RAM AIR PARACHUTE

Owner's Manual

Precision

aerodynamics, inc.

Serial #:

REVISIONS

THIS MANUAL IS SUBJECT TO REVISION. YOU MUST VERIFY THAT AU REVISIONS STAY WITH THIS MANUAL. THIS MANUAL IS ISSUED TO A SPECIFIC CANOPY, AND WAS SHIPPED WITH THE FOLLOWING REVISIONS INCLUDED. THE *OWNERS MANUAL* IS INCOMPLETE IF IT DOES NOT CONTAIN ALL REVISIONS.

SHIPPED WITH REVISIONS:

Ram-Air Parachute
Owners Manual

Part # PI 3001

Address all inquiries to:
Precision Aerodynamics
Publications Desk
Highway 127 North. P. 0. Box 386
Dunlap, TN - USA 37327

Member,
PIA Parachute Industry Association

Quick Reference:

Please read this manual for the first time from front to back, beginning on page 1. After doing this, please fill in and return the postage-free owner registration card.

Reserves

About this manual . . .

Single words displayed in **bold** type will be found in the Glossary on page 7 or in the above "Quick Reference."

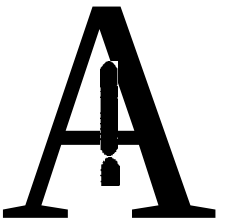
This warning symbol indicates items of extreme importance throughout the manual. Bold type is also used **for** emphasis.

WARNING

Skydiving is a sport in which the risk of injury or death is inherent. Nothing can reduce the risk to zero or guarantee your safety. Your participation in the sport is an admission that in spite of the training you have received, the level of proficiency you have achieved, the equipment you have bought or borrowed, and the abilities of all involved in your skydive, injury or death could occur.

Your participation means **you accept total responsibility for your own injuries or death** whether arising from personal error, equipment malfunction, the others involved in your skydive or manufacturer error.

NO GUARANTEE

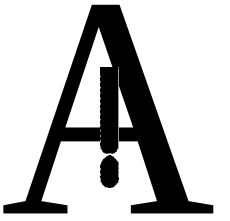


In spite of all that is done to ensure **that** our canopies will operate properly, nothing and no one can guarantee that injury and death will not occur as a result of their use.

By jumping our canopy you are accepting the risk that it may not operate properly due to your error or to a defect in design, raw materials, workmanship, manufacturing process, or seller's error. By using this canopy, or allowing it to be used by others, you waive any manufacturer liability for personal injury or other damages arising from such use. **If you are not willing to accept this risk, you may return the unused canopy to your dealer within 30 days of purchase for a full refund.**

Precision canopies are sold with all faults and without any warranty for fitness for any **purpose. Manufacturer** also disclaims any liabilty in tot-t for damages, direct or consequential, including personal injuries, resulting from a malfunction or from a defect in design, material, workmanship, or manufacturing technique whether caused by negligence on the part of the manufacturer or otherwise.

TRAINING



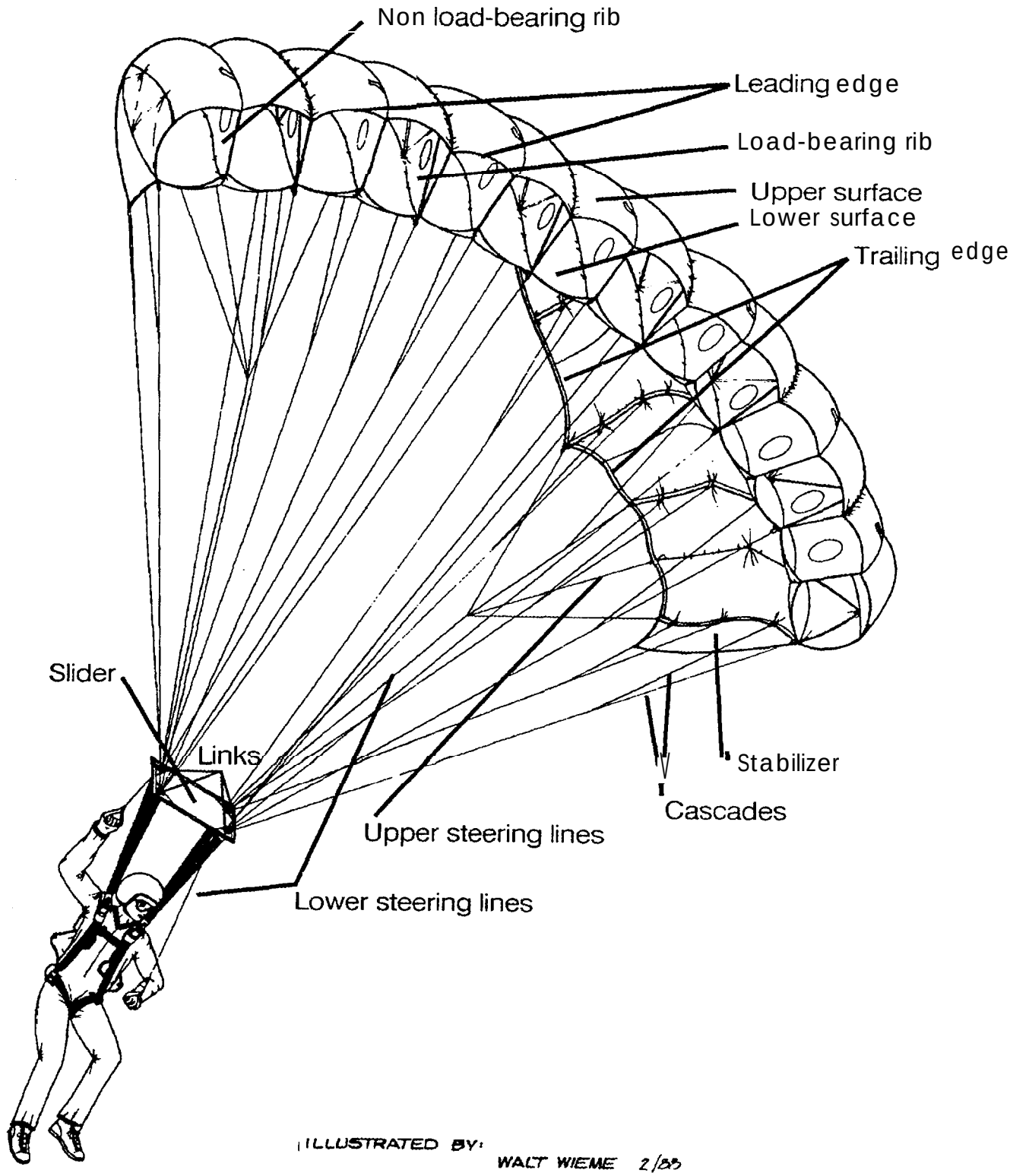
Unlike simple decellerating devices such as traditional round canopies, the ram-air parachute is a true flying machine and cannot be operated safely without a thorough understanding of the proper techniques.

Precision Aerodynamics makes no attempt to provide training either through this manual or in any other way. Your purchase of this equipment does not represent an assumption by the manufacturer that you are appropriately qualified to operate it.

Before using this equipment you must complete a controlled program of instruction, and read and understand all appropriate flight manuals and packing instructions.

US E I N COMPATIBLE HARNESS/CONTAINER

This Precision product is not a complete parachute System. It is meant to be used only in conjunction with **approved** harness/container Systems **. Assembly** instructions (for connecting the canopy to the harness/container System) are provided in this manual. Packing methods (for folding the canopy, stowing the lines and Container closure) will vary with Container design. Be certain to obtain packing instructions from the Container manufacturer.


Non load-bearing rib
Leading edge
Load-bearing rib
Upper surface
Lower surface
Trailing edge
Slider
Links
Stabilizer
Cascades
Upper steering lines
Lower steering lines
ILLUSTRATED BY:
WALT WIEME 2/85

Glossary

Aft section-The section of canopy located between the D line groups and the trailing edge.

Angle of attack-The angle created by the relative wind line and the Mean Aerodynamic Chord line of the wing.

Approved-For the purpose of this manual, refers to procedures or items subject to manufacturer approval.

Aspect Ratio-Descri bes t he relationship between the dimensions of a canopy. It is expressed as span divided by chord. A ruler 12 inches long and one inch wide has an aspect ratio of 12, written **as** 12:1.

Assembly-For the purpose of this manual, refers to the attachment of the canopy to the risers. The procedure for attachment to the harness/container is determined by the harness/container manufacturer.

Chord-Refers to the distance from the canopy leading edge to the canopy trailing edge.

Compatible-The manufacturer of the harness/container to be used has tested and determined compatibility with the specific model and size of each component in the System.

Exit Weight-The weight of the jumper including all equipment. The "ready-to-jump" weight.

FAA Parachute Rigger-A person identified and certificated by the FAA for packing of reserve or emergency parachutes. To pack a reserve or emergency parachute, a person must additionally meet all qualifications outlined by each manufacturer of the equipment involved (see page 13).

Lift-to-Drag Ratio-The lift generated by a device, divided by the drag produced, expressed as a ratio. Nominally equal to glide ratio. Anything which increases (or decreases) the ratio of lift to drag increases (or decreases) the theoretical glide angle.

Packing-For the purpose of this manual, refers to stowing the folded canopy in the harness/ Container and closing the Container. **Packing instructions are** provided by the harness/ Container manufacturer.

Porosity-Is an index to the resistance of a material to Penetration by fluids (air). Low porosity indicates a great resistance to air migrating from one side of the material to the other. **High porosity** indicates a material which allows air to pass through.

Span-Refers to the distance between the canopy right side and canopy left side.

Wing Loading-Is expressed as the amount of weight supported by a given Segment of the surface area. Example: **a** canopy with 200 square feet of surface supporting an exit weight of 175 pounds yields a wing loading of .875 pounds per square foot (175/200).

