapes on those canopies which place the tapes in a "V" pattern. Found on the loaded ribs only. Used to distribute loads from the line attachment tapes into the canopy.
- **Rib Leading Edge Tapes**: Found in the leading edge of each rib section.
- **Leading Edge Tapes**: Found in the leading edge of the top and bottom surfaces.
- **Trailing Edge Tape**: Found in the trailing edge seam; usually rolled into the seam.
- **Line Attachment Tapes**: Sewn to the bottom edge of the loaded ribs in alignment with the load tapes; used to transfer the load from the lines to the load tapes. Some canopies use line attachment tapes that continue onto the loaded rib thus taking the place of the load tapes.
- **Cross Tapes**: Reinforcing tapes that run spanwise on the top or bottom surface to distribute concentrated loads into the canopy.
- **Bridle Attachment Tapes**: Used to attach the pilot chute bridle to the top (usually) of the canopy. Most often is tied into the other reinforcing tapes in the canopy in order to distribute the loads.

**Trim Line**: The trim line is the straight line formed using the farthest forward and farthest aft line attachment points (not control line attachment points) as endpoints. Note that this eliminates the effects of a curved bottom surface when specifying trim angle; however, the trim measurements are still required for an accurate specification. The trailing edge may be used as the aft reference point only if it is not used as a control surface or deployment aid.

**Toggles, Control**: Control (steering) toggles are attached to the bottom end of the lower control lines to allow the jumper an adequate handhold on the control lines. May consist
of a wide variety of configurations of webbing or hard plastic T-handles. Where required or critical, a drawing of the control toggle should be supplied. Figure 1.

**Trim Measurements:** See suspension lines measurements. Figure 3a.
Attachment I

FIGURE 1

NOTE: IN THIS VIEW
"B" - LINES ARE CASCADED TO "A" LINES
"D" - LINES ARE CASCADED TO "C" LINES

NOTE: ALL NUMBERING/LETTERING PRECEDENCE IS LEFT TO RIGHT AND FRONT TO REAR (RELATIVE TO DIRECTION OF FLIGHT)
FIGURE 3A

LOADED RIB WITH DIRECTLY ATTACHED SUSPENSION LINES SHOWING SUSPENSION LINE MEASUREMENTS AND TRIM DIMENSIONS

AIRFOIL SECTION

"A" LINE LENGTH

"B" LINE → "C" LINE → "D" LINE

MEASUREMENTS 1 2 3 ARE TRIM DIMENSIONS

CONTROL LINES

MEASUREMENT 4 IS USED TO SPECIFY FULL FLIGHT & DEPLOYMENT BRAKE SETTING RELATIVE TO "A" LINE LENGTH

NOTE: "A" LINE LENGTH + 1 = "B" LINE LENGTH
"A" LINE LENGTH + 1 + 2 = "C" LINE LENGTH
"A" LINE LENGTH + 1 + 2 + 3 = "D" LINE LENGTH
"A" LINE LENGTH + 4 = CONTROL LINE LENGTH FOR FULL-FLIGHT SETTING
"A" LINE LENGTH + 4 = CONTROL LINE LENGTH FOR DB DEPLOYMENT BRAKE SETTINGS

NOTE: IN THIS VIEW SUSPENSION LINES ARE NOT CASCADED
FIGURE 3B

LOADED RIB USING FLARES FOR SUSPENSION LINE ATTACHMENTS

NOTE: TRIM AND RIGGING INFORMATION IS THE SAME AS SHOWN IN FIGURE 3a.
HALF CELL CHORDWISE CONSTRUCTION

SECTION VIEW FROM FRONT

NON-LOADED RIBS

UPPER SURFACE PANELS

LOAD RIBS

LOWER SURFACE PANELS

TYPICAL

FIGURE 4A
FULL CELL CHORDWISE CONSTRUCTION "I" BEAM
SECTION VIEW FROM FRONT

LOADED RIBS

UPPER SURFACE

LOWER SURFACE

NON-LOADED RIBS

FIGURE 4B
FULL CELL CONSTRUCTION
INTERLOCKING "T" BEAM
SECTION VIEW FROM FRONT

NON-LOADED RIBS
UPPER SURFACE

LOADED RIBS
TYPICAL

LOWER SURFACE
TYPICAL

FIGURE 4C
SPANWISE CONSTRUCTION
SECTION VIEW FROM FRONT

NON-LOADED RIBS

UPPER SURFACE PANELS

LOADED RIBS

LOWER SURFACE PANELS

TYPICAL

TYPICAL

FIGURE 4D
FIGURE 5

LEGEND

- PLUMB LINE
- REFERENCE LINE
- CHORD LINE
- TRIM LINE

α  ANGLE OF ATTACK
γ  FLIGHT PATH ANGLE (NEGATIVE FOR GLIDE)
θ  ANGLE OF INCIDENCE FORMED BY INTERSECTION OF CHORD LINE & PLUMB LINE (AT THE CHORD POINT) 90
ϕ  TRIM ANGLE - BETWEEN CHORD LINE & PLUMB LINE 90

CONFLUENCE POINT OF CONNECTOR LINES

FLIGHT PATH ANGLE (RELATIVE TO HORIZON)

% CHORD POINT - USUALLY ASSUMED AS AERODYNAMIC CENTER

θ + 90°
θ + 90°
90°
Parachute Canopy Fabric Pull Test, 
Non-Destructive Method

Background:

The purpose of this test method is to provide a simple, standardized, non-destructive method of verifying the strength of parachute fabric. Although this test is non-destructive caution should be exercised as this test could be damaging to the fabric, if the clamps are not tight and it may affect the fabric permeability. This method is readily usable in the field and is designed to replace the old "Riggers' Thumb Test". This test was first devised in response to the "acid-mesh" discovery in the mid-1980's, but is now the accepted method for all parachutes requiring fabric strength tests. Reasons for testing may vary from fabric age, chemical contamination, UV exposure or discoloration of a suspicious origin, such as grease.

Tools Required and Possible Source:

(2 ea.) Locking Fabric Clamps:
Para-Gear Equipment Co. (800) 323-0437
Aerostar International, P/N 51406M, (605) 331-3500
Aero Store (609) 893-1722

(AR) MIL-I-6903C, Type IV Parachute Ink: See 5a, page 2.
(1 ea.) Spring Scale, 50 lb. (22 Kg.) minimum capacity:
Para-Gear or Aero Store.

This scale must be calibrated in an approved manner at least once a year. It must be identified with a serial number and written verification of calibration must be kept on file. A stick on label or something similar should be affixed to the scale showing the date calibrated and date due next calibration. If the scale is damaged in any manner, such as dropping, it must be pulled from service and tagged as unserviceable until such time as it's recalibrated and returned to service.

Test Procedures:

These test procedures were originally written to address the acid-mesh problem of the mid-1980's that came under factory service bulletins or FAA AD's. However the test is designed to be used on any canopy. The procedures for non-mesh related testing will be the same only the areas being tested will differ. A minimum of 2 areas should be tested on a canopy, but not less than 2 pull tests on each separate color (1 in the warp direction and 1 in the fill direction). It is recommended that fabric pull tests begin when placing a canopy into service and continue every year there after, for the life of the parachute.
When testing fabric next to the mesh proceed as follows:

1. Locate the mesh vents in the canopy and determine the fabric areas which are in contact with the mesh when the canopy is packed. These areas are shown as the diagonally shaded lines in (Figure 1), for typical tri-vent canopies.

2. This non-destructive test does not supersede service bulletins issued by canopy manufacturers for their products or FAA AD's. A minimum of 1 pull test should be performed on each panel of material that comes in contact with the mesh, when the canopy is packed. Alternate your tests from the warp to fill direction on the panels. This could be as few as four tests or as many as twelve tests on some bias constructed canopies, such as the G.Q. Security SAC. The area to be tested must be visibly marked for future reference and to insure that you do not retest the same area. Refer to (figure 4), for examples of how to mark the parachute to be tested.

3. After the marking ink has dried attach the locking fabric clamps (figure 2) to the ripstop fabric as shown in (figure 3). The distance between the clamps should be 3" plus or minus 1/4" (7.5 cm.) and the clamps must be aligned so that the ripstop pattern is parallel to the edge of the jaws. Lock the clamps very securely. This will prevent slippage and possible damage to the fabric.

a). If the area to be tested is too small to allow 3" plus or minus 1/4" between the jaws of the clamps, such as the apex area, you can reduce the distance between the jaws to 2" plus or minus 1/4" (7.5 cm.).

4. Pass a short length of suspension line or other suitable material through the eye of one clamp and secure it to the packing table or other object which will allow a 40 lb. (18 kg.) load without movement. Pass the hook from the spring scale through the other fabric clamp eye and slowly apply a gradual 40 lb. (18 kg.) load and hold for 3 seconds.

5. The area tested must be stamped with the results of your test, (see figure 5). The color must be in contrast to the area tested. It must include the pounds or kg. pulled to, the date tested, the word pass or fail and the loft or name and number of the individual performing the test. After completing the tests the remarks section of the packing data card should reflect your results. As an example: Passed 40 lb. pull tests, your name and number, date and where performed. In addition your master logbook should also be noted in a like manner.

a). The most common color parachute ink is strata-blue. Another color is orange-yellow. With these two colors you will be able to visibly mark any area to be tested. Use only MIL-I-6903C, Type IV Parachute Ink. A possible source for this ink is listed below:

American Writing Ink Co. (617) 482-9167
33 Farnsworth St.
Boston, MA. 02210

Strata-Blue------------------- P/N 7510-00-286-5362
Orange-Yellow-------------- P/N 7510-00-634-6583
Below are diagrams of typical tri-vent modifications.

Diagonally shaded areas show fabric that comes in contact with mesh or may contact mesh.

Figure 1.
TS-108: Canopy Fabric Test Method

Fabric Clamp (Rubber Padded/Square Jaw)

Figure 2.

Ripstop pattern parallel to edge of jaw

Clamp Jaw

*Note: See figure 4 for alternate method of marking area to be tested.

Direction of Load

How to Attach Clamps

Figure 3.
40LB. TENSILE TEST:  
DATE: 
LOFT (AND/OR) NAME AND NUMBER

NOTE: This method uses the corner dots or the right angles as the guides for fabric clamps.

Examples of actual size canopy markings
Figure 4

40LB. TENSILE TEST: PASSED  
DATE: DEC 25 1992  
LOFT (AND/OR) NAME AND NUMBER

Example of completed test
Figure 4
Technical Standard Order

Subject: TSO-C23d, PERSONNEL PARACHUTE ASSEMBLIES

a. Applicability.

(1) Minimum Performance Standards. This technical standard order (TSO) prescribes the minimum performance standard that personnel parachute assemblies must meet in order to be identified with the applicable TSO marking. New models of personnel parachute assemblies that are to be so identified and that are manufactured on or after the date of this TSO must meet the standards set forth in Society of Automotive Engineers, Inc. (SAE) Aerospace Standard (AS) Document No. AS 8015B, “Minimum Performance Standards for Parachute Assemblies and Components, Personnel,” dated July 7, 1992.

b. Marking. Each personnel parachute assembly or separate sub-assembly must be marked in accordance with 14 CFR part 21, section 21.607(d) and paragraph 4.2 of SAE AS 8015B. This marking requirement applies to any previously approved major component/sub-assembly used in this TSO.

c. Data Requirements.

(1) In addition to the requirement in part 21, section 21.605, the manufacturer shall furnish the manager of the Aircraft Certification Office (ACO), FAA having geographical purview of the manufacturer’s facilities, one copy each of the following technical data:

(i) A complete description of the personnel parachute assemblies, including detail drawings, material identification and specifications.

(ii) Operating instructions and limitations, to include donning, retention, adjustment, and deployment.

(iii) Installation instructions and limitations.

(iv) A report of the tests conducted in accordance with SAE AS 8015B for qualification and approval of personnel parachute assemblies.
(v) Detailed maintenance instructions, including specific guidance on the limits of wear and damage permissible to webbing material that would warrant replacement.

(vi) The quality control inspection and functional test specification to be used to ensure each production article complies with this TSO, as required by part 21, section 21.605(a)(3) and part 21, section 21.143(a)(3).

(2) The manufacturer must furnish to the user of the article one copy of the data and information specified in paragraphs e(l)(ii) and e(l)(v). This data and information is necessary for proper installation and use and for continued airworthiness of the product or article.

"The conditions and test required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install the article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if further evaluation by the applicant (user/installer) documents an acceptable installation and is approved by the Administrator."

d. Availability of Referenced Documents.