New Owner's Checklist

0 **Before assembling this canopy to a System, complete the following Checklist:**

0 I UNDERSTAND this canopy is not a skydiving system, but rather a part of a total System. It must be installed in a compatible harness/ Container system in accordance with instructions provided by the manufacturer of that system and by Precision Aerodynamics.

0 I UNDERSTAND this canopy is designed to be used as a main canopy only, unless it has been TSOed for use as a reserve. It may be used as one or the other (if FAA approved for use as a reserve) but it is not **to be used for a reserve** if it has been intentionally jumped as a main canopy. One familiarization jump is allowable prior to packing for reserve use.

◯ I AM AWARE that if this canopy is approved for use as a reserve, federal law requires it to be inspected and installed (and repacked at the appropriate intervals) only by a current qualified FAA parachute rigger. Federal law also requires the canopy be packed according to instructions provided by both Precision and the manufacturer of the harness/container System. I have read and understand the Federal Aviation Regulations (FAR) Part 105. (see page 53.)

0 I AM QUALIFIED and practiced in the Operation of a ram-air parachute canopy. I have read and understand the section in this manual on "Canopy Size Selection" (page IO), and have determined the best canopy size for my weight. I understand my **exit weight will** affect canopy behavior and Performance, especially glide and landing Performance.

0 I HAVE INSPECTED the shipping Container and contents for complete materials and for darnage which could have occurred during shipping. All components are included and are undamaged.

0 I AM FAMILIAR with instructions for storage, cleaning, maintenance and repair beginning on page 48.

0 I HAVE CHECKED compatibility of my harness/ Container system with this canopy, and the harness/container includes all necessary components not included with the canopy.

0 I HAVE READ and understand the "Packing Instructions" on page 17 or 25 (for main canopies) and have provided my rigger with the appropriate reserve packing instructions (pages 13-24) if this canopy is to be used as a reserve.

0 I UNDERSTAND the necessity to explore the flight behavior of any new canopy by operating it initially under the safest possible conditions. I know all parachutes can be incorrectly installed (and can therefore operate incorrectly). I know I need to leave extra margin in selecting a flight path when judging the performance and behavior of a new canopy.

Selecting the Right Canopy .

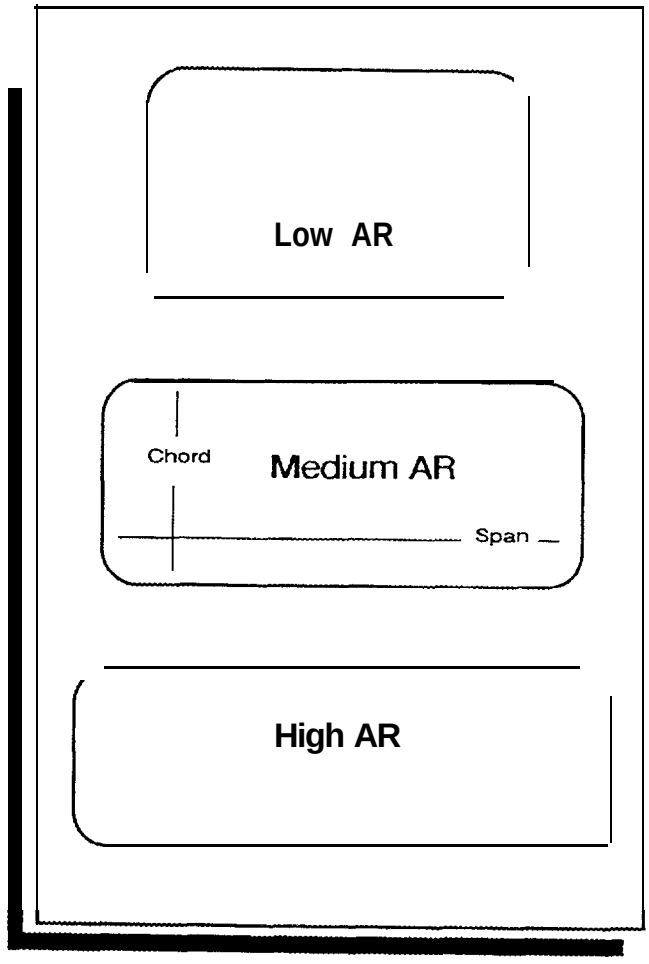
Weight and See

This section provides information on canopy selection and the ways in which Performance varies with exit weight. Use this information to select the proper canopy for your weight and/or to ascertain how the performance and flight behavior of your canopy will vary depending upon where your weight falls along the acceptable range. Although some pilot weights may fall within the acceptable range for more than one canopy size, Precision recommends you choose the canopy for which your listed weight is not at one extreme or the other of allowable weig hts.

Choice One: Which Canopy?

Your first decision in selecting a canopy will be choosing an **Aspect** Ratio (AR). A higher AR (it means a wider side-to-side, or **span** compared to the front-to-back or **chord** measurement) produces less drag for a given amount of lift, which results in a more efficient design.

Higher AR canopies (Precision's Falcon™, for example) exhibit performance significantly better in one area: a much improved



Lift-to-Drag ratio (L/D), because the drag produced for a given lift requirement is even less.

For equal canopy areas, these canopies provide more "glideability" than their smaller, more "Square" counterparts. This performance is gained at the expense of some of the more familiar characteristics of traditional canopies. The higher Performance may demand more from the Operator: more judgment; more planning; more landing area. The high-AR canopies deliver more forgiveness in selecting an exit "spot" but in return require more accuracy during final approach and a longer area for the landing flare. If "nailing" the target is your bag, or for tighter landing spots such as those encountered in most demonstration jumping, you may not prefer a canopy with a super-high Aspect Ratio.

Remember: Higher Aspect Ratios yield more efficiency in the glide and require more area for the final approach and landing than their counterpar-ts with lower Aspect Ratios.

Choice Two: Which Size?

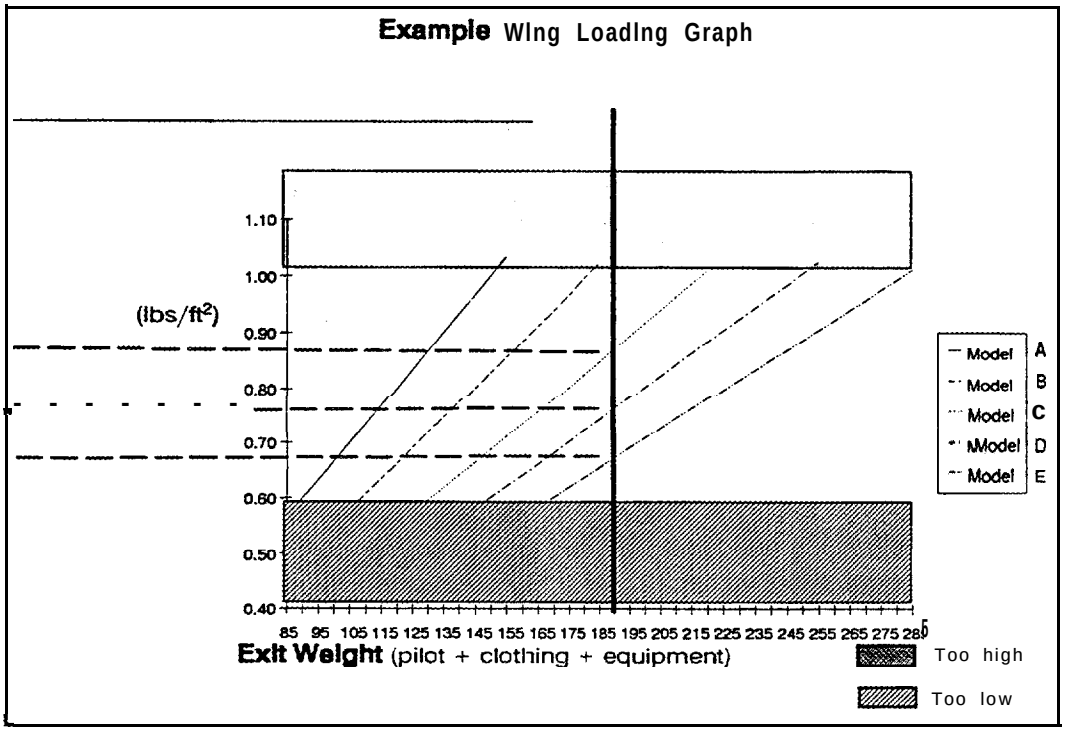
After canopy type another choice exists: Which canopy size?

In determining the weight range specification of a canopy, the manufacturer considers many factors: What weight will the canopy stand structurally? Where do you draw the line as flig ht Performance deteriorates at high speeds (too little weight) and low speeds (too much weight)?

As a jumper selecting a canopy size, you should consider the same factors. There is a theoretical "ideal" weight for each canopy. But since the number of canopy sizes it's feasible to build is limited, you may not actually be able to choose a canopy for which your weight is ideal. Precision recommends you choose a canopy which allows the most margin on either side of your weight. In other words, it's best not to choose a canopy for which your weight is at the extreme of allowable weights.

Please turn the page for more Information. . .

Example Wing Loading Graph



1. Find your weight on the horizontal axis. Draw a vertical line upward.

2. Find the points where your vertical line intercepts the line for each canopy. Extend a line from each point to the wing loading scale on the left. in this example. the exit weight is 189 pounds, and the jumper can choose from the model C at .87 lbs per sq ft wing loading, the Model D at .76 or the Model E at .68 psf. Notice that jumpers below 85 and above 285 pounds are outside the acceptable weight range for these canopies. Remember too that reserves are approved by FAA under TSO C-23c category B for use at exit weights up to 254 pounds only.