(1) Copies of SAE AS 8015B may be purchased from the Society of Automotive Engineers, Inc., Department 331, 400 Commonwealth Drive, Warrendale, PA 15096.


(3) Advisory Circular 20-110, "Index of Aviation Technical Standard Orders," may be obtained from the U.S. Department of Transportation, General Services Section, M-443.2, Washington, DC 20590.

/S/ John K. McGrath
Manager, Aircraft Engineering Division
Aircraft Certification Service
SAE AS8015 REV. B
AEROSPACE STANDARD

MINIMUM PERFORMANCE STANDARDS FOR PARACHUTE ASSEMBLIES AND COMPONENTS, PERSONNEL

1. SCOPE:

This document defines the minimum performance standards for personnel parachute assemblies to be carried in aircraft or worn by passengers, crew, or parachutists for emergency use.

This document covers three types of personnel carrying parachute assemblies and the operating limitations for each:

1.1 Types:

1.1.1 Single harness reserve parachute assembly (and components thereof).

1.1.2 Emergency parachute assembly (and components thereof).

1.1.3 Dual harness reserve parachute assembly (and components thereof).

1.2 Maximum Operating Limits, General:

Parachute assemblies, or components, may be certificated for any operating weight limit equal to or greater than 220 lb (100 kg), and for any pack opening airspeed equal to or greater than 150 KEAS (277.8 km/h).

1.2.1 Dual Harness Reserve Parachute Assembly: The maximum operating weight need not be the same for each harness; however, the maximum operating limits must not be less than 400 lb (181.4 kg), 200 lb (90.7 kg) in each harness, and 175 KEAS (324.1 km/h).

2. REFERENCES

2.1 Definitions:

2.1.1 GENERAL: For purposes of this document a parachute assembly normally, but not exclusively consists of the following major components:

a. Deployment initiation device (pilot chute, drogue, or functional equivalent); bridle, if applicable.

b. Deployment control device (sleeve, bag, diaper, or functional equivalent), if used

c. Canopy(s) (includes suspension lines, connector links if used, and reefing device, if used)

d. Riser(s), if used, when not integral with harness and/or canopy

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e. Stowage container

f. Harness(es)

g. Primary actuation device (ripcord or functional equivalent, including reserve static line, if used)

2.1.2 SINGLE HARNESS RESERVE PARACHUTE ASSEMBLY: A certificated parachute assembly (including the reserve deployment initiation device, deployment control device, canopy, risers, stowage container, harness, and actuation device) that is worn in conjunction with a main parachute assembly used for premeditated jumps.

2.1.3 MAIN PARACHUTE ASSEMBLY: A noncertificated parachute assembly (excluding the reserve deployment initiation device, deployment control device, canopy, risers, stowage container, harness, and actuation device) that is worn in conjunction with a certificated reserve parachute assembly as the primary parachute (the one intended for use) for premeditated jumps.

2.1.4 EMERGENCY PARACHUTE ASSEMBLY: A certificated parachute assembly worn for emergency, unpremeditated use only.

2.1.5 DUAL HARNESS RESERVE PARACHUTE ASSEMBLY: A certificated parachute assembly that is used for a premeditated jump by two people: A parachutist in command and a passenger (each in own harness), utilizing one main parachute assembly and one reserve parachute assembly.

2.1.6 FAILURE OF A PARACHUTE ASSEMBLY OR COMPONENT: The term “failure” in this document shall mean any change in a component or assembly that adversely affects its airworthiness.

2.1.7 FUNCTIONALLY OPEN: Functionally open shall mean a parachute sufficiently deployed to provide a rate of descent equal to or less than the limit specified in 4.3.7.

2.1.8 RESERVE STATIC LINE: A device connected to the main canopy that is capable of actuating the reserve parachute assembly following a breakaway from the main canopy.

2.1.9 MAXIMUM OPERATING WEIGHT: The maximum operating weight is the total weight of all individuals or dummies and their equipment.

2.1.10 MAXIMUM OPERATING SPEED: The maximum operating speed equals the maximum pack open speed in KEAS.

3. MATERIALS AND WORKMANSHIP:

Materials and workmanship shall be of a quality which documented experience and/or tests have conclusively demonstrated to be suitable for the manufacture of parachutes. All materials shall remain functional for storage and use from -40 to +200°F (-40 to +93.3 °C), and from 0 to 100% relative humidity. All plated ferrous parts shall be treated to minimize hydrogen embrittlement.
4. DETAIL REQUIREMENTS

4.1 Design and Construction:

4.1.1 Materials: All materials shall be designed to support the proof loads specified in the applicable specification, drawing, or standard, without yielding. In the absence of an applicable specification, drawing, or standard for a particular material, successful completion of the 4.3 tests shall be considered adequate evidence of suitability.

4.1.2 Stitching: Stitching shall be of a type that will not ravel when broken.

4.1.3 Main Parachute Assembly: The main parachute assembly when installed but not deployed shall not interfere with the proper function of the reserve parachute assembly.

4.1.4 Primary Actuation Device/Ripcord/Reserve Static Line: The primary actuation device/ripcord/reserve static line, including all joints, shall withstand the test loads of 4.3.1 without failure and shall meet the functional requirements of 4.3.2.

4.1.5 Harness Release: The harness shall be so constructed that the parachutist can separate himself from the reserve canopy and/or harness assemblies unaided.

On a dual harness reserve parachute assembly: The parachutist in command must be able to separate himself and the passenger from the reserve canopy and/or harness assemblies unaided.

4.1.6 Main Parachute Release: A device capable of releasing the main parachute assembly from the harness of a reserve parachute assembly is optional. If used, the main parachute assembly release shall meet the applicable functional requirements of 4.3.2.

4.1.7 Dual Harness Reserve Parachute Assembly, Reserve Static Line: A reserve static line, or functionally equivalent device, is required on dual harness reserve parachute assemblies.

4.1.8 Dual Harness Parachute Assembly, Drogue Release: On dual harness parachute assemblies the use of a drogue is optional. If a drogue is used, it shall meet the functional requirements of 4.3.2.

4.2 Marking:

Except as noted below, the following information shall be legibly and permanently marked on each major component in a location subject to a minimum of obliteration:

a. Part number, including dash numbers
b. Manufacturer's name and address
c. Date of manufacture (month and year) and serial number
d. FAA TSO-C23 ( )
e. Maximum operating limits (see 1.2 and 4.3.4)
NOTE: These items need not be marked at the same location on the component as long as all of the pertinent information is permanently marked and readily available.

4.2.1 Stowage Container: The information in 4.2 shall be marked on or attached to the outside of the parachute stowage container (pack), and a space provided to mark the information from 4.2.3 and 4.2.4. The lowest maximum operating weight of any component in the assembly (canopy, harness, etc.) and the lowest maximum operating speed of any component (canopy, harness, etc.) shall be marked on the outside of the stowage container (pack) in such a location as to be readily visible to the user during donning of the parachute assembly and subject to a minimum of obliteration during use. Such markings shall be in a block type face, in a minimum size of 3/8 in (9.5 mm) tall (27 point type). The other information required by 4.2, 4.2.3, and/or 4.2.4 may be marked in another location, if desired. In addition, the stowage container shall be provided with a parachute data card pocket constructed such that the card will not be easily lost but will be readily accessible.

4.2.2 Primary Actuation Device/Ripcord: The following information shall be marked on the primary actuation device/ripcord:
   a. Part number, including dash number
   b. Manufacturer's identification
   c. TSO-C23 ( )
   d. Batch, serial number, or date of manufacture (month and year)

4.2.3 Canopy: In addition to 4.2 the following shall be marked on the canopy:
   a. Average peak force measured during 4.3.4 tests.
   b. "Approved for use with emergency parachute assemblies and single harness reserve parachute assemblies without main parachute release only", for canopies that have not passed the test specified in 4.3.6.2.
   c. "Approved for use with single harness reserve parachute assemblies equipped with or without a main parachute release", for canopies which have passed the test specified in 4.3.6.2.
   d. "Approved for use with dual harness reserve parachute assemblies equipped with a main parachute release", for canopies which have passed the test specified in 4.3.6.2.

4.2.4 Harness: In addition to 4.2 marking, the following data shall be marked on the harness:
   a. Average peak force measured during 4.3.4 tests

4.3 Qualification Tests:

The following minimum performance standards shall be met. There shall be no failure to meet any of the requirements during the qualification tests of this section. In case of a
failure, the cause must be found, corrected, and all affected tests repeated. The packing method must be specified and the same packing method must be used for all tests.

4.3.1 Primary Actuation Device/Ripcord Test: The ripcord, including all joints, shall not fail under a straight tension test load of 300 lbf (1337.7 N) applied for not less than 3 s. The reserve static line, if used, must not fail under a straight tension test load of 600 lbf (2667.3 N) for not less than 3 s. If the ripcord is to be static line operated, the test shall be 600 lbf (2667.3 N) for not less than 3 s. The pins, if used, shall not yield under a 8 lbf (35.6 N) load applied to the cable (or equivalent) perpendicular to the axis of the pin, for not less than 3 s. The pin shall be supported for 0.5 in (12.7 mm) maximum at the end farthest from the cable attachment. The pin(s) shall be deemed to have passed this test if the primary actuation device/ripcord which it (they) is (are) a part of then passes the tests specified in 4.3.2.4.

4.3.2 Human Factors and Actuation Force Tests: An anthropometrically diverse group of individuals from the intended user group shall be employed for all human factors tests in 4.3.2.

4.3.2.1 Primary Actuation Device/Ripcord, Human Factors Tests: The primary actuation device/ripcord shall be ground tested by a representative user group of no less than 6 male and 6 female subjects. They shall be able to operate the actuation device without difficulty. The ripcord, or equivalent, shall be sealed in accordance with FAR 65.133 for these tests.

4.3.2.1.1 Single harness reserve parachute assemblies shall be tested with the main compartment(s) both full and empty. The tests shall be conducted by the user in a suspended harness¹ (3 male/3 female), and while standing upright (3 male/3 female); (24 tests total).

4.3.2.1.2 Emergency parachute assemblies shall be tested while standing upright only (6 male/6 female); (12 tests total).

4.3.2.1.3 Dual harness reserve parachute assemblies shall be tested with the passenger attached as follows: Main compartment(s) both full and empty; with the user in a suspended harness¹ (3 male/3 female), with the user suspended by the drogue bridle (3 male/3 female) and while standing upright (3 male/3 female). These tests shall be repeated without the passenger attached; (72 tests total)².

4.3.2.2 Main Canopy Release, Human Factors Tests: The main canopy release, if used, shall be ground tested in a suspended harness¹ by a representative group of no less than 6 male and 6 female subjects; (12 tests total). They shall be able to operate the release without any undue difficulty.

Dual harness reserve parachute assemblies shall be tested while in a suspended harness¹ and while suspended by the drogue bridle with and without a passenger attached by a representative group of no less than 6 male and 6 female subjects; (48 tests total).

¹ “In a suspended harness” shall mean suspended by the risers of the main canopy.

² Dual harness reserve parachute assemblies while being tested with an attached passenger are required to be tested/operated by the parachutist in command. If passenger operated devices are used, all 4.3.2.2 and 4.3.2.3 tests with a test subject in the passenger harness must be repeated with the passenger operating the device.
tests total). They shall be able to operate the release device without any undue difficulty.

4.3.2.3 Drogue Release, Human Factors Tests: The drogue release (if used) shall be ground tested by a representative group of no less than 6 male and 6 female subjects. They shall be able to operate the release device without any undue difficulty. The drogue release shall be tested with the test subject(s) suspended by the drogue bridle (6 male/6 female), and with an additional test subject, if used, in the passenger harness (6 male/6 female); (24 tests total)².

4.3.2.4 Primary Actuation Device/Ripcord, Actuation Force Tests: A load at the ripcord handle, or equivalent, of not less than 5 lbf (22.2 N), applied in the direction giving the lowest pull force, nor more than 22 lbf (97.9 N), applied in the direction giving the highest pull force under normal design operations, shall result in a positive and quick deployment initiation on all tests. A minimum of 10 pull tests is required. For chest type parachute assemblies, the maximum pull force shall be 15 lbf (68.7 N).

4.3.2.5 Main Canopy Release, Actuation Force Tests: While in a suspended harness (with additional ballast as required to equal twice the maximum operating weight), a force at the main canopy release handle, or equivalent (if used), of not less than 5 lbf (22.2 N) (applied in the direction requiring the least force), nor more than 22 lbf (97.9 N) (applied in the direction requiring the greatest force under normal design operations), shall result in a positive and quick release of the main canopy on all tests. A minimum of 12 pull tests is required.

4.3.2.6 Drogue Release, Actuation Force Tests: A force at the drogue release handle (if used), or equivalent, of not less than 5 lbf (22.2 N) (applied in the direction requiring the least force), nor more than 22 lbf (97.9 N) (applied in the direction requiring the greatest force under normal design operations), while suspending the maximum operating weight, shall result in a positive and quick release of the drogue on all tests. A minimum of 12 tests is required.

4.3.3 Compressed Pack and Environmental Tests: Three drops shall be made to the lowest applicable direct drop speed in 4.3.6 except that prior to the test the parachute assembly shall be subjected to the following preconditioning: (These tests may be combined with other tests.)

4.3.3.1 Precondition for 16 h at not less than +200 °F (93.3 °C), stabilize to ambient and test drop.

4.3.3.2 Precondition for 16 h at not greater than -40 °F (-40 °C), stabilize to ambient and test drop.

4.3.3.3 Precondition for not less than 400 continuous hours with a 200 lbf (889.6 N) or greater load applied to compress the pack in a manner similar to that most likely to be encountered in actual use. Test drop within 1 h after removing the load.

4.3.4 Strength Test: No material(s) or device(s) that attenuates shock loads and is not an integral part of the parachute assembly or component being certificated may be used. Tests may be conducted for either a complete parachute assembly or separate components. There shall be no evidence of material, stitch, or functional failure that
will affect airworthiness. The same canopy, harness, component, and/or riser(s) shall be used for all 4.3.4 tests. Opening forces shall be measured on all 4.3.4 tests. The parachute must be functionally open within the number of seconds calculated for 4.3.6 tests. Parachute assemblies shall be tested in accordance with the following schedule:

a. Test weight = Maximum operating weight limit x 1.2
b. Test speed = Maximum operating speed limit x 1.2

However, test weight must be not less than 264 lb (119.7 kg) and the test speed must be not less than 180 KEAS (333.4 km/h) for reserve and emergency parachute assemblies; for dual harness parachute assemblies for test weight must not be less than 480 lb (217.7 kg) and the test speed must not be less than 210 KEAS (388.9 km/h).

4.3.4.1 Emergency Parachute Assembly: Three drops shall be made with weight and speed in accordance with 4.3.4. Where easily detachable hardware (such as snap and ring) is used to attach the canopy or riser(s) to the harness, a cross connector must be used and one of the above drops shall be with only one attachment engaged to test the cross connector and hardware.

4.3.4.2 Canopy to be Used With a Single or a Dual Harness Reserve Parachute Assembly (Alternate Test for 4.3.4.1): Three drops shall be made with a suspended weight and speed in accordance with 4.3.4. A test vehicle (e.g., a bomb) may be used. The canopy, deployment device (if used), a pilot chute (if used), and riser(s) (if used) shall be tested as a unit. The riser(s), or equivalent, shall be secured to the test vehicle in the same manner that it is intended to attach to the harness. Where easily detachable hardware (such as snap and ring) is intended to attach the canopy or riser(s) to the harness, one of the above drops shall be made with only one attachment engaged to test the cross connector and hardware.

4.3.5 Functional Test (Twisted Lines): A minimum of 5 drops shall be made with a weight not more than the maximum operating weight dummy or person\(^3\) in each harness. The airspeed at the time of pack opening shall be 60 KEAS (111.1 km/h). Three twists in the same direction (360° each) shall be purposely packed in the suspension lines adjacent to the lowest attachment point to the canopy. The parachute must be functionally open within the time calculated for 4.3.6 tests +1 s from the time of pack release.

4.3.6 Functional Test (Normal Pack All Types): For all 4.3.6 tests the maximum allowable opening time for parachute canopies with a maximum operating weight of 250 lb (113.4 kg) or less, is 3 s from the moment of pack opening. For parachutes with a maximum operating weight of greater than 250 lb (113.4 kg) the maximum allowable opening time shall be increased by 0.01 s for every pound of maximum operating weight in excess of 250 lb (113.4 kg).

\(^3\) A person's or individual's body weight may be increased to equal the maximum operating weight by using a weight belt or similar device.
Alternatively altitude loss instead of time may be measured and the maximum allowable altitude loss may be calculated as follows.

For all 4.3.6 tests the maximum allowable altitude loss for parachutes with a maximum operating weight of 250 lb (113.4 kg) or less is 300 ft (91.5 m) from the altitude at pack opening. For parachutes with a maximum operating weight of greater than 250 lb (113.4 kg) the maximum allowable altitude loss shall be increased by 1 ft for every pound of maximum operating weight in excess of 250 lb (113.4 kg).

NOTE: Altitude loss measurements must be measured along a vertical trajectory only. However, the deviation from the vertical produced by a gliding main parachute descending with a vertical velocity of less than 20 FPS (6.1 m/s) shall be acceptable.

4.3.6.1 Direct Drop Tests: There shall be a minimum of 48 drops with a weight not more than the maximum operating weight. There shall be a minimum of 6 dummy drops at the maximum operating weight. The airspeed at the time of pack opening shall be as outlined in the test table. The airspeeds are in KEAS (km/h). The parachute canopy must be functionally open within the time obtained in 4.3.6 from the time of pack opening.

4.3.6.2 Breakaway Drop Tests: Eight drops shall be made by a person weighing not more than the maximum operating weight by breaking away from an open and normally functioning main parachute canopy with a vertical velocity of less than 20 FPS (6.1 m/s) at the time of breakaway and actuating the reserve pack within 2 s of the breakaway. If a reserve static line is part of the assembly, no less than 4 of the breakaway drops shall be made with the reserve static line actuating the reserve pack. The parachute canopy must be functionally open within the time +2 s, or altitude, obtained in 4.3.6 from the time of breakaway.

4.3.6.3 Emergency Parachute Assembly: There shall be a minimum of 48 drops with a weight not more than the maximum operating weight. There shall be a minimum of 6 dummy drops at the maximum operating weight. The airspeed at the time of pack opening shall be as outlined in the test table. The parachute canopy must be functionally open within the time obtained in 4.3.6 from the time of pack opening. The airspeeds are in KEAS (km/h).
TABLE 1

<table>
<thead>
<tr>
<th>KEAS (km/h)</th>
<th>KEAS (km/h)</th>
<th>KEAS (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 (111.1)</td>
<td>86 (157.4)</td>
<td>110 (203.7)</td>
</tr>
</tbody>
</table>

Main Compartment Full  7  7  7  Live or Dummy
Main Compartment Empty  7  7  7  Live or Dummy
Main Compartment Full  1  1  1  Dummy
Main Compartment Empty  1  1  1  Dummy

NOTE: Reference to full and empty main compartments do not apply to emergency parachute assemblies.

4.3.7 Rate of Descent Tests, All Types: There shall be not less than 6 drops, with an individual and/or dummy in each harness weighing not less than the maximum operating weight. The average rate of descent shall not exceed 24 ft/s (7.3 m/s), and the total velocity shall not exceed 36 ft/s (11.0 m/s), in an unaltered post deployment configuration, corrected to standard sea level altitude conditions. The rate of descent measurement shall be taken over a minimum interval of 100 ft (30.5 m). These tests may be combined with other tests in this section.

4.3.8 Stability Test, All Types: There shall be not less than 6 drops, with a dummy weighing one half the maximum operating weight. The oscillations shall not exceed 15° from the vertical, in an unaltered post deployment configuration. These tests may be combined with other tests in this section.

4.3.9 Live Drop Tests, All Types: There shall be a minimum of 4 live drop tests with an individual weighing not more than the maximum operating weight in each harness. Two drops shall include a freefall of not more than 3 s and 2 drops shall include a freefall of at least 20 s. These tests may be conducted in conjunction with functional and/or rate of descent tests when practical. The user(s) must suffer no significant discomfort from the opening shock and must be able to disengage himself (themselves) unaided from the harness after landing. For this test the standard harness may be altered to permit attachment of a certificated reserve parachute assembly (less harness) provided that such alteration does not interfere with the normal operation of the parachute assembly being tested. Reserve parachute assemblies shall be tested with the main compartment(s) full and empty, except dual harness reserve parachute assemblies.

5 COMPONENT QUALIFICATIONS:

5.1 Parachutes may be qualified as complete assemblies or as separate components (such as a canopy, a stowage container [pack], and/or a riser[s]). The airworthiness of a parachute assembly, including other separately approved nonoriginal components, is the responsibility of the manufacturer who performs the certifying tests for the parachute assembly. The manufacturer shall publish and make available a list of interchangeable components which have passed the following tests in 4.3 when tested in conjunction with the assembly or component(s) being certificated.

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4 A person's or individual's body weight may be increased to equal the maximum operating weight by using a weight belt or similar device.
5.1.1 Canopy Including Suspension Lines: 4.3.3, 4.3.4.1 (or 4.3.4.2), 4.3.5, 4.3.6, 4.3.7, 4.3.8, 4.3.9
5.1.2 Deployment Device: 4.3.3, 4.3.4.1 (or 4.3.4.2), 4.3.5, 4.3.6, 4.3.9
5.1.3 Pilot Chute (Including Bridle): 4.3.3, 4.3.4.1 (or 4.3.4.2), 4.3.5, 4.3.6, 4.3.9
5.1.4 Stowage Container (Pack): 4.3.2.1, 4.3.2.3, 4.3.3, 4.3.6, 4.3.4.1 (or 4.3.4.2), 4.3.5, 4.3.9
5.1.5 Harness: 4.3.4.1, 4.3.6, 4.3.9
5.1.6 Actuation Device (Ripcord and/or Reserve Static Line): 4.3.1, 4.3.2, 4.3.6.2, 4.3.9
5.1.7 Actuation Device (Reserve Static Line): 4.3.1, 4.3.6.2
5.1.8 Riser(s): 4.3.4.1 (or 4.3.4.2), 4.3.6, 4.3.9
Technical Standard Order

Subject: TSO-C23c, PERSONNEL PARACHUTE ASSEMBLIES

(a) Applicability

(1) Minimum Performance Standard. This Technical Standard Order (TSO) prescribes the minimum performance standard that personnel parachute assemblies must meet in order to be identified with the applicable TSO marking. This TSO has been prepared in accordance with the procedural rules set fourth in Subpart O of the Federal Aviation Regulations, Part 21. Personnel parachute assemblies that are to be so identified and that are manufactured on or after the date of this TSO must meet the standard set fourth in society of Automotive Engineers, Inc. (SAE), Aerospace Standard (AS) 8015A, Minimum Performance Standard for Parachute Assemblies and Components, Personnel, dated September 30, 1982, as amended and supplemented by this TSO.

(b) Markings. None in addition to the marking specified in Federal Aviation Regulations (FAR)/21.607(d).

(c) Data Requirements.

In addition to FAR/21.605, the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), having purview of the manufacturer’s facilities, one copy each of the following technical data:

(1) Operating instructions.
(2) Equipment limitations.
(3) Inspection and test procedures applicable to this product.
(4) Specifications.
(5) Maintenance procedures.
(6) Manufacturer’s TSO qualification test report.

(d) Previously Approved Equipment. Personnel parachute assemblies approved prior to the date of this TSO may continue to be manufactured under the provisions of the original approval.
(c) Availability of Reference Documents.

(1) Copies of SAE AS 8015A may be purchased from the Society of Automotive Engineers, Inc., Department 331, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

(2) Federal Aviation Regulations, Part 21, Subpart O and Advisory Circular 20-110, Index of Aviation Technical Standard Orders, may be reviewed at the FAA Headquarters in the Office of Airworthiness, Aircraft Engineering Division (AWS-110) and at all ACOs.

M.C. BEARD
Director of Airworthiness
SAE AS8015 REV. A
AEROSPACE STANDARD

MINIMUM PERFORMANCE STANDARDS FOR PARACHUTE ASSEMBLIES AND COMPONENTS, PERSONNEL

1. SCOPE:

This specification defines the minimum performance standards for personnel parachute assemblies to be carried in aircraft or worn by passengers, crew, or paratroopers for emergency use.

This specification covers two types and three weight/speed categories of personnel carrying parachute assemblies:

1.1 Types:

1.1.1 Reserve parachute assembly (The term reserve and auxiliary are used synonymously).

1.1.2 Emergency parachute assembly.

1.2 Weight/Speed Ranges: The weights and speeds are maximum for each category.

1.2.1 Category A: 90 kg (198 lb)/130 knots.

1.2.2 Category B: 115 kg (242 lb)/150 knots.

1.2.3 Category C: 115 kg (242 lb)/175 knots.

2. Definitions:

2.1 RESERVE PARACHUTE ASSEMBLY: A parachute assembly which is worn in conjunction with a main parachute assembly used for a premeditated jump.