Here are some of the effects of weighf change on canopy performance:

Higher Weights (nearthe maximum allowed)

FLYING SPEED INCREASES

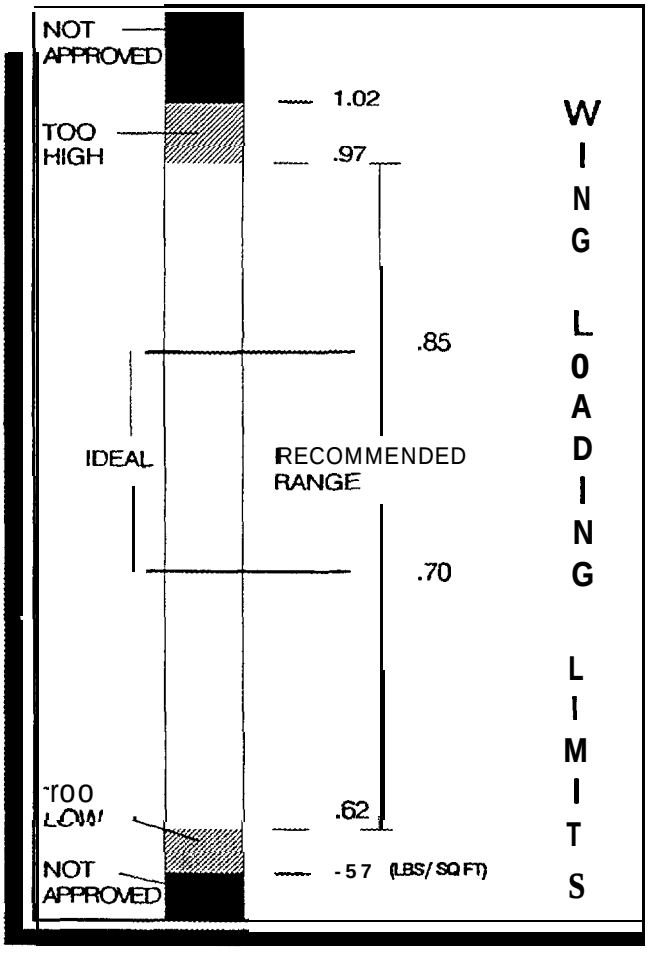
The glide angle of a canopy remains fairly constant as weight is added to the System. However, as weight increases so does the speed at which the canopy travels in order to produce enough lift to equal that weight.

SINK RATE INCREASES

Since the glide angle is nearly constant, and forward speed is increasing, downward speed also increases. The increased sink rate will result in the need for more precise flare timing and the increased weight also prolongs deceleration during the flare. You may need to flare sooner and more aggresively if you are at the high end of allowable weight. **Caution:** don't flare too high!

STALL SPEED INCREASES

Stall speed is related to **wing loading** (amount of weight supported by each square foot of canopy) more than any other factor. As weight increases, so does the speed at which the canopy stops flying smoothly. This means faster landing speeds overall and perhaps a tendency, while familiarizing yourself, to flare too late.



Lower Weights (nearthe minimum allowed)

FLYING SPEED IS REDUCED

Again at the same glide angle, the lower weight produces less forward speed. . .

SINK RATE IS REDUCED

. . .and less downward speed than weights in the middle of the range.

STALL SPEED IS REDUCED

Stall speeds are less at the lower wing loading, and deceleration in the flare requires less energy. The tendency with light wing loading might be to

flare too high or too soon on your first several flights. The canopy may not fly fast enough to provide for sufficient flare unless you increase speed. For safety's sake, a canopy should be allowed to glide naturally at the best approach speed.

Exit weight is a consideration when trimming (setting the pitch angle of) a canopy, and weight Variation will affect the trim. Canopies are trimmed prior to shipping by the manufacturer. Angle **of attack** of the canopy in flight is determined by the factory trim setting. **Do not attempt to adjust the factory trim setting.**

It is important to select a canopy which places you well within the center of the weight range. Above or below the center of the range, a canopy may not glide at the "ideal" speed due to a less-than-ideal angle of attack.

Remember: For the most efficiency, the most "forgiveness" and the greatest satisfaction, choose the canopy best suited for your exit weight.

Remember: "Exit weight" includes your weight plus the weight of any clothing, equipment or instruments you wear while jumping. Calculate your exit weight.

Reserve Canopy Installation and Packing

Instructions for packing of reserve canopies will vary with harness/ Container design. Refer these instructions for installation and folding (pages 13-24), then consult the harness/container manufacturer's instructions for inserting the canopy in the bag and closing the Container.

Main Vs. Reserve

A canopy which has been intentionally jumped as **a main canopy** (beyond one familiarization jump prior to reserve packing) **should not be packed or used as a reserve- You may, however, use a canopy which has been previously packed as a reserve as a main canopy. After you intentionally jump the canopy as a main, do not return it to Service as a reserve.**

Experience and Currency Requirements for Reserve Packing

The FAA Master or Senior Rigger who packs a Precision canopy into a reserve or emergency Container must have logged a minimum of 10 complete ram-air pack jobs, with at least one being of the same canopy/ Container combination and within the preceding 120 days. Failure to observe this requirement is a Violation of Federal Aviation Regulations Part 65.129.

Attaching the Canopy to the Risers

Canopy attachment fvr 7-cell (9-cell) modets. Nine-cell tine numbers in (bold).

1. Lay out the canopy on its left side, the slider spanwise with its tape down and lay out the Container with the harness up.

2. Thread one slider bumper over each main riser and down a few inches. (Omit for reserves, if desired.)

3. Place the slider on the risers spanwise, with its tape facing the canopy.

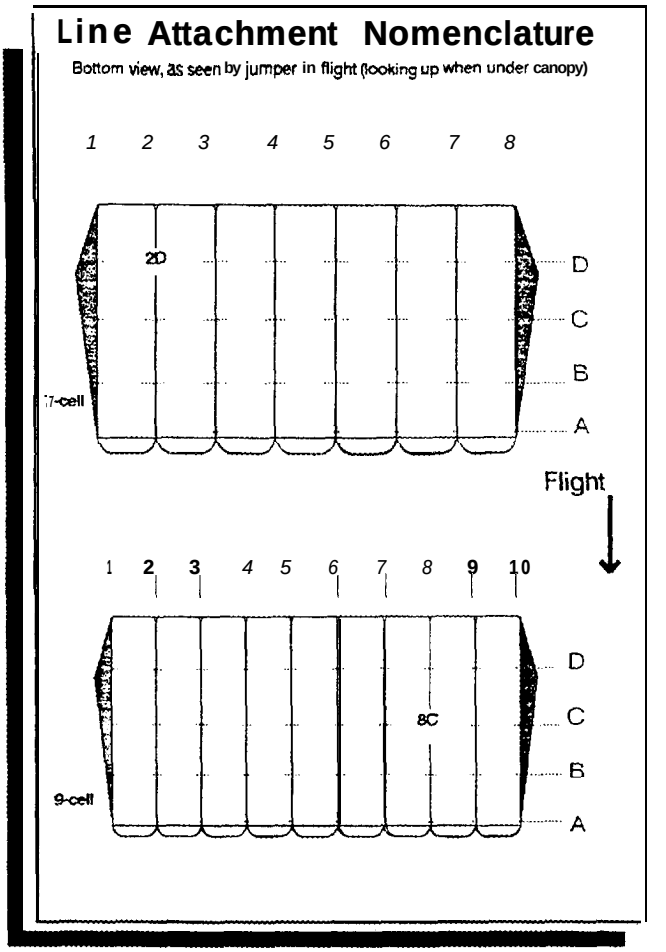
3. Locate the leading edge and A line attachment. Follow line 8A(10A) to the outboard side of its link and attach the link to the right front riser, finger tight.

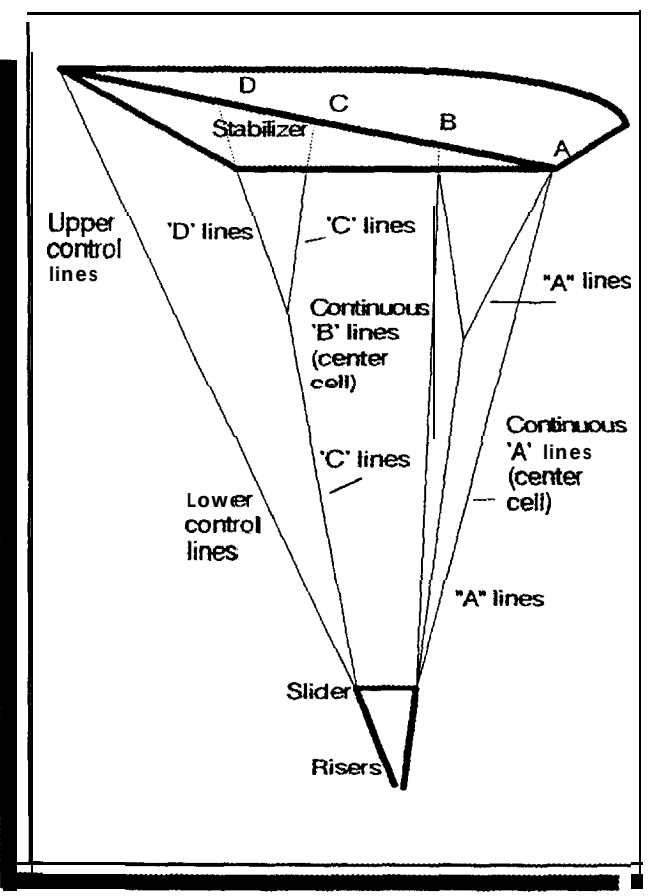
4. Pick up line 1A at the canopy attach point and follow it down to the outboard side of its link and attach the link to the left front riser, finger tight.

5. Turn the Container over, harness down, and orient the rear risers to receive their respective links. This simplifies CD link attachment.

6. Rotate the leading edge under the rest of the canopy. Split the aft section along with its associated control line groups to make the CD links easily accessible for routing and installation.