2.2 MAIN PARACHUTE ASSEMBLY: A parachute assembly, excluding the harness, that is used in conjunction with a reserve parachute assembly as the primary parachute assembly (the one intended for use) for premeditated jumps.

2.3 TANDEM (PIGGYBACK) PARACHUTE ASSEMBLY: A parachute assembly having a reserve and a main parachute, stowed separately, but in compartments on the same side of the body.

2.4 EMERGENCY PARACHUTE ASSEMBLY: An emergency parachute assembly worn for emergency, unpremeditated use only.
2.5 GENERAL: For purposes of this specification a parachute assembly normally consists of seven major components:

1. Canopy (includes suspension lines).
2. Deployment device (sleeve, bag, or equivalent), if used.
3. Pilot chute (including bridle), if used.
4. Riser(s), if used, when not integral with harness and/or canopy.
5. Stowage container (pack).
6. Harness.
7. Primary actuation device (ripcord assembly or equivalent)

3. MATERIAL AND WORKMANSHIP:

3.1 Materials and workmanship shall be of a quality which documented experience and/or tests have conclusively demonstrated to be suitable for the manufacture of parachutes. All materials shall remain functional for storage and use from -40 to +93.3 °C (-40 to +200 °F). All plated ferrous parts shall be treated to minimize hydrogen embrittlement.

4. DETAIL REQUIREMENTS

4.1 Design and Construction:

4.1.1 Fittings: All fittings shall be designed to support the proof loads specified in the applicable specification, drawing, standard, etc., without yielding.

4.1.2 Stitching: Stitching shall be of a type that will not ravel when broken.

4.1.3 Primary Actuation Device/Ripcord: The primary actuation device/ripcord, including joints between the handle and the release, shall withstand the test loads of 4.3.1 without failure and shall meet the functional requirements of 4.3.2. The actuation grip shall be located as to be readily visible and accessible.

4.1.4 Harness Release: The harness shall be so constructed that the rider can separate himself from the canopy and/or harness assembly unaided.

4.1.5 Main Canopy Release: A quick releasing device between the harness of a reserve parachute assembly and the main canopy is mandatory.

4.2. Marking: Except as noted below, the following information shall be legibly and permanently marked on each major component in a location subject to a minimum of obliteration:

Part number, including dash numbers
Manufacturer name and address
Date of manufacture and/or serial number
FAA TSO-C23c
Category A, B, C placards (see table)
4.2.1 Stowage Container: The information in 4.2 shall be marked on or attached to the outside of the parachute stowage container (pack). In addition, the stowage container shall be provided with a parachute data card pocket constructed such that the card will not be easily lost but will be readily accessible.

4.2.2 Canopy: In addition to the above information, the canopy markings shall include the canopy serial number.

4.2.3 Primary Actuation Device/Ripcord: The following information shall be marked on the primary actuation device/ripcord:

- Part number, including dash number
- Manufacturer's identification
- TSO-C23c
- Batch or serial number, and/or date of manufacture

4.2.4 Documents: The manufacturer shall provide all necessary instructions and/or manuals.

4.3 Qualification Tests: The following minimum performance standards shall be met. There shall be no failure to meet any of the requirements during the qualification of this section. In case of a failure, the cause must be found, corrected, and all affected tests repeated.

4.3.1 Ripcord Test: The ripcord, including all joints between the handle and the release, shall not fail under a straight tension test load of 1335 N (300 lbf) applied for not less than three seconds. If the ripcord is to be static line operated, the test shall be 2670 N (600 lbf) for not less than three seconds. The pins, if used, shall not yield under a 36 N (8 lbf) load applied to the cable (or equivalent) perpendicular to the axis of the pin. The pin shall be supported for 13 mm (.5 in.) maximum at the end farthest from the cable attachment.

4.3.2 Pull Test, Primary Actuation Device/Ripcord: Reserve parachute assemblies shall be tested both with the main compartment(s) full and empty.

4.3.2.1 Human Factors: The primary actuation device shall be ground tested by use of a representative group of no less than five male and five female subjects. They shall be able to operate the actuation device without undue difficulty while in a suspended harness. The ripcord, or equivalent, shall be sealed for these tests.

4.3.2.2 Pull Tests: A load AT THE RIPCORD HANDLE of not less that 23 N (5 lbf) (applied in the direction giving the lowest pull load) nor more than 97 N (22 lbf) [APPLIED IN THE DIRECTION GIVING THE HIGHEST PULL LOAD UNDER NORMAL DESIGN OPERATIONS] shall be required to cause a positive and quick functioning of the parachute assembly on all tests. A minimum of ten pull tests is required. For chest-type parachute assemblies, the maximum pull force shall be 66 N (15 lbf)
4.3.3 Compressed Pack and Environmental Test: Three drops shall be made to the lowest applicable speed phase in 4.3.6 except that prior to the test the parachute assembly shall be subjected to the following conditioning:

4.3.3.1 Four hundred continuous hours with a 890 N (200 lbf) load applied to compress the pack. Sixteen hours at 93.3 °C (+200 °F) without the 890 N (200 lbf) load. Immediately re-apply 890 N (200 lbf) load and stabilize to ambient and test drop.

4.3.3.2 Sixteen hours at -40 °C (-40 °F) without the 890 N (200 lbf) load. Immediately apply 890 N (200 lbf) load and stabilize to ambient and test drop.

These tests may be combined with 4.3.6 when practical.

4.3.4 Strength Test: No material(s) or device(s) that attenuates shock loads and is not an integral part of the parachute assembly or component being certificated may be used. Tests may be conducted for either a complete parachute assembly or a separate canopy. There shall be no evidence of material, stitch, or functional failure that will affect airworthiness. The same canopy, harness and/or riser(s) shall be used for all 4.3.4 tests. Parachute assemblies may be tested in accordance with Category A, B, or C.

4.3.4.1 Parachute Assembly: Three drops shall be made with a 136 kg (300 lb) man-shaped dummy. The velocity of the dummy shall be in accordance with category A, B, or C schedule (see Table 1). Where easily detachable hardware (such as snap and ring) is used to attach the canopy or riser(s) to the harness, a cross connector must be used and one test shall be with only one attachment engaged to test the cross connector and hardware.

4.3.4.2 Canopy (Alternate Test for 4.3.4.1): Three drops shall be made with a suspended weight of 136 kg (300 lb) and a velocity in accordance with Category A, B, or C schedule (see Table 1). A test vehicle (e.g., a bomb) may be used. The canopy, deployment device (if used), a pilot chute (if used), and riser(s) (if used) shall be tested as a unit. The riser(s), or equivalent, shall be secured to the test vehicle in the same manner that it is intended to attach to the harness. Where easily detachable hardware (such as snap and ring) is intended to attach the canopy or riser(s) to the harness, one drop shall be made with only one attachment engaged to test the cross connector and hardware.

4.3.5 Functional Test (Twisted Lines): A minimum of five drops shall be made with a 77 kg (170 lb) dummy or person. The indicated airspeed at the time of release shall be 60 knots. Three twists (360° each) shall purposely be packed in the suspension lines adjacent to the lowest attachment point to the canopy. The parachute must be fully open within four seconds from the time of pack release.

4.3.6 Functional Test (Normal Pack): There shall be a minimum of 48 drops from an aircraft with a 77 kg (170 lb) dummy or person. The indicated airspeed at the time of pack release shall be as follows for 16 drops each: 60, 85, and 110 knots IAS. In addition, reserve parachute assemblies shall be dropped 8 times by breaking away
from an open and normally functioning main parachute canopy and releasing the reserve pack within two seconds of breakaway. The parachute canopy must be fully open within three seconds from the time of pack release. These tests may be live jumps by a 77 kg (170 lb) individual except that at least two dummy drops shall be made at 60, 85, and 110 knots IAS. Reserve parachute assemblies shall be tested with the main compartment(s) full and empty (24 tests full).

4.3.7 Rate of Descent Tests: There shall be at least 6 drops, of which at least 3 shall be dummy drops, from an aircraft with a 77 kg (170 lb) (min) individual and/or dummy. The average rate of descent shall not exceed 6.4 m (21 ft) per second for that last 30 m (98 ft) corrected to standard sea level altitude conditions. A method shall be employed for direct and accurate measurement of rate of descent such as the use of a weighted cord or cable by which the descent may be timed for the last 30 m (98 ft) from the time of ground impact of the weight to ground impact of the dummy. The oscillation shall not exceed 15 from the vertical. These tests may be combined with other tests in this section.

4.3.8 Live Drop Tests: There shall be a minimum of 4 live drop tests from an aircraft with an individual weighing 77 kg (170 lb) (PLUS the weight of the certificated reserve parachute assembly). Two drops shall include a freefall of not more than three seconds and two drops shall include a freefall of at least 15 seconds. These tests may be conducted in conjunction with functional and/or rate of descent tests when practical. (The user must suffer no significant discomfort from the opening shock and must be able to disengage himself unaided from the harness after landing.) For this test the standard harness may be altered to permit attachment of a certificated reserve parachute assembly (less harness) provided that such alteration does not interfere with the normal operation of the parachute assembly being tested. Reserve parachute assemblies shall be tested with the main compartment(s) both full and empty.

5. COMPONENT QUALIFICATION:

5.1 Parachutes may be qualified as complete assemblies or as components (e.g., just the harness/container assembly). The airworthiness of a parachute assembly, including other separately approved, non-original components, is the responsibility of the manufacturer who performs the certifying tests for the parachute assembly. The manufacturer shall publish and make available a list of interchangeable components which have passed the following tests in 4.3 when tested in conjunction with the assembly or component(s) being certificated.
TABLE I
CATEGORIES A, B, OR C SCHEDULE

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>TEST</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>A TEST</td>
<td>136 kg (300 lb) at 150 knots.</td>
<td></td>
</tr>
<tr>
<td>Placard</td>
<td>CATEGORY A: This parachute is limited to use by persons up to 90 kg (198 lb) fully equipped, and up to 130 knots.</td>
<td></td>
</tr>
<tr>
<td>B TEST</td>
<td>136 kg (300 lb) at 175 knots.</td>
<td></td>
</tr>
<tr>
<td>Placard</td>
<td>CATEGORY B: This parachute is limited to use by persons up to 115 kg (254 lb) fully equipped, and up to 150 knots.</td>
<td></td>
</tr>
<tr>
<td>C TEST</td>
<td>136 kg (300 lb) at 230 knots.</td>
<td></td>
</tr>
<tr>
<td>Placard</td>
<td>CATEGORY C: This parachute is limited to use by persons up to 115 kg (254 lb) fully equipped, and up to 175 knots.</td>
<td></td>
</tr>
</tbody>
</table>

SPEEDS ARE GIVEN IN KIAS, AND ARE INTENDED TO BE AT PACK OPENING.

5.1.1 Canopy Including Suspension Lines: 4.3.2, 4.3.3, 4.3.4.1 (or 4.3.4.2), 4.3.5, 4.3.6, 4.3.7, 4.3.8
5.1.2 Deployment Device: 4.3.2, 4.3.3, 4.3.4.1, (or 4.3.4.2), 4.3.5
5.1.3 Pilot Chute (Including Bridle): 4.3.2, 4.3.3, 4.3.4.1 (or 4.3.4.2), 4.3.5, 4.3.6, 4.3.8
5.1.4 Stowage Container (Pack): 4.3.2, 4.3.3, 4.3.6
5.1.5 Harness: 4.3.4.1, 4.3.6, 4.3.8
5.1.6 Actuation Device (Ripcord): 4.3.1, 4.3.2, 4.3.6, 4.3.8
5.1.7 Riser(s): 4.3.4.1 or 4.3.4.2, 4.3.6, 4.3.8
FEDERAL AVIATION AGENCY
Washington 25, D. C.

TECHNICAL STANDARD ORDER
Regulations of the Administrator

Part 514

SUBJECT: PARACHUTES

Technical Standard Orders for Aircraft Materials, Parts, Processes, and Appliances

Part 514 contains minimum performance standards and specifications of materials, parts, processes, and appliances used in aircraft and implements the provisions of sections 3.18, 4a.31, 4b.18, 6.18 and 7.18 of the Civil Air Regulations. The regulation uses the Technical Standard Order system which, in brief, provides for FAA-industry cooperation in the development of performance standards and specifications which are adopted by the Administrator as Technical Standard Orders, and a form of self-regulation by industry in demonstrating compliance with these orders.

Part 514 consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. These provisions are summarized below for the convenient reference of the public. Subpart B contains the technical standards and specifications to which a particular product must conform, and each Technical Standard Order is set forth in the appropriate section of Subpart B. The subject Technical Standard Order is printed below. ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D. C.

SUBPART A--GENERAL

This subpart provides, in part, that a manufacturer of an aircraft material, part, process, or appliance for which standards are established in Subpart B, prior to its distribution for use on a civil aircraft of the United States, shall furnish a written statement of conformance certifying that the material, part, process, or appliance meets the applicable performance standards established in this part. The statement of conformance must be signed by a person duly authorized by the manufacturer, and furnished to the Chief, Engineering and Manufacturing Division, Bureau of Flight Standards, Federal Aviation Agency, Washington 25, D. C.

Subpart A also requires appropriate marking of materials, parts, processes, and appliances as follows:
(a) Name and address of the manufacturer responsible for compliance,
(b) Equipment name, or type or model designation,
(c) Weight to the nearest pound and fraction thereof,
(d) Serial number and/or date of manufacture, and
(e) Applicable Technical Standard Order (TSO) number.

In addition, Subpart A provides that no deviation will be granted from the performance standards established in Subpart B, and that the Administrator may take appropriate action in the event of noncompliance with Part 514.
SUBPART B

514.33 Parachutes - TSO-C23b--(a) Applicability--(1) Minimum performance standards. Minimum performance standards are hereby established for parachutes which are to be used in civil aircraft of the United States. New models of parachutes manufactured for use in civil aircraft of the United States on or after March 29, 1962, shall meet the minimum performance standards of National Aircraft Standards Specification 804 dated August 24, 1949, with the exceptions covered in subparagraph (2) of this paragraph. Parachutes approved prior to March 29, 1962, may continue to be manufactured under the provisions of the original approval.

(2) Exceptions. (i) The auxiliary parachute used in combination with a standard parachute shall be designed for use in combination with the specific main parachute.

(ii) For the purpose of testing an auxiliary type parachute used in combination with a standard parachute the speed specified in Section 4.3.8 of NAS Specification 804 shall be 25 feet per second instead of 21 feet per second.

(b) Marking. The auxiliary parachute and its pack shall be marked "Auxiliary Parachute" in addition to the other marking requirements contained in Subpart A.

(c) Data requirements. (1) The manufacturer shall maintain a current file of complete design data.

(2) The manufacturer shall maintain a current file of complete data describing the inspection and test procedures applicable to his product. (See paragraph (d) of this section.)

(d) Quality control. Each parachute shall be produced under a quality control system, established by the manufacturer, which will assure that each parachute is in conformity with the requirements of this section. This system shall be described in the data required under paragraph (c)(2) of this section. A representative of the Administrator shall be permitted to make such inspections and tests at the manufacturer's facility as may be necessary to determine compliance with the requirements of this section.

(e) Effective date. March 29, 1962.

1/Copies may be obtained from the National Standards Association, 616 Washington Loan and Trust Building, Washington 4, D. C.
SPECIFICATION - PARACHUTES

This specification defines the minimum performance and safety standards for parachutes to be used in certificated aircraft.

1. APPLICABLE SPECIFICATIONS
   1.1 None.

2. TYPES
   2.1 This specification covers two types of man-carrying parachutes for use in certificated civil aircraft

   Standard Type Parachute
   Low Speed Type Parachute (Up to 150 miles per hour).

3. MATERIAL AND WORKMANSHIP
   3.1 Materials shall be of a quality which experience and/or tests have conclusively demonstrated to be suitable for use in parachutes. Workmanship shall be consistent with high-grade parachute manufacturing practice.

   3.1.1 Canopy Material: The fabric used in the canopy construction shall be free from harmful gums, starches and other foreign material. It shall also be free from avoidable imperfections in manufacture and from defects or blemishes affecting its strength or durability and shall have been finished without application of excessive heat. The canopy material shall have sufficient resilience to insure proper opening of the canopy under conditions outlined in 4.3.5.

   3.1.2 Fitting Materials: Fittings shall be fabricated from carbon steel, alloy steel, or corrosion-resisting material. Fittings made from metals that are not corrosion-resisting shall be plated or otherwise protected, to resist corrosion during the normal life of the parachute. The use of dissimilar metals, especially brass, copper, or steel in intimate metal-to-metal contact with aluminum or aluminum alloy, shall be avoided, wherever possible.

4. DETAIL REQUIREMENTS
   4.1 Design and Construction

   4.1.1 Fittings: All fittings shall be designed to carry their full rated load without yielding.
NATIONAL AIRCRAFT STANDARDS COMMITTEE
AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA, INC., 610 SORRELL BUILDING, WASHINGTON D. C.

4.1.2 Suspension Lines: All suspension lines of a given model parachute shall be marked under equal tension to show points of attachment.

4.1.3 Stitching: Stitching shall be of a type that will not ravel when broken.

4.1.4 Rip Cord: The rip cord, including joints between the handle and the release, shall be designed to withstand the tension test load of 4.3.1.

4.1.5 Pack Opening Device: No more than 22 pounds pull shall be required to cause the positive and quick functioning of the pack opening device.

4.1.6 Harness Release: The harness shall be so constructed that the rider can release himself and drop clear in case of a water landing, but a quick-attachable or quick-releasing device between the harness and the parachute is not mandatory.

4.2 Marking

4.2.1 Pack: The following information shall be legibly and permanently marked on or attached to the outside of the parachute pack by use of a name plate, identification label or stenciled letters.

- Manufacturer's name
- Model number or model name*
- Parachute serial number
- Date of manufacture
- National Aircraft Standard Number (NAS804)

*Note: Special designation or identification of low speed type parachutes must be indicated on the outside pack by stenciling in red letters one inch high the following: "Low Speed Parachute" and in red letters one-half inch high, "Limited to Use in Airplane Under 150 MPH."

4.2.2 Canopy: Each parachute canopy shall be legibly and permanently marked, preferably adjacent to the skirt, with the same information as in 4.2.1.

4.2.3 Harness: The parachute model number or model name and date of manufacture shall be stenciled on all harnesses. This marking shall be placed inside the back strap of the harness or other suitable location where it will be subject to minimum of obliteration.
4.2.4 Inspection Data Packet: Each parachute outfit shall be provided with an inner and an outer pocket for keeping a record card containing space for recording the date of repacking or repair and the rigger’s name and serial number. The inner pocket shall be located in the center of the packed container, tray or frame and the outer pocket placed externally in an easily accessible position. If the inner record card can be read from the outside of the pack because of the use of transparent materials, only the inner pocket need be provided.

4.3 Qualification Tests: 100% performance in qualification tests 4.3.1 through 4.3.8 is required.

4.3.1 Rip Cord Tension Test: The rip cord, including joints between the handle and the release, shall not fail under a straight tension test load of 300 pounds applied for not less than three seconds.

4.3.2 Pull Test - Pack Opening Device: The pack opening device shall be tested by use of an accurate spring balance to indicate its positive and quick-functioning with no more than 22 pounds pull.

4.3.3 Functional Test (Normal Pack): Twelve drops at least six of which shall be from an airplane with a 170-pound dummy man, from an altitude of not more than 500 feet. The indicated air speed at the time of release shall be 70 miles per hour. No twists shall purposely be packed in the suspension lines. The parachute must be fully open within three seconds from time of release.

4.3.4 Functional Test (Twisted Lines): Five drops with a 170-pound dummy man, from an altitude of not more than 500 feet. The indicated air speed at the time of release shall be 70 miles per hour. Three twists shall purposely be packed in the suspension lines near the skirt. The parachute must be fully open within four seconds from time of release.

4.3.5 Compressed Pack Test: This test is required only when canopy materials other than pongee, silk or nylon are used (Ref. 3.1.1). Three drops with the conditions stated in 4.3.3 except that prior to the test the parachutes completely packed shall be subjected continuously to a 200-pound weight for 400 hours and then dropped without being repacked.
4.3.6 Strength Test

4.3.6.1 Standard Type Parachute: Three drops with a parachute of the same type at an altitude of not more than 500 feet shall be made with a dummy weight and indicated air speed to give the equivalent of 5000 lbs. shock load. (See Table I.) No twists shall purposely be packed in the suspension lines. The weight shall be attached to the harness. No external shock absorbers or material which may act as such shall be permitted. The parachute shall show no failure of any material.

<table>
<thead>
<tr>
<th>Speed - MPH</th>
<th>Total Weight (Incl. Chute) - Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>660</td>
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<tr>
<td>175</td>
<td>500</td>
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<tr>
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<td>325</td>
<td>175</td>
</tr>
<tr>
<td>350</td>
<td>160</td>
</tr>
<tr>
<td>375</td>
<td>150</td>
</tr>
</tbody>
</table>

* Data computed for 28 ft. Standard Flat-Type Parachute based on USAF Parachute Handbook Section V.

4.3.6.2 Low Speed Type Parachute: Three drops with a parachute of the same type at an altitude of not more than 500 feet shall be made with a dummy weight and indicated air speed to give the equivalent of 3000 lbs. shock load. No twists shall purposely be packed in the suspension lines. The weight shall be attached to the harness. No external shock absorbers or material which may act as such shall be permitted. The parachute shall show no failure of any material.

<table>
<thead>
<tr>
<th>Speed - MPH</th>
<th>Total Weight (Incl. Chute) - Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>750</td>
</tr>
<tr>
<td>125</td>
<td>525</td>
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<tr>
<td>150</td>
<td>375</td>
</tr>
<tr>
<td>175</td>
<td>300</td>
</tr>
<tr>
<td>200</td>
<td>235</td>
</tr>
<tr>
<td>225</td>
<td>200</td>
</tr>
</tbody>
</table>

* Data computed for 28 ft. Standard Flat-Type Parachute based on USAF Parachute Handbook Section V.
4.3.7 Live Drop Tests: Two live drop tests from an airplane with a man weighing approximately 170 pounds, including the weight of an additional certificated auxiliary parachute, from an altitude of 2000 feet on a comparatively still day. The rider must suffer no discomfort from the opening shock and must be able to disengage himself unaided from the harness after landing. For this test the standard harness may be altered to permit attachment of an auxiliary parachute provided that such alteration does not interfere with the normal operation of the parachute and harness equipment being tested.

4.3.8 Rate of Descent Test: At least six drops from an airplane with a 170-pound dummy man. The average rate of descent shall not exceed 21 feet per second for the last 100 feet under standard sea level altitude conditions. A method shall be employed for direct and accurate measurement of rate of descent for the last 100 feet, such as the use of a weighted cord or cable by which the descent may be timed from the time of ground impact of the weight to ground impact of the parachute.
Glossary

ACCORDION FOLDING—The folding of the canopy for stacking in the container prior to closing.

ADMINISTRATOR—The Federal Aviation Administrator or any person to whom he/she has delegated his/her authority in the matter concerned.

ADVISORY CIRCULAR—The Federal Aviation Administration (FAA) issues advisory circulars (ACs) to provide guidance and information in a designated subject area or to show a method acceptable to the Administrator for complying with a related Code of Federal Regulation (CFR). Each AC is issued with a number corresponding to the subject it addresses in the Code of Federal Regulations. Unless incorporated into a regulation by reference, the contents of an AC are not binding on the public.

AERODYNAMICS—The study of the behavior of moving air and the forces that it produces as it passes over or around certain shaped objects such as wings, propellers, or parachute canopies.

AGL—Above ground level.

AIRFRAME AND POWER-PLANT MECHANIC—Any person certificated by the FAA to perform maintenance or inspections on an aircraft’s airframe or powerplant.

AIRWORTHINESS DIRECTIVES (ADs)—Issued by the Federal Aviation Administration (FAA) to notify owners and users of aeronautical products of unsafe conditions and the mandatory corrections under which the product may continue to be used. Each AD is an amendment to Title 14, Code of Federal Regulations, part 39; as such, it is part of the Federal Public Laws.

AIRWORTHINESS—A complete parachute assembly is considered airworthy when it conforms to its TSO and/or properly altered condition, and is in condition for safe operation.

ALTERATION—A change to the original configuration or any other major change to any portion of the parachute from its original manufacture specifications.

APEX—The center and topmost point of a round parachute canopy.

APPROVED—An item which in its present form has received official certification from the FAA.

ASSISTOR POCKET—Air scoops at the top of a sleeve, which provide drag and aid in anchoring the sleeve as the canopy is pulled out. Also, fabric pockets on the bridle of a free bag, which aid in the deployment of the bag in the event of a horseshoe-type malfunction.

AUTOMATIC ACTIVATION DEVICE (AAD)—A device for automatically releasing the reserve or emergency parachute. Utilizes barometric and rate of descent sensors.

AUXILIARY PARACHUTE—A reserve parachute.

BACK PARACHUTE—A parachute which is worn on the back.