7. Locate the data panel at the center cell's upper surface trailing edge. From this center reference point follow the trailing edge to the left stabilizer and pick up line 1 D.





8. Route this line to the outboard side of its link and attach the link to the left rear riser, finger tight.

9. Again from the center reference, follow the trailing edge to the right stabilizer and pick up line 8D(10D).

10. Route this line to the outboard side of its link and attach the link to the right rear riser, finger tight.

11. Return to the center reference point of the trailing edge. Locate and pick up the left side upper control lines consecutively. Verify their continuity to the junction with the lower control line.

12. Removing twists as you go, follow the left lower control line to its running end. Route it through the appropriate slider grommet, and the guide ring.

13. Remove the toggle from the riser and route the running end of the lower control line through the toggle attachment loop.

14. Slide the toggle up to the mark on the control line. Secure it with an overhand knot tied closely to the toggle.

15. The control line attachment for the right side is done in a similar manner.

16. When the control line installation is complete you may wish to compare the two toggle attachment settings under equal tension to ensure their uniformity.

17. This is an appropriate time to verify continuity of the control line System. Begin at the trailing edge on each side, verifying that all twists have been removed from the upper and lower control lines. Also make sure that the lower control lines have been properly routed through their appropriate slider grommets and guide rings, and that toggles have been properly secured equidistant from the trailing edge.

18. Separate the aft section and control line groups to their respective sides and locate the center reference point at the trailing edge.

19. Following the trailing edge control sutface outboard will lead you to the left stabiliter's bottom seam and the attachment point of line 1 D.

20. Holding D lines 1, 2, 3 and 4(1,2,3,4,5) in your right hand and D lines 5, 6, 7 and 8(6,7,8,9,10) in your left hand, verify the continuity of the C and D lines through the cascades to their respective rear risers.

21. Gather in the control lines and flip the canopy over so the leading edge faces up. Verify this orientation by locating the attachment points of A lines 1 and 8(10).

22. In the same direction you flipped the canopy, rotate the Container system harness-up.

23. Pick up the front riser groups, follow them to the canopy, and separate.

24. Pick up A lines 8, 7, 6 and 5(10,9,8,7,6). If you have continuous center cell lines, follow the bottom seam down and pick up line 5B(6B). Verify continuity of the A and B lines, through the cascades, to the right front riser.

25. Pick up A lines 1, 2, 3 **and** 4(**and 5). If you have continuous** center cell **lines,** follow **the bottom seam down and pick up line** 4B(**5B**). **Verify continuity of the A and** B **lines, through the cascades to the** left **front** riser. **The continuity check is now** complete.

26. Tightening the connector links properly is critical to safety. Thread the barrel up snugly against the barrel stop. Use a 9mm **wrench to secure the links.**

DO NOT OVERTIGHTEN ! A **Overtightening the connector links** can **be dangerous** because **it could** strip **the threads or** split **the barrel. This is an appropriate time to inspect the links for any darnage possibly inflicted** during **tightening. Inspect** each **link thoroughly for any signs of darnage which could deteriorate** structural **integrity.**

27. Move the slider from the risers, across **the tightened links onto the suspension lines.**

(Omit step 28 for reserves, If step 9 was also skipped.)

28. Move the slider bumpers up and install **them at the links in the** manner **shown in the illustration. An** 8-foot **length of** 3/32" **MW finish lacing tape is included with your new canopy to secure the bumpers as shown.**

This completes the assembly process.

It is assumed throughout these instructions that you are assembling to "Standard" risers, which will result in a distance of 4 inches from the inside of the control line guide ring to the top of the riser.

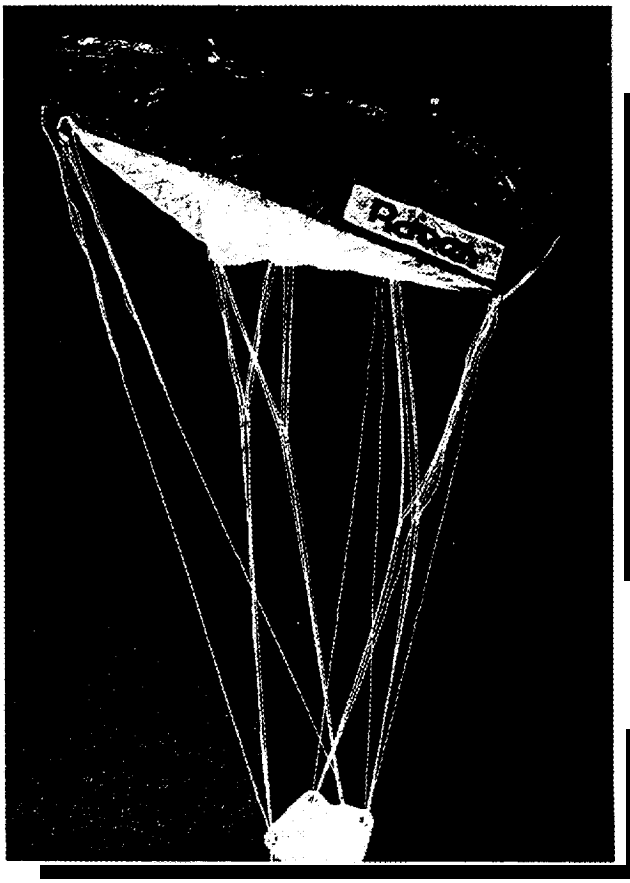
Reserve or Main Canopy Folding

Reserve canopy folding is accomplished by "stack" packing (also known as side packing) only. Reserve or main canopy folding can be accomplished by "stack packing" in the following manner. The instructions for "pro packing", which is approved for the main canopy only (pro packing is not approved for reserves) begin on page 25. The Checklist below applies to either method.

Prepacking Checklist

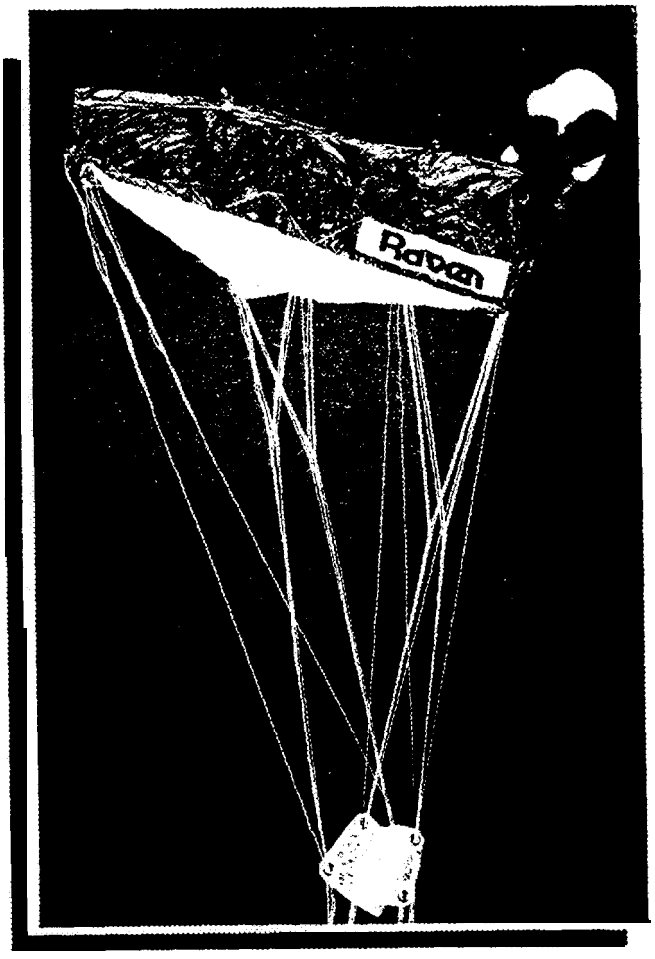
- ○ **Bridle Attachment Point** (main only)
- ○ Canopy
- ○ **Slider Stops**
- ○ **Links**
- ○ **Slider Bumpers** (main only)
- ○ **Slider**
- ○ **Lines**
- ○ **Control Line Locking Loops**

Tools Required: Three shot bags.

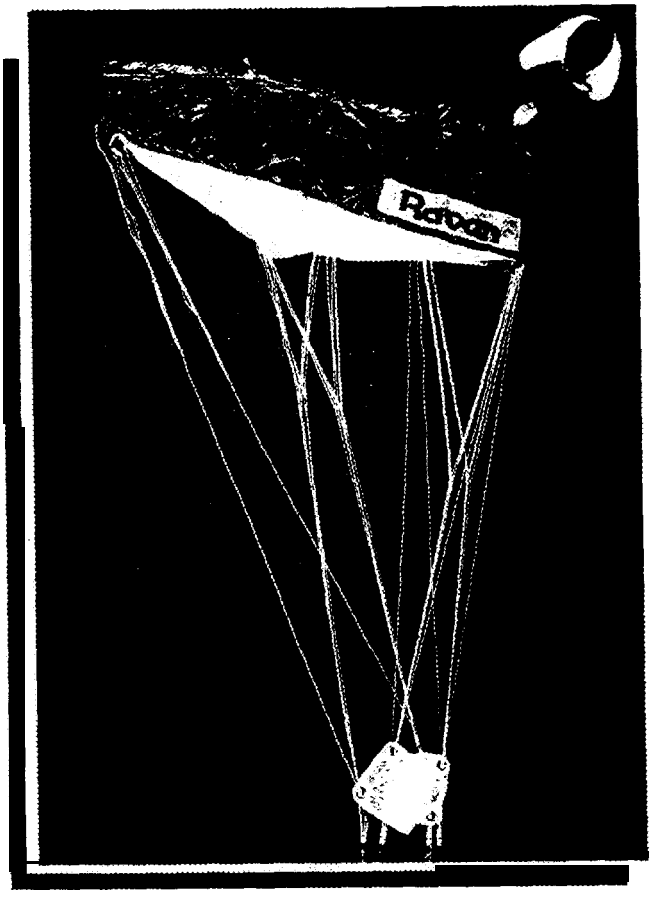


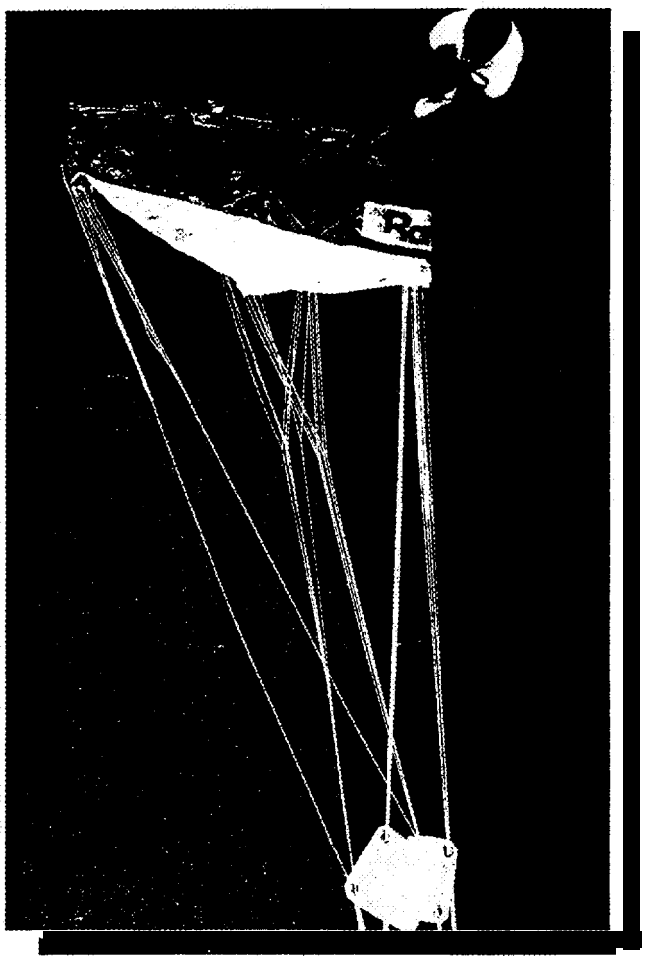
1. To prepare for packing, orient the container harness down, the slider at the links, with the lines clear and the canopy on its left side.

2. Fold the leading edge under, using caution not to twist the A lines.

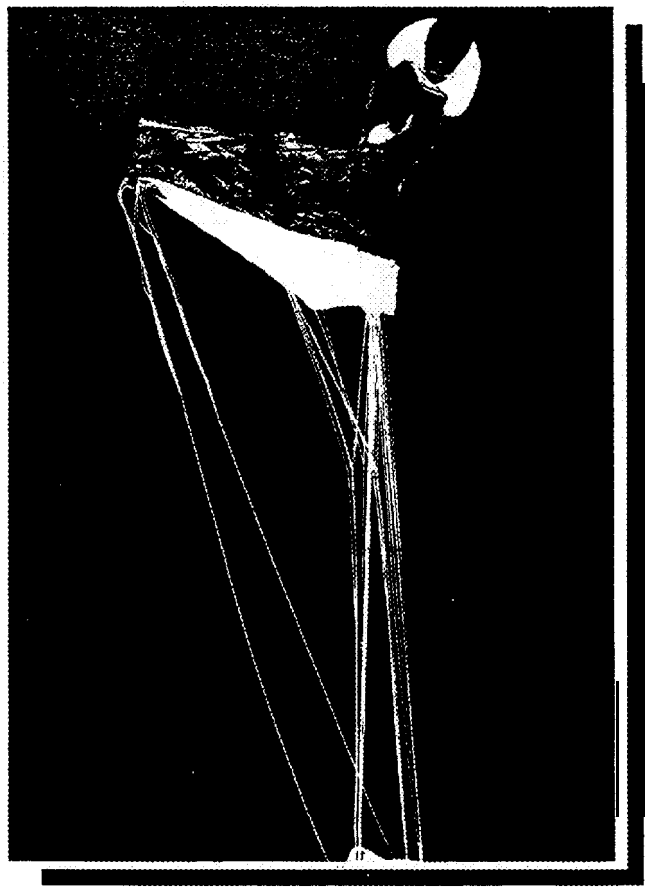


3. S-folding the A iines under the B lines keeps the canopy centered on the Container.





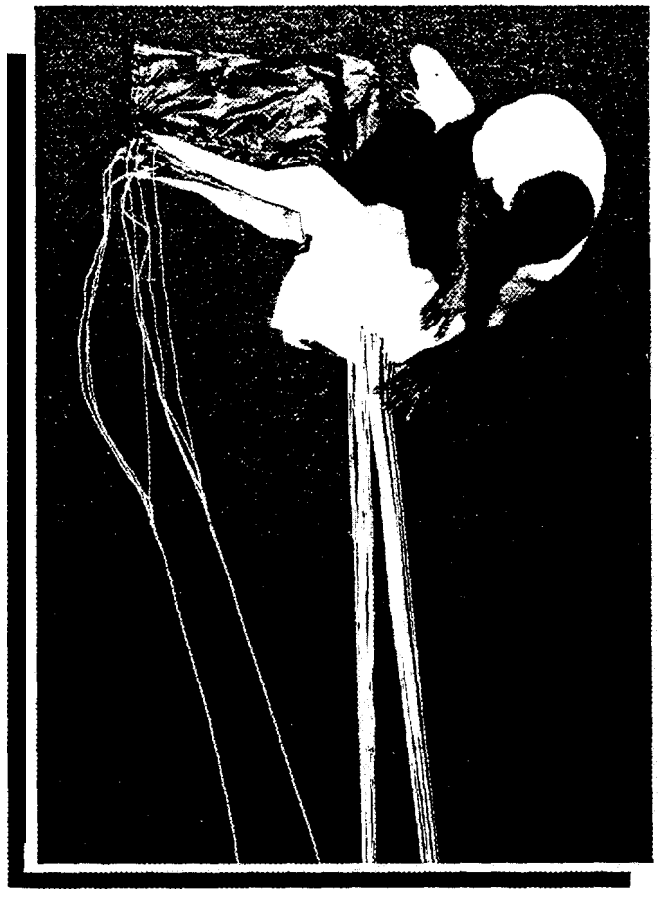
4. S-fold the C lines and the D lines onto the stack.



5. True "S folds" distribute equal amounts of canopy fabric bulk to each side of the stacked line groups.

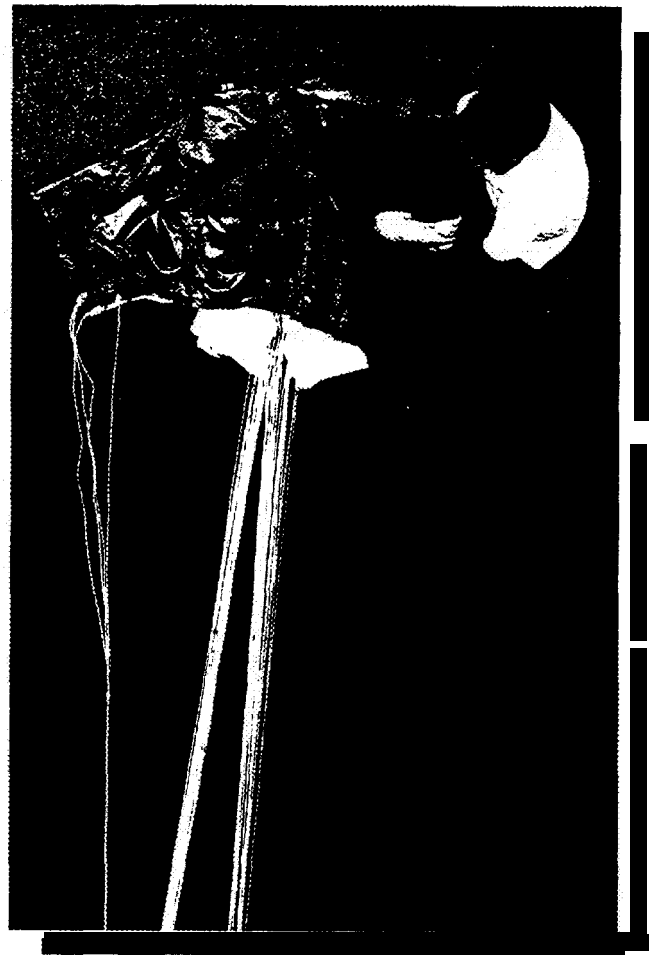
6. When the S-folds are complete, purge the air from the remaining portion of the canopy.

7. Clear the D-C section, the C-B section and the B-A section of the right stabilizer. Likewise clear all sections of the left stabilizer. Clear the sections aft of the D lines. Reestablish equal line tension from the high points of each S fold.



Next, set the deployment brakes.

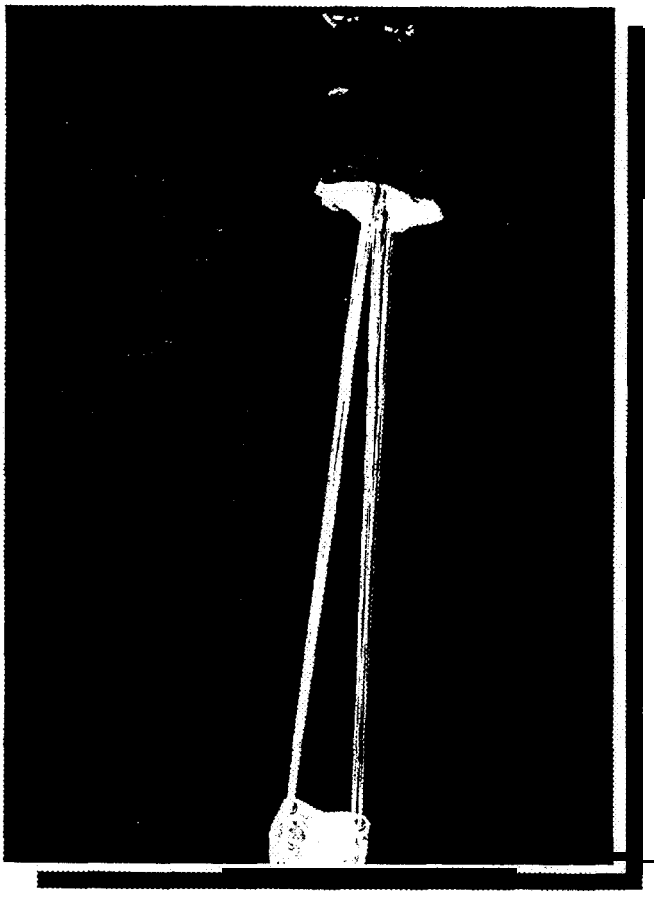
Instructions for setting the brakes will vary with Container design. **Follow the nstructions supplied by the manufacturer of the harness System.**



8. In dressing the aft section of the airfoil, the left hand serves two purposes. First, it contains the flaked trailing edge. Second, it helps maintain tension on the D lines and associated attachment points.

Extra time and attention in dressing the aft section of the airfoil not only enhances a more orderly deployment, but is also helpful in canopy bulk distribution when filling out the free bag.

When the right aft section of the canopy has been dressed, contain it with both knees.

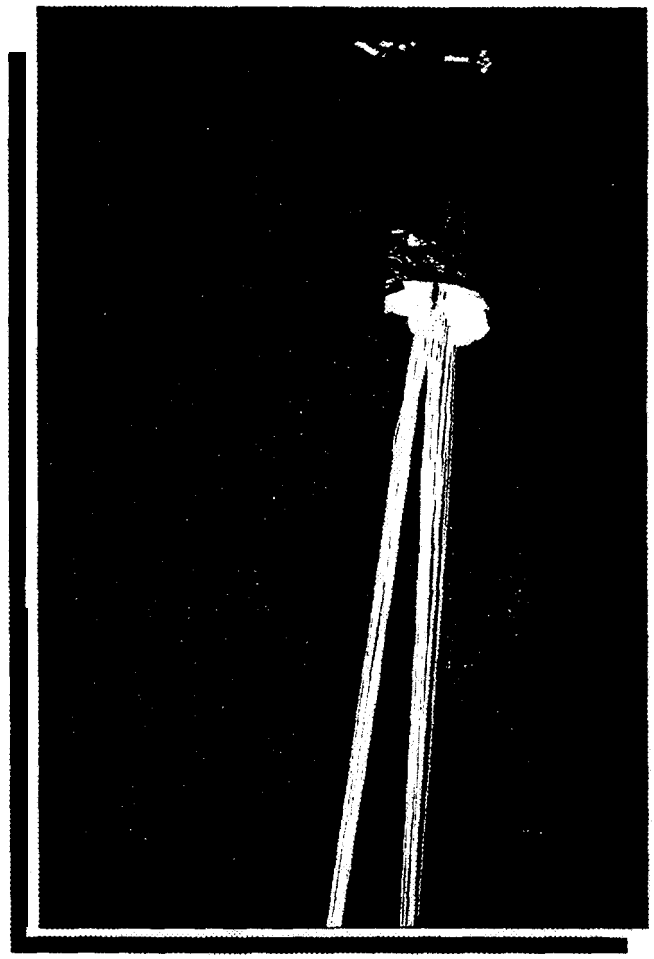


9. Gather up the left section in order to dress it away from you in a similar manner. Reestablish tension on the D lines.

10. All of the seams across the aft section of the airfoil are either double stitch row, non-load bearing type or blind stitched loadbearing seams. All these seams are folded parallel and adjacent to the line groups, while the fabric between these seams is folded on the outside. Dressing the seams as high on the aft section as is practical helps keep slack from developing in the D lines. It will also help in distribution of the bulk.

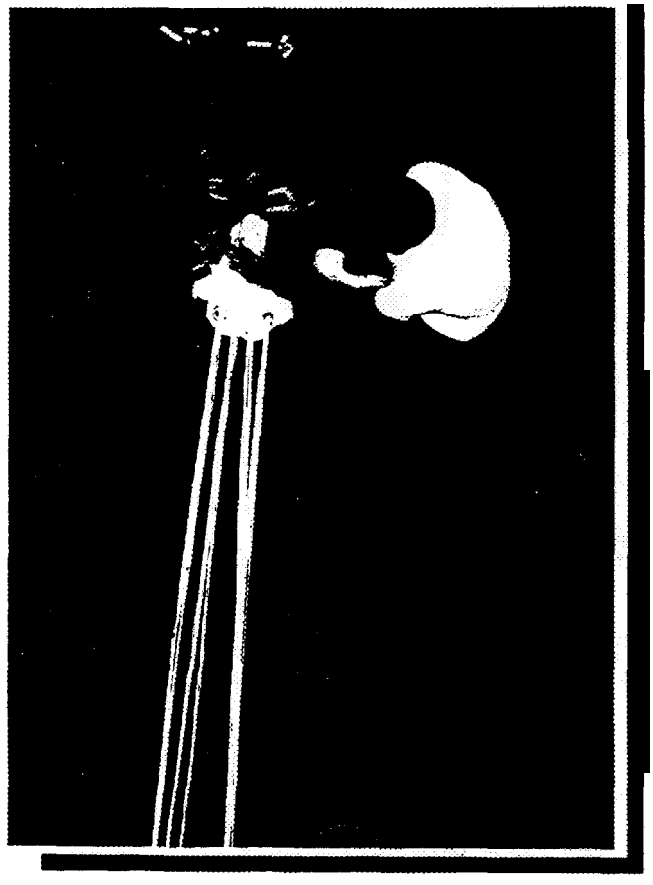
Kneeling on the trailing edge, purge the air from the canopy. Folding under the edges of the flaked aft section assists in controlling the airfoil when exposing the leading edge.

As you pack, good technique Warrants that you purge the canopy frequently to ensure optimum control.



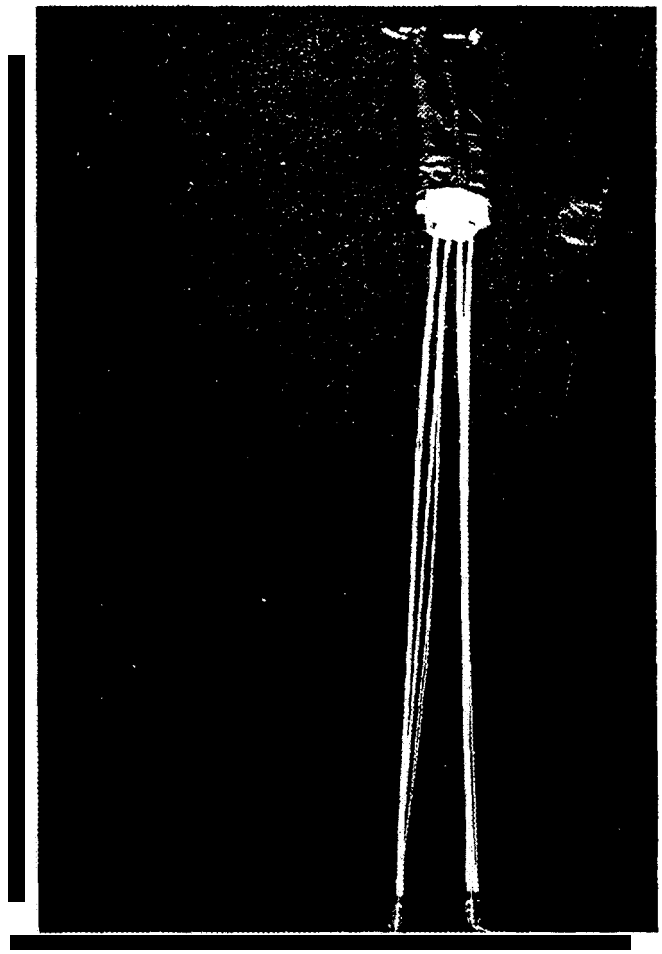
11. Lift the canopy onto your lap and expose the high points of the leading edge.

12. While maintaining control, return the canopy to the floor and purge again.



13. Grasp the slider, and without lifting the grommets from the carpet, bring the slider up the lines and set it against the stops. Spread the grommets to distribute the bulk. Position the slider under the trailing edge.

14. Dress the canopy to the width of the free bag, plus 2 inches on each side



This concludes the canopy folding sequence. Installation into the deployment bag and/or container must be done in accordance with instructions provided by the container manufacturer.

Main Canopy Folding

Main canopy folding can **be** accomplished by "stack packing" in the normal manner (page 17), or "pro packing" (sometimes known as the "stand up" pack job). The instructions for pro packing begin on page 26. The Checklist below applies to either method.

Attention to the following items will help to prolong the life of your canopy and to prevent darnage during the packing procedure:

1. Pack where the wind will not affect you.

2. Do not pack on concrete or asphalt. This will cause additional wear on lines, links and fabric. Packing on a dry lawn or packing mat is preferable.