BACKSTITCH—Used to anchor a row of stitching by turning the material and sewing over the stitching for a short distance.

BACKPAD—A foam-filled pad placed between the harness and the wearer which provides comfort and/or holds the harness in place.
BACK STRAP—A part of the harness which extends across the wearer’s back. It may be diagonal, horizontal, or vertical, and may or may not be adjustable.

BAG, DEPLOYMENT—A container, usually fabric, and usually enclosed in a parachute pack containing a parachute canopy.

BAR TACK—A concentrated series of zigzag-like stitches used to reinforce points of stress.

BECKET—A piece of tape or webbing sewn to a parachute or pack to form a loop through which a cord or thread may be passed.

BEEPSWAX—A wax, usually mixed 1:1 with paraffin and heated. Webbing is dipped into it to prevent fraying.

BELLYBAND—A reserve tie-down strap.

BIAS CONSTRUCTION—Construction where the warp and filler threads of the material are at 45 degrees to the centerline of the gore.

BIAS CUT—A diagonal cut across a piece of fabric. Canopy fabric may be cut on the bias and assembled so that both warp and fill threads run at a 45 degree angle to the vertical centerline of the gore.

BLOCK CONSTRUCTION—An arrangement of the gores such that the warp threads are parallel to the peripheral hem.

BOBBIN—A small spool used to hold thread. Commonly found in sewing machines.

BODKIN—A large-eyed needle, flat or round, and usually blunt, used to draw tape, ribbon, elastic, or cord through a loop or hem. Used to pull pack opening bands through containers.

BOLT—A compact package or roll of fabric.

BREAK TIE—Any tie or tacking designed to break under a specified amount of stress.

BREAKAWAY—The jettisoning of the malfunctioned main parachute by activating riser releases and deployment of the reserve parachute. Also known as cutaway.

BREAKCORD—A thread or tape tied between parachute components that is intended to break under the desired load during deployment.

BRIDLE—A line which attaches the pilot chute to the apex of the canopy or to a sleeve or bag.

BUNGEE—Pack opening bands.

BURBLE—The turbulent and unstable airflow behind a falling object such as a skydiver in free fall.

CABLE, RIPCORD—A flexible cable joining the locking pins and the ripcord handle.

CALENDAR—The process where a machine with heated rollers is used to finish fabric. The heat and pressure process lowers permeability by forcing the fibers between each other and flattening them.

CANOPY RELATIVE WORK (CRW)—A skydiving discipline, where the parachutists fly their open canopies in a formation formed by grasping the canopies or lines using the hands or legs.

CANOPY RELEASES—Devices which allow immediate release of the parachute canopy. They disconnect the harness main lift webs from the risers.

CANOPY—The umbrella-like surface of a parachute and its framework of cords, called suspension lines, from which the load is suspended. The drag surface of the decelerator.

CENTERLINE—Lines which run from the risers to the apex of a canopy and are used to pull the apex down such as on a Para Commander.

CENTER PULL—A ripcord design for chest parachutes.

CERTIFIED—A personnel parachute holding an FAA TSO certificate. Also used to refer to other FAA-approved parachutes, such as Government surplus personnel models, which were manufactured under military contract.

CFM—Cubic feet per minute. A measure of permeability.

CHAFING STRIP—A light piece of webbing positioned between the load bearing webbing and a piece of hardware which acts as a buffer between the two.

CHEST PARACHUTE—A parachute worn on the wearer’s chest.

CHUCK—The upper part of the tool used to install fastener or grommet parts.

CHUTE—A contraction of the term “parachute,” and used interchangeably with it.

CLAMP—A medical hemostat used by riggers for picking threads or retrieving small objects.

CLOSING LOOPS—Fabric or cord loops used to secure the container closed. Used in place of locking cones.

CLOTH—A pliable fabric, woven, felted, or knitted from any filament; commonly fabric of woven cotton, woolen, silk, nylon, rayon, or linen fiber.
CLOVERLEAF HANDLE—A ripcord handle with a cloverleaf shape. Commonly found on chest parachutes.

COCKING—Setting the collapsible bridle for operation.

CONE, LOCKING—A cone shaped metal device used in conjunction with end tabs and ripcord pins to hold the container flaps closed.

CONFLUENCE WRAP—A piece of webbing which wraps around the confluence of two or more pieces of webbing. Prevents the stitching from splitting. Most common use is on main risers and the 3-ring harness ring installation.

CONNECTOR SNAP, QUICK—A large hook-shaped, spring-loaded snap, two of which are used to quickly attach the chest-type parachute to the two D-rings on the harness.

CONNECTOR STRAP, CROSS—A short length of webbing sewn across a lift web assembly between the snaps of a chest parachute. This webbing is designed to prevent a “streamer” if only one side of the left web assembly is engaged to the harness. Also known as a spreader bar.

CONTAINER—That portion of the parachute assembly which holds the canopy in place after being folded. This is not to be confused with the term “pack.”

CONTAMINATION—Where foreign materials or substances come into contact with parachute materials and possibly cause degradation or weakening of the materials.

CORDS—Suspension lines.

CROSS CONNECTOR STRAP—A webbing strap attached between the risers to prevent the collapse of the canopy in the event one riser becomes disconnected.

CROSS SEAM—A seam joining sections of a panel.

CUTAWAY—The cutting of risers or suspension lines to release the deployed canopy while the parachutist is still in the air. Also known as breakaway.

DECELERATE—To slow down. A free-falling body will decrease its rate of descent due to pressure of the atmosphere against its frontal area. This resistance will gradually increase as the falling body nears the earth due to increasing atmospheric pressure.

DENIER—A unit of measurement of silk in which the size of yarn is quoted as its weight per length. This is determined by weighing 9,000 meters and quoting the size of the yarn in grams. Thus, if 9,000 meters weigh 30 grams, the size of the yarn is then known as 30 denier.

DEPLOYMENT—That portion of a parachute’s operation occurring from the moment of pack opening to the instant the suspension lines are fully stretched but prior to the inflation of the canopy. Also known as development.

DESIGNATED PARACHUTE RIGGER EXAMINER (DPRE)—A master parachute rigger appointed by the Administrator to conduct oral and practical tests required for the certification of parachute riggers.

DIAGONAL SEAM—A French fell seam of the canopy which joins two sections of a gore. Diagonal seams meet the centerline of the gore at angles of 45 degrees and 135 degrees.

DIAMETER—The greatest distance across a flat canopy, from skirt to skirt, measured when the canopy is lying flat. This measurement designates the size of the parachute in feet.

DIAPER—Generally, a fabric panel secured by the suspension lines which is sewn to and wrapped around the canopy. Used to control and reduce opening forces. Found mostly on round reserves.

DIE—The lower part of the tool used in a press to install snap fasteners or grommets.

DIRECT BAG STATIC LINE SYSTEM—A static line deployment system where the bag is attached to the static line and the canopy deploys free into the airstream.

DOUBLE THROW ZIGZAG STITCHING—Stitching in which the needle makes a center stitch between each left and right stitch. Also known as a No. 308 stitch.
DOUBLE-W—A three-point cross-stitch.

D-RING—A metal fitting shaped like a D into which snap connectors are hooked.

DROP TEST—Dropping a dummy or other load from an aircraft in flight or otherwise simulating a live jump to prove serviceability of a parachute.

DROP ZONE (DZ)—A specified area upon which personnel or equipment are dropped by parachute.

DURING TOWER—A facility where parachutes are suspended for airing and drying.

DUAL PARACHUTE PACKS—A sport assembly consisting of a main and a reserve parachute.

DUMMY (PARACHUTE)—Torso-shaped dummy of variable weight used for testing parachutes; may be of fixed or articulated construction.

DUMMY DROP—A parachute test using a dummy as the suspended load.

DURABLE DOT FASTENER—The common snap fastener used for closing flaps, etc.

END TABS—Metal tabs on the end flap of the pack (principally chest and seat containers) used to secure it closed.

EYE—A small steel-wire loop attached to the parachute pack, into which a hook on a pack-opening elastic is fastened.

F

FABRIC, CANOPY—The fabric used in the fabrication of parachute canopies. It is light in weight and woven to withstand the impact of air pressure when the parachute opens. The canopy fabric is woven from nylon yarns usually in a ripstop weave.

FASTENER, SLIDE—A zipper.

FASTENER, SNAP—Metal fastening device that usually consists of four parts: button, socket, stud, and eyelet. Device is manufactured in various shapes and sizes.

FASTENER, TAPE—Velcro®.

FEDERAL AVIATION ADMINISTRATION (FAA)—An organization within the Department of Transportation. The FAA establishes aviation rules and regulations as well as enforces those policies. The purpose of the FAA is to set the standards for civil aircraft in the interest of public safety.

FEED DOG—A mechanical device located under the throat plate of a sewing machine which feeds the material through a sewing machine.

FERRULE—Device which provides a strong and smooth finish on the ends of a ripcord housing.

FID—A small flat, tapered bar of metal or wood used to insert the corner flaps into the container when packing.

FINGER TRAP—A method of attaching or splicing lines by inserting one line into another. Used primarily on hollow braided lines.

FINISH—The condition of the parachute fabric caused by the application of heat and pressure whereby the fibers are forced closer together. This treatment is used to determine the permeability of the fabric.

FISH SCALE—A spring scale used to measure the ripcord pull force or fabric strength test.

FOLDER—A device used as an attachment to a sewing machine to guide and fold fabric.

FORCE—A push or pull which tends to change the velocity or direction of a body’s motion.

FORGING—A high-pressure shaping of hot metal. The process used to make parachute hardware.

FORWARD SPEED—The rate at which a parachute moves horizontally in a mass of air.

FOUR LINE CHECK—On a round canopy, the four lines that run to the top center and bottom center gores. Used to check the line continuity. On a 28-foot canopy, they are lines 1, 14, 15, and 28.

FPS—Feet per second.

FREE BAG—A type 5 reserve deployment device used with ram-air canopies. Not attached to the canopy, it is designed to allow deployment of the canopy in the event of a horseshoe-type malfunction.
FREE FALL—A parachute jump in which the parachute is activated manually at the discretion of the parachutist.

FRENCH FELL SEAM (LSC-2)—A plain overlap in which the material is folded over on itself and stitched so as to prevent raveling.

FRICITION BURNS—The result of two textile surfaces rubbing together rapidly and generating frictional heat which reduces the tensile strength of the textile and causes deterioration of the individual threads; it occurs primarily during parachute deployment and initial inflation.

G

G FORCE—The measure or value of the gravitational pull of the earth as modified by the earth’s rotation, equal to acceleration of a freely moving body at the rate of 32.16 feet per second. Example: If a 100-pound load places a 300-pound stress on the parachute during opening, the shock is 3 Gs.

GAUGE—The space between needles on a sewing machine.

GLIDE—The horizontal movement of the canopy.

GORE—That portion of the canopy contained between two adjacent suspension lines and the area between them, extending from the apex of the canopy to the skirt.

GROMMET—A metal eyelet, used as a reinforcement around a hole in fabric. Grommets are used on pack flaps to fit over locking cones or loops.

GROSS WEIGHT—The complete weight of the parachute assembly.

H

H.A.L.O.—High Altitude, Low Opening.

HANDLE—Ripcord handpull or grip.

HARDWARE—All metal parts associated with parachutes, parachute systems, and their suspended loads.

HARNESS—An arrangement of cotton, linen, or nylon webbing which is designed to conform to the shape of the load to be carried in order to secure it properly so that the opening shock and the weight of the load are evenly distributed during descent.

HESITATOR LOOP—One of a series of webbing loops which hold the suspension lines in an orderly position in the container when the parachute is packed and which pay the lines out in sequence (hesitate) for orderly deployment.

HOT KNIFE—An electrically heated cutting tool used to cut and sear webbing and fabrics.

HOUSING CLAMP STIFFENER—A metal plate sewn to the top flap of the main parachute container and used to hold the ripcord cable housing in place and to give rigidity to the housing. Designed to provide stiff separation between the housing and the top cone for an automatic opener.

HYGROSCOPIC—A substance or material that absorbs water readily from its surroundings.

I

INITIAL LAYOUT—Process in which the canopy is stretched out on the table with the top center gore on top in preparation for securing proper layout.

INSPECTION—A step by step procedure for examining a parachute prior to packing to identify any damage or non-airworthy condition.

INVERSION—State in which the canopy has been turned completely inside out. Also see partial inversion.

J

JOINT EFFICIENCY—The comparison of the strength of the junction or joining materials against the original materials.

JUMPING—To engage in a premeditated parachute jump.

K

KEEPER, HARNESS—Elastic webbing used to hold harness straps in place.

KICKER PLATE—A launching disc which is placed under the pilot chute.

KILL-LINE COLLAPSIBLE BRIDLE—A main pilot chute bridle configuration whereby the pilot chute is collapsed by use of a retractable centerline after it has deployed the parachute.

KNOT, CLOVE HITCH—A type of knot used for attaching the suspension lines of a parachute to the connector links.

KNOT, OVER HAND—A simple knot tied in each running end of a piece of cord above a square knot or surgeon’s knot to prevent the ends from slipping back through the knot.

KNOT, SQUARE—A strong knot for joining two cords or lines, which does not slip or loosen easily.
KNOT, SURGEON’S — A type of knot commonly used for tying nylon threads or cords in place of a square knot to prevent mis-tying.

L

L/D — Lift to drag ratio.

LAP PARACHUTE — A parachute which rests in the lap of the wearer and attaches to the harness with risers to snaps and D rings on the front. Resembles a chest parachute with long risers. Not in current use.

LATERAL BAND — Lower (in the periphery) or upper (in the vent hem), a reinforcement web.

LAUNCHING DISC — A kicker plate placed under the pilot chute.

LEG STRAP — That part of the harness webbing which encircles the wearer’s leg. The leg straps can be adjusted to fit the user.

LIFE CYCLE — Service life. The time that a parachute may be considered usable.

LIFT WEB (MAIN) — The portion of the harness from the shoulder to the hip area. Generally from the canopy releases to the leg strap junction.

LIFT WEBS — The front portion of the harness from the shoulder to the leg strap junction. Includes the risers if there are no riser releases.

LIFT — The force perpendicular to drag which helps reduce vertical descent.

LINE EXTENSION — When the lines are fully deployed. Prior to line stretch.

LINE SEPARATOR — A tool used to separate and hold the lines of a round parachute during the packing process.

LINE STOWING — The process of drawing the suspension lines into suspension line retaining loops in the parachute pack; accomplished to prevent entanglement or twisting of the lines during opening of the parachute. Stows may be held by retaining loops or rubber bands.

LINE STRETCH — Occurs during deployment, after the lines are fully extended. Follows snatch force and line extension.

LINE, GUIDE OR CONTROL — One or more parachute lines that run from a slot or orifice in a steerable canopy to the harness providing better steerability.

LINE, STATIC — A line, cable, or webbing, one end of which is fastened to the pack, the other to some part of the launching vehicle; used to open a pack or to deploy a canopy.

LINE-OVER — A type of deployment malfunction. It occurs when one or more suspension lines pass over the top of the canopy during deployment preventing complete, normal inflation. Not to be confused with “partial inversions.”

LINES, SUSPENSION — Cords or webbing of silk, nylon, cotton, rayon, or other textile materials which connect the drag surface of the parachute to the harness. They are the means by which the wearer or weight is hung or suspended from the inflated canopy.

LINK, CONNECTOR, SEPARABLE — Any connector link comprised of readily separable elements, which may be used to facilitate assembly of parachute canopies to a riser system.

LINK, CONNECTOR — Usually identified as a small, rectangular metal fitting used to connect ends of risers or lift webs to suspension lines. The suspension lines are tied and sewn above one part of the link, the webs being stitched about the lower part. The design of the link may vary in size and shape according to the intended use.

LOCKSTITCH — Type of stitching used in manufacturing parachutes. This type of stitch is formed by two threads. A loop of the thread is passed through the material where it is entered by the supply of the other thread. The loop of the first thread is drawn into the material to the extent that the loop or lock is approximately halfway between the two surfaces of the material. Also known as a type 301 stitch.

LOFT — A facility for the repair and maintenance of parachutes.

LOGBOOK — A format for complying with 14 CFR part 65, subsection 65.131(a) in regards to recording the work done by the rigger on parachutes.

LOOPS, HESITATOR — Retain the suspension lines in a neat and orderly arrangement in the parachute pack. These loops are made in varying sizes and materials.

M

MACHINE HEAD — The entire metal housing which supports the moving parts and bearings of the machine.

MAIN PARACHUTE — A parachute assembly, excluding the harness, that is used in conjunction with a reserve parachute assembly as the primary assembly for a premeditated jump.
**MAIN SEAM**—That which joins two adjacent gores in a canopy. Also known as a radial seam.

**MAIN SLING, HARNESS**—The main load-carrying member of the harness formed by two lengths of webbing, beginning at the shoulder adapter or D-ring, continuing down across the seat and up the other side, ending at the opposite adapter or D-ring.

**MAINTENANCE**—Inspection, overhaul, repair, preservation and replacement of parts but excludes preventative maintenance.

**MAJOR REPAIR**—A repair that, if improperly done, might appreciably affect weight, balance, structure strength, performance, powerplant operation, flight characteristics or other qualities affecting airworthiness; or that is not according to accepted practices or cannot be done by elementary operations.

**MALFUNCTION OR DEFECT REPORT**—FAA Form 8330-2 used to report serious defects or other recurring unairworthy conditions of parachutes or aircraft.

**MALFUNCTION**—The complete or partial failure of the parachute canopy to effect proper opening and descent. Some malfunctions are canopy damage, twisted suspension lines, inversion or semi-inversion of the canopy, a line over, etc.

**MARQUISETTE**—Netting.

**MASS**—The quantity of matter in an object.

**MASTER PARACHUTE RIGGER**—An individual certified by the FAA to pack, maintain and alter parachutes. The highest classification of parachute rigger.

**MAXIMUM OPERATING WEIGHT**—The total weight of the parachutist and all equipment that exits the aircraft with the jumper.

**MILDew**—A type of fungus or mold which forms on fabric and leather in damp environments. Mildew weakens some materials and if it appears on a parachute canopy, the areas must be cleaned, repaired, or replaced.

**MILITARY SPECIFICATION (MS)**—A specification (MIL-SPEC) set by military agencies and used for the procurement of military supplies and equipment.

**MINOR REPAIR**—A repair other than a major repair.

**MODIFICATION**—1. A change. 2. Often refers to the removing of canopy area to effect steerability and forward glide.

**MOUTH LOCK**—A device which holds the mouth of the canopy closed until the lines are deployed.

**MPH**—Miles per hour.

**MSL**—Mean Sea Level.

**MS**—Military Specification under the MS system.

**NAS-804**—National Aircraft Standards Specifications Number 804; this is the minimum performance standards required by Technical Standard Order, TSO-C23b, for parachute assemblies manufactured under this TSO.

**NAS**—National Aircraft Standards.

**NEEDLE**—A small, slender, pointed piece of steel with a hole for thread used for sewing.

**NICOPRESS**—A copper sleeve used to join cables to form loops or splices.

**NYLON, RIPSTOP**—A type of weave designed to prevent tears from spreading. Extra numbers of yarns are closely woven into the cloth intermittently across the width and across the length.

**NYLON, TUBULAR**—Sleeve-like weave, seamless, and pressed flat, similar in appearance to tape, but stronger and hollow in the center.

**NYLON**—A synthetic material of protein-like structure derived from coal, air, and water, which is adapted for fashioning into filaments of extreme toughness, strength, and elasticity, and used in the manufacture of parachutes.

**OPENING SHOCK**—The decelerating force exerted on the load following that of the snatch force. Caused by the acceleration of the canopy and the air mass associated with it.

**OPENING TIME**—The time elapsing between the opening of a parachute pack and the opening of the canopy to its fullest extent.

**OPENING, PREMATURE**—Any accidental opening of the parachute prior to the intended time.

**OSCILLATION**—Pendulum-like swinging of the suspended load beneath the inflated canopy. Usually the result of trapped air escaping under the lower lateral band.
OUTBOARD—Meaning facing to the outside such as a ripcord facing to the side of the jumper rather than toward the breastbone.

OVERHAND KNOT—A simple knot tied separately in each end of a piece of cord above a square, surgeon’s, or other knot to prevent the end from slipping through the lower knot.

PACK—A synonymous term for the parachute container.

PACK OPENING BAND—A cloth covered steel spring assembly with hooks at each end, used to expedite the opening of the pack by rapidly pulling the flaps away from the canopy.

PACK STIFFENER—Generally, metal stiffeners used in military assemblies to give shape and form to the pack.

PACK TRAY—The portion of the container or deployment device where the lines are stowed.

PACKING BAR—A long, flat bar of metal or wood used in the folding of the canopy of a parachute during the packing process and to aid in closing the container. Also known as a long bar, paddle, or fid.

PACKING HOOK—A special hook-like tool used to draw the suspension lines into place in the hesitator loops. Pull-up cords are sometimes used for this purpose.

PACKING PADDLE—A flat, narrow piece of metal or wood used to form the packed container. Also known as a packing bar, or fid.

PACKING TABLE—A table used in packing parachutes, normally 3 feet wide by 40 feet long with a smooth top surface.

PACKING—The operation of folding the canopy and enclosing it in the container.

PANEL—A subdivision of a gore. Also known as a section.

PARACHUTE INDUSTRY ASSOCIATION (PIA)—An international trade organization composed of parachute manufacturers, dealers, riggers and others involved in the parachute industry.

PARACHUTE PACK—Such as a back pack or chest pack, means the parachute assembly less the harness. That is, it means the container, canopy, suspension lines, pilot chute risers and connector links. The terms “pack” and “container” are not synonymous in the terminology of this part.

PARACHUTE RECORD CARD—A card kept in the record pocket, which records the packing intervals of the parachute and other important information as required under 14 CFR subsection 65.131(c). Also known as the “packing data card.”

PARACHUTE RIGGER—A person certified by the Federal Aviation Administration who is authorized to perform packing and maintenance on parachutes.

PARACHUTE STANDARD (PS)—PIA Specification for parachute materials.

PARACHUTE, STATIC LINE OPERATED—A parachute operated by a length of webbing after a jumper has fallen the length of the static line. The ripcord pins are pulled from the pack, the parachute opens, and a “break tie” breaks, freeing the parachute.

PARACHUTE—An umbrella-like device designed to trap a large volume of air in order to slow the descent of a falling load attached to the parachute. The word “parachute” is formed from the French words “para,” for shield and “chute,” to fall. Thus, “parachute” literally means “to defend from a fall.”

PARTIAL INVERSION—A type of deployment malfunction. It occurs when one or more gore sections near the skirt become inverted during deployment and form a small pocket which inflates, causing a partial inversion of the canopy. The condition may or may not work out or may become a complete inversion; i.e., the canopy turns completely inside-out. It is the skirt, not the line, which is “over;” not to be confused with a “line-over.” Also known as a “Mae West.”

PATCHING—Method of repair by covering a hole or tear in a canopy or pack.

PERFORMANCE STANDARDS—The specifications which define the minimum performance and safety standards for certificating parachutes. There are three standards that have been used or are in use. They are NAS-804, AS-8015A, and AS-8015B.

PERMEABILITY—The mass rate of flow or the volume rate of flow per unit projected area of cloth for a prescribed pressure differential. In the U.S., permeability is measured in cubic feet of air through one square foot per minute at 1/2” of water pressure. Sometimes confused with porosity.

PERSONNEL PARACHUTES—Parachutes designed expressly for human use as opposed to cargo drops or aircraft deceleration.
PIGGYBACK—A single harness, dual parachute system used for intentional parachute jumping where both parachutes are mounted on the back of the jumper.

PILOT CHUTE ASSIST SYSTEM—A connection of breakcord or Velcro® between the static line and the pilot chute of a sport parachute which pulls the pilot chute out of the pack and then separates.

PILOT CHUTE—A small parachute used to accelerate deployment; constructed in much the same manner as the main canopy and from similar material. Some types of pilot chutes are equipped with a spring-operated, quick-opening device. The frame is compressed so as to open immediately when released from the pack.

PIN PROTECTOR FLAP—A flap which covers the locking pins and cones to prevent the pack from being opened by any means other than the ripcord.

PINS, LOCKING—Straight or curved metal pins used with a throw-out or pull-out pilot chute for securing the container closed.

PLATE, TENSION—A device hooked into the connector links in order to put tension on the canopy while packing.

PLEAT—A fold sewn in the fabric.

POCKET, DATA—A small patch pocket sewed to a parachute pack for carrying the parachute packing data card.

POCKET, RIPCORD HANDLE—Elastic or spring edged pocket that holds ripcord handle in an accessible position on the harness. The chest-type pocket consists of a piece of straight elastic webbing serving the same purpose.

POROSITY—The ratio of void or interstitial area to total area of a cloth expressed in percent. The ratio of open space to covered area of a drag surface. Used for ring slot, ribbon, ring sail, and rotafoil canopies. Not to be confused with permeability.