3. Inspect the canopy prior to every packing. The following Checklist is explained in greater detail on **page 41.**

Prepacking Checklist

- **0 Bridle Attachment Point**
- **0 Canopy**
- **0 Slider Stops**
- **0 Links**
- **O Slider Bumpers**
- **O Slider**
- **O Lines**
- **0 Control Line Locking Loops**

Main canopy packing instructions begin on the following page. Reserve **packing instructions begin on page 13.**

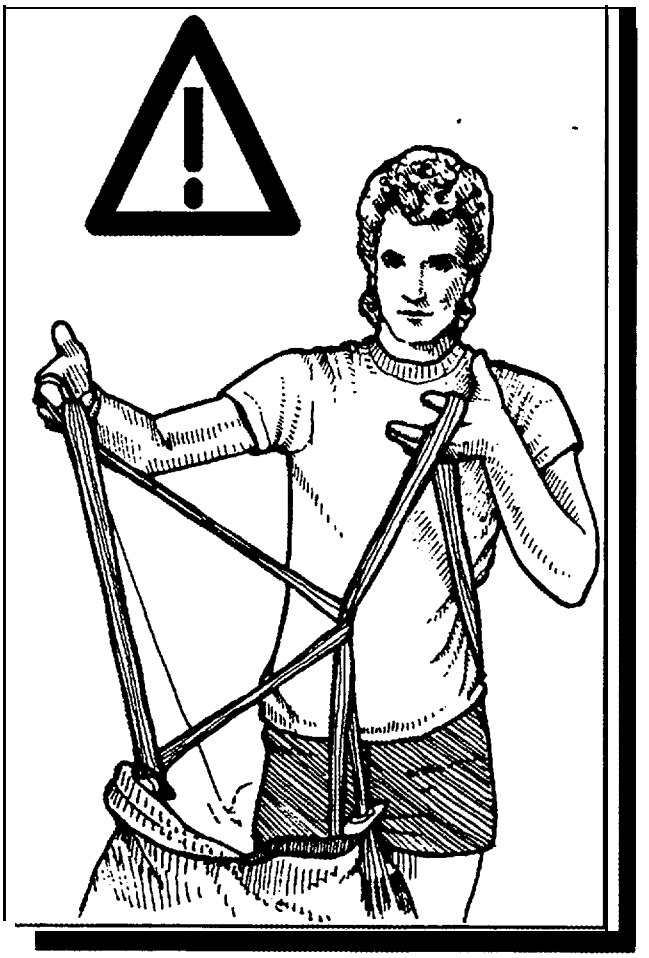
Main Canopy Folding Instructions

The Line Check

1. Crouch next to the risers and face your canopy. Slip the fingers of your left hand between each left-hand riser and between the left-hand steering line and the risers. Do the same with your right hand. The idea is to have each line group and each steering line occupying its own slot between two of your fingers.

2. Stand between the right- and left-hand riser groups and start moving up the lines, allowing them to slide between your fingers. Push the slider ahead, until you reach the lower surface of the canopy.

At this point, it's possible to determine whether or not your canopy and lines are straight. If you have twists in the lines as shown, your rig has done a "loop" through your risers at some point. To fix this, drop the lines, stretch the canopy and lines out again and straighten out the entanglement. Get help from a rigger if you have any questions. Repeat the line check after Clearing to confirm you have done it correctly.



3. If you have something that looks like this, it's likely a control line is passed around evetything else.

A control line which passes around everything else will result in a malfunction that will almost surely require a breakaway.

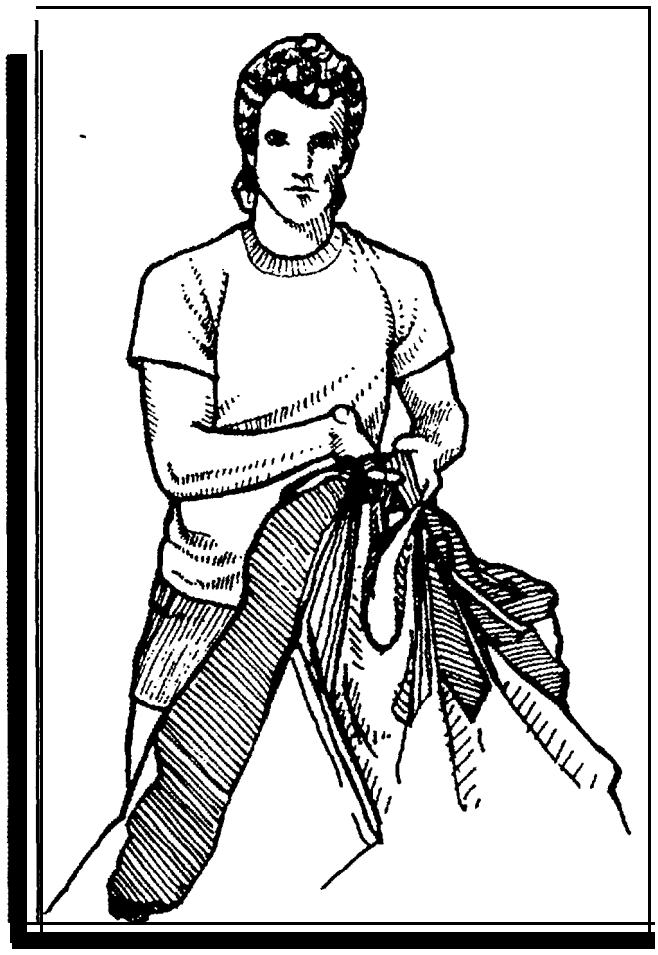
To fix this, lay the canopy down on the ground. Starting at the canopy, find the second and third lines on one end cell (these are called the B and C lines).

Carefully follow these two lines down through the slider to the links on the risers. You should be able to see where you will need to pass your rig through the lines to correct the steering line routing. Again, seek capable assistance if you have any questions.

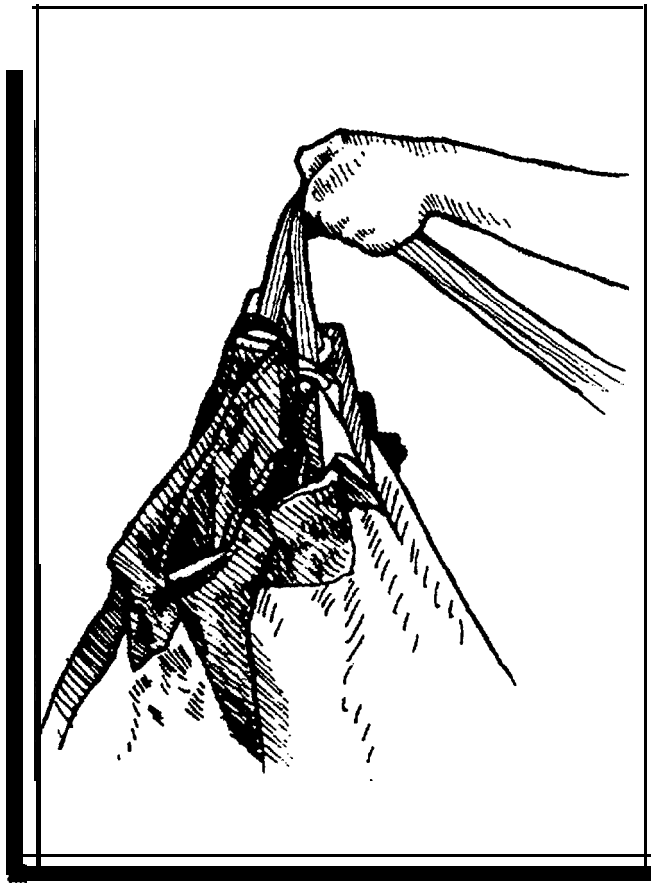
Flaking the Leading Edge

4. When you reach your canopy, pull both hands apart as far as the slider will allow. Shake the canopy a couple times to settle everything.

5. Now step to one side, outside the lines and transfer the lines in one hand to the other . . .



6. . . . so you are holding all the lines in one hand--preferably with your stronger arm.

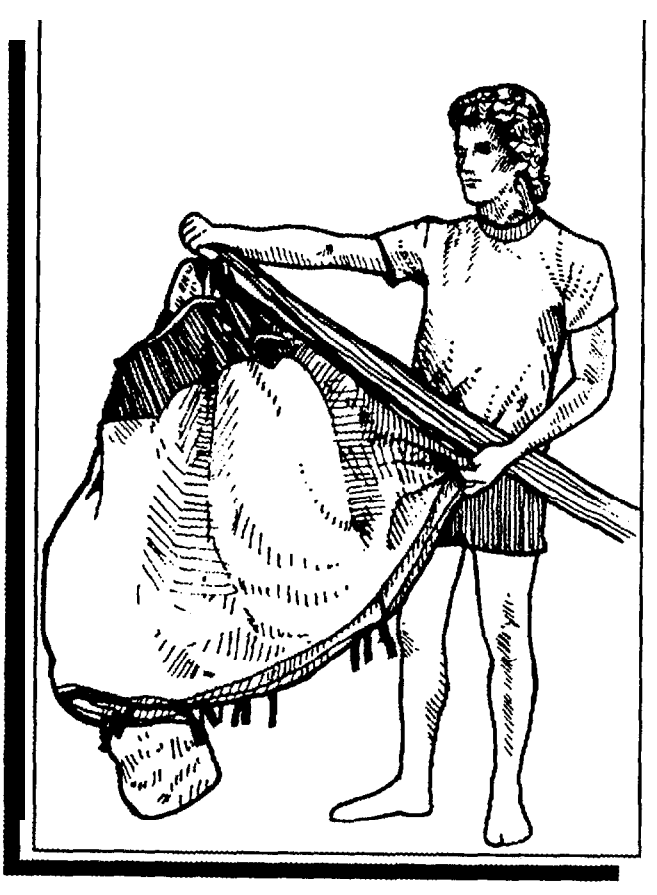


7. Locate the leading edge of the canopy; it should be facing your rig. (If it is facing "up" or away from your rig, it might mean your canopy has been attached backward.)

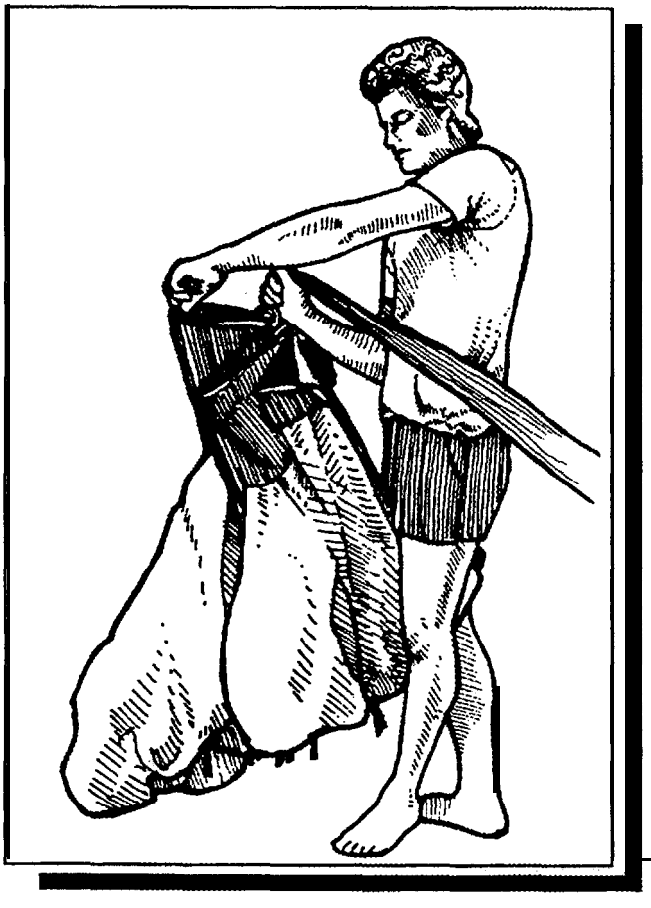
8. Starting with the end cell nearest your legs, flake the entire leading edge with one hand as shown.

9. Pull each cell all the way out and keep it in your hand. Then move to the next cell, taking care not to miss any, until all of them are in your hand.

10. When you've got the entire leading edge flaked . . .



11. . . . tuck it between your knees and hold it there.

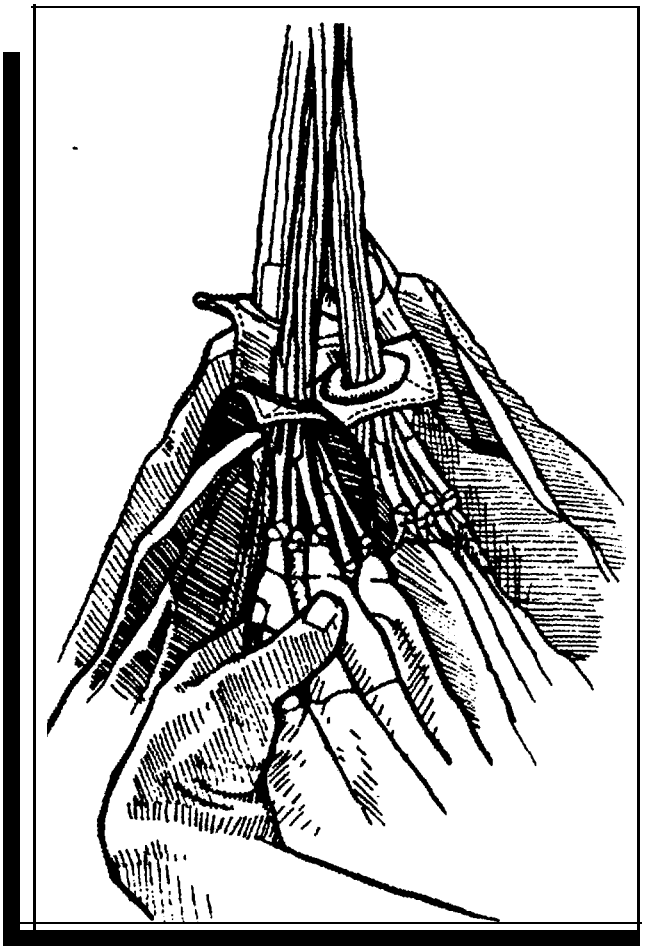


Clearing the Stabilizers.

12. Since **all the** lines are **bunched up** in the **middle,** pull out each stabilizer panel **one by one** until they form an irregular shape resembling the petals of a flower viewed from the top.

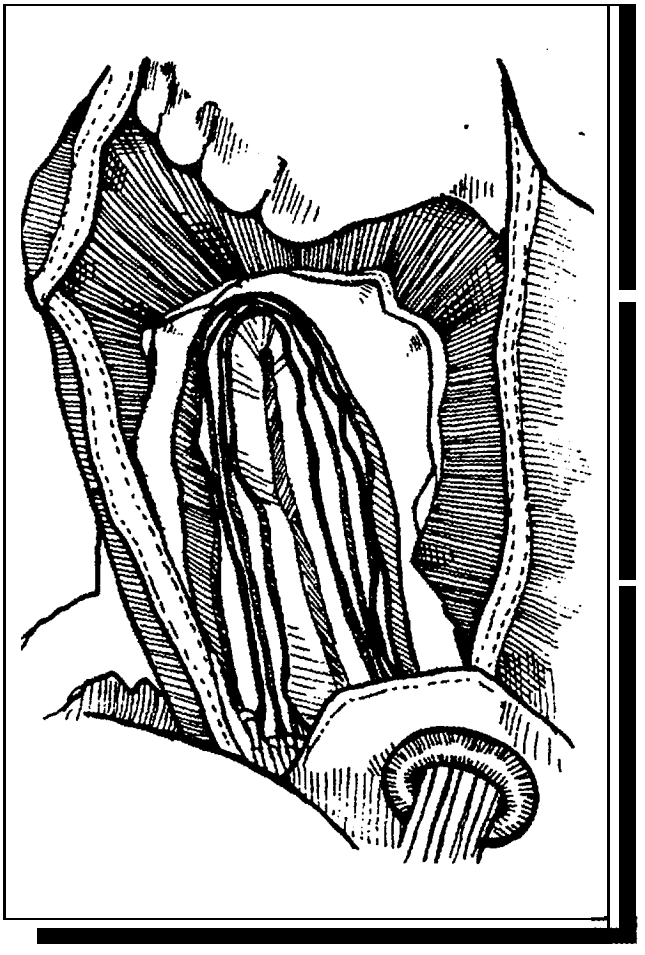
13. Find the group of A lines on one side of the canopy. With the canopy held in front of you as you have it now, the A lines are the front , part of the line group that go through the front slider grommets, the ones that should be closest to you.

(Each load-bearing cell rib has four lines attached to it: the A line at the leading edge, followed by the B and then the C lines, ending with the D line closest to (but not on) the trailing edge. Some cells have confrol lines attached to them at the trailing edge. The A and B lines pass through the front grommets of the slider, while the C, D and control lines all pass through the rear grommets.)



14. Since there is a lot of fabric between the A and B line attachment points, it's easy to separate the two line groups; (See the drawing.)

Now you're going to S fold the rest of the canopy like the stabilizers. Put your hand in between the A and B lines on one side (near where they pass their own grommet) and pull them out to one side. This will give the cells on one side the correct type of flaking. Now repeat with the other A and B group, pulling the fold out the other side.



15. Now that you've pulled out the canopy between the A and B line groups, do the same thing between the B and C lines: pull the fold between the two groups out to each side. When you look down between the stabilizer folds after you've done your "flaking," the folds should look nice and neat like this.

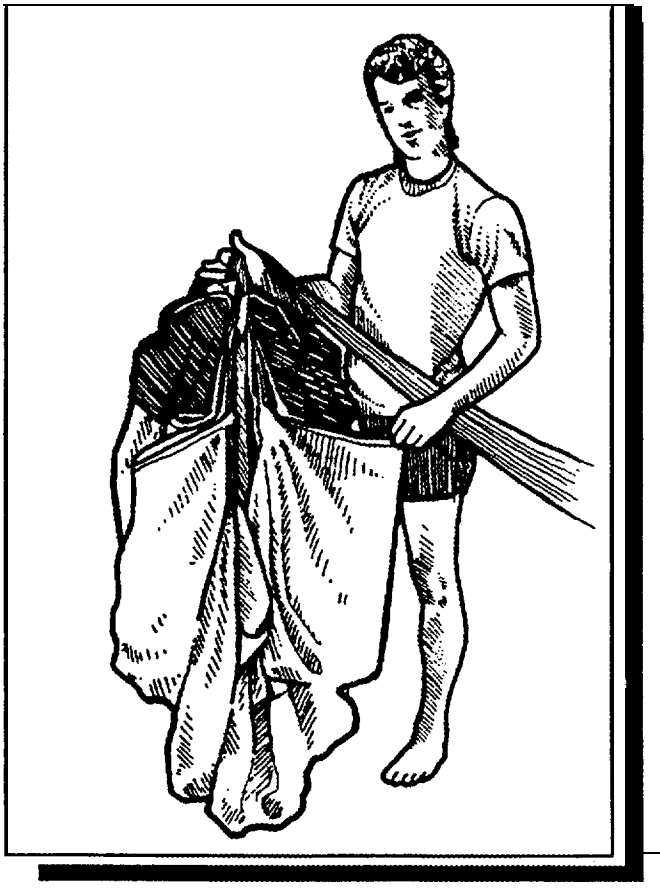
Flaking the Trailing Edge

16. Now find the D line group, the group of lines nearest the tail. (Not the control lines; they are attached at the traiiing edge.)

17. Take the whole D line group on one side . . .

18. . . . pull it out gently; then fold it with one motion to put a real fold in the fabric between the C and D lines. Do the same thing on the other side.

19. Now grasp the control lines where they attach to the trailing edge, pull the entire trailing edge out and drop it straight