PREMATURE OPENING—Opening of a parachute before the user is clear of the aircraft; any accidental opening of a parachute.

PREPACK INSPECTION—The inspection made on the parachute prior to its packing.

PRESSER FOOT—The part of the sewing machine above the feed dog that holds the fabric in place.

PREVENTATIVE MAINTENANCE (PM)—The systematic care, servicing, and inspection of equipment and facilities for the purpose of maintaining them in a serviceable condition and detecting and correcting incipient failures. Simple or minor preservation operations and the replacement of small standard parts not involving complex assembly operations.

PROOF LOAD—The testing of an item for conformance with strength requirements.

PROPER LAYOUT—Process by which the canopy and suspension lines are arranged on the packing table for inspection and packing.

PULL THE DOT—A particular type of snap fastener that can only be opened or closed by pulling in one direction designated by an indented dot on the button.

PULL-UP CORDS—Nylon cords of varying length used to pull up the sides and ends of the container flaps over the container cones, and to pull the cones through the grommets. They are also used to pull the suspension lines into place in some types of containers.

QUALITY CONTROL—A method of describing the inspection and test procedures necessary to ensure that each article produced conforms to the type design and is in a condition for safe operation.

RADIAL SEAM—A seam joining two gores which extends in a radial direction from the vent to the skirt hem.

RAM-AIR PARACHUTE—Generally, a rectangular, double surface canopy with airfoil shaped ribs inflated by the air flowing into the front openings to produce an airfoil shape.

RATE OF DESCENT—The vertical velocity, in feet per second, of a fully-opened parachute.

RATING—A statement that, as a part of a certificate, sets forth special conditions, privileges, or limitations.

RAVEL (UNRAVEL)—To separate, untwist, or unwind, leaving a frayed or ragged edge. “Unravel” is often used with the same meaning, although grammatically incorrect.

RAW EDGE—The unfinished edge of the material; liable to raveling.

REEFING—A temporary restriction of the skirt of a parachute to a diameter less than the fully inflated diameter. Reefing is used to decrease drag area, and/or to obtain stability.

REINFORCEMENTS—Commonly strong tape or webbing used to strengthen parts of the canopy, container, or harness.
**RELATIVE HUMIDITY**—Ratio of the amount of water vapor present in the air to that which the air would hold at saturation at the same temperature.

**RELEASE, BAROMETRIC PRESSURE**—A device of the automatic opening of a free-fall parachute operating on the differences of barometric pressure.

**RELEASE, RISER**—A canopy release.

**REPACK CYCLE**—The time that a certificated parachute is considered to be airworthy before being inspected and repacked. The current U.S. repack cycle is 120 days.

**RESERVE PARACHUTE**—The second or “auxiliary” parachute worn by a person making a premeditated jump.

**RESERVE STATIC LINE (RSL)**—A backup device for activating the reserve after a cutaway. Usually a line, webbing or cable, which connects the main risers with the ripcord handle, housing, or cable.

**RESTITCHING**—The process of sewing directly over base or broken stitching.

**RETAINER BAND**—A rubber band used to hold folded suspension lines or static lines to the parachute pack.

**RIGGER ROLL**—To prepare an unpacked parachute for storage by rolling the canopy into a ball with the suspension lines around it.

**RIGGING, PARACHUTE**—The process of inspecting, repairing, and replacing minor parts of a parachute assembly, and of repacking the parachute so that it is ready for immediate use. Parachute rigging also includes fitting and adjusting the harness.

**RIG**—To pack. A set of sport parachute equipment. To assemble a parachute.

**RING, v**—Used in conjunction with snaps to fasten the harness around the wearer. Larger than the newer triangle ring.

**RIPCORD CABLE**—A flexible metal cable 3/32” diameter made of 49 strands of stainless steel wire. The cable runs from the ripcord grip to the locking pins. It is housed in a flexible, protective tube.

**RIPCORD HOUSING CLAMP**—A metal clamp located on the outside of the end flap of back and seat-type parachutes. The clamp secures the ripcord cable and power cable of the actuator.

**RIPCORD HOUSING**—A flexible tubing in which the ripcord is installed for protection and to provide a free path for the ripcord.

**RIPCORD PIN, LOCKING**—A small metal prong, slightly smaller in diameter than the ripcord cable and fastened to it by means of a swage fitting or serving and solder. One pin is attached to the end of the cable and the others (when two or more are used) are set at intervals on the cable. The spacing of the pins is dependant on the distance between the cones on the container flap. The locking pins pass through the locking cones of the flaps and thus serve to lock the container until such time as the pins are withdrawn.

**RIPCORD**—A locking device which secures the pack in a closed condition and by which the release of the parachute is effected. It may consist of a handle, cable, locking pins and a cable swage.

**RIPSTOP NYLON**—Nylon fabric woven in intermittent box form with additional closely-picked yarns.

**RIPSTOP TAPE**—Ripstop nylon fabric with a pressure sensitive adhesive. Used to repair small tears in canopies.

**RISER**—That portion of the suspension system between the lower end of a group of suspension lines and the point of attachment to the load.

**ROLL PACKING**—A method of packing a ram-air parachute whereby the nose and the tail are rolled towards the center of the canopy.

**ROUTINE INSPECTION**—A visual inspection of all parts of a packed parachute which may be checked without opening the parachute.

**S**

**S.A.E.**—Society of Automotive Engineers.

**SADDLE**—The part of the harness positioned under the seat of the wearer.

**SAFETY TIE**—The thread used in sealing a parachute.

**SCISSORS**—A cutting instrument with two opposing blades.

**SEAL PRESS**—A mechanical press used for compressing lead seals to seal parachutes in accordance with 14 CFR subsection 65.133.

**SEAM RIPPER**—A small tool used for picking or cutting threads in sewing operations.

**SEAM, DIAGONAL**—The diagonal or horizontal seams which join the section of each gore.
SEAM, RADIAL—A seam extending from the skirt to the apex, joining two gores. A portion of the suspension lines may be concealed in the tube formed by the radial seam.

SEAMS—Where two pieces of fabric are joined together.

SEAR—Damage to fabric or lines by heat generated through rubbing. The melting of webbing, fabric or line of nylon to prevent fraying.

SEAT PARACHUTE—Parachute positioned below the back of the wearer. Forms part of the seat cushion in the aircraft.

SECTION—Any one of the pieces of cloth which, when assembled, form one gore of a parachute canopy. Also known as a panel.

SELVAGE EDGE—The edge of cloth which is so woven as to prevent raveling.

SENIOR PARACHUTE RIGGER—An individual certified by the FAA to pack and maintain parachutes. A journeyman level classification of parachute rigger.

SEPARATOR, LINE—A slotted metal or wood device used to hold suspension lines at the canopy skirt after separation into groups during packing.

SEWING MACHINE KNEE LIFTER—A knee operated mechanism which lifts the presser foot of a sewing machine.

SEWING MACHINE UPRISE—The uprise is the upright part of the head (generally located on the right side of the head) that houses a portion of the moving parts that transmit motion through mechanical shafts and linkages to the mechanisms in the base of the machine.

SEWING MACHINE—A machine with a mechanically driven needle used for sewing.

SEWING PATTERNS—A design outlined in drawings for joining parts.

SHOCK CORD—A straight elastic cord comprised of continuous strands of rubber encased in a braided cover. Used today primarily for Safety Stow® loops on free bags.

SHOCK LOAD—The maximum force exerted on the canopy by inflation. This maximum force may be the snatch force or it may be the opening shock.

SHOCK, OPENING—The maximum force developed during inflation of the canopy. Follows the snatch force.

SHOT BAG—A parachute packing tool. A rectangular bag filled with shot and used to hold folded gores in position during packing.

SHOULDER STRAP—That part of the harness webbing which crosses the wearer’s back diagonally between the shoulder blades and the horizontal backstrap.

SIDE FLAP—A fabric extension on each of the long sides of the pack which fold over to enclose the canopy.

SILK—A fiber produced by the silk worm.

SINGLE POINT RELEASE—A harness release which has a single closure such as the T-10 type; also, a canopy release system operated by one hand or action.

SINGLE THROW ZIGZAG—A machine zigzag stitch from left to right to left, etc. Also known as a 304 stitch.

SKIRT—The reinforced hem forming the periphery of a canopy.

SKYDIVING—A popular name for sport parachuting.

SLAG—A type 6 deployment device. A short sleeve configuration used on ram-air parachutes.

SLEEVE—A tapered, fabric tube in which the canopy is placed to control deployment. A deployment device.

SLIDE FASTENER—Zipper.

SLIDERS—A reefing device usually for ram-air canopies. Comprised of a fabric panel with grommets at the corners through which pass the suspension lines of the canopy.

SNAG—A fabric imperfection.

SNAP, CONNECTOR, QUICK—A hook-shaped, spring-loaded snap which snaps over a D-ring to connect two Webbings.

SNAP, HARNESS, EJECTOR TYPE—A harness snap that attaches to the V-ring to secure two parts of the harness together. An ejector arm expels the V-ring when the finger-grip lever is pulled outward.

SNATCH FORCE—The shock produced on the load when the parachute assembly fully strings out and becomes suddenly accelerated to the same speed as the load. Comes just prior to opening shock.

SNIVELING—Slow opening of a parachute.

SPEC—Specification, MIL-SPEC. (Military specification).

SPIRAL VANE PILOT CHUTE—A pilot chute with a cone-shaped, cloth-covered coil spring used in free-type parachute assemblies.
SPLICING—The process of joining together, as the interweaving of strands, overlapping and stitching of materials.

SPLIT SADDLE—The lower part of a harness which has independent leg straps; no saddle cross strap.

SPORT PARACHUTING—The making of premeditated parachute jumps for pleasure.

SPORT RIG—A skydiving harness and container system.

SQUARE KNOT—A knot in which the terminal and standing parts are together and parallel to each other.

SQUARE PARACHUTE—A gliding or ram-air canopy, having a square or rectangular shape.

STAND—A sewing machine table.

STATIC LINE SYSTEM—A parachute system which is attached to the aircraft with a line and automatically deploys the parachute.

STRAPS—The webbing components of a harness.

SWAGES—The ball or other device used at the end of a ripcord to secure the cable to the handle.

TAIL POCKET—A deployment device sewn onto the tail of a ram-air canopy used to stow the suspension lines.

TANDEM—A dual harness, dual parachute system for use by two people under the same main parachute.

TAPES—Narrow woven ribbons used for reinforcing parachutes.

TECHNICAL STANDARD ORDER—A minimum performance standard for specified articles such as materials, parts, processes, or appliances used on civil aircraft.

THREAD—A thin continuous filament made by spinning fibers and combining the strands.

TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (14 CFR)—The rules, regulations, and guidelines established by the FAA to govern the operation of aircraft, airways, airmen, and the safe operation of civil aircraft.

TOGGLE—A knob or webbing loop at the end of the steering line for grasping by the parachutist.

TRIMMING—Clipping or paring to reduce to a neat orderly state.

TUCK—A shortening of material caused by pulling fabric up in folds and stitching across the gathered fabric.

ULTIMATE LOAD—Maximum load that can be applied without causing any part of the structure to fail.

ULTRAVIOLET LIGHT DAMAGE—Degradation of nylon fabric by exposure to sunlight or fluorescent lights. Identified by a yellowish color on white fabric or excessive fading to colored fabric.

UNITED STATES PARACHUTE ASSOCIATION—A nonprofit division of the National Aeronautic Association (NAA) which governs sport parachuting activities in the U.S.

VELCRO®—The commercial name for hook and pile nylon tape fastener.

VELOCITY—A vector quantity that includes both magnitude (speed) and direction relation to a given frame of reference; also the time rate of change of position.

VENT CAP—A piece of fabric sewn to the upper lateral band and covering the vent. Also known as a vent patch.

VENT—The opening at the top, or peak, of the canopy.

V-RING—A metal fitting shaped in the form of a closed letter V, used with snaps to secure or attach a load to a parachute.

WARP—The threads which run parallel to the selvage edge of cloth; those which are crossed by the filling threads.

WEAVE—The forming of a textile by interlacing yarns. The making or manufacturing of cloth on a loom by interlacing warp and filling yarns.

WEBBING—A stout, close-woven tape used for straps, belts, harnesses, etc.

WEIGHT (FABRIC)—The weight of fabric measured in ounces per square yard.

WEIGHT—Gravitational force on a mass.

WRINKLES—A series of small pleats.

ZIGZAG—A stitch formation of alternating left and right throw stitches, usually made on a sewing machine which moves the needle bar alternately left and right during sewing.

ZIPPER—A slide fastener.
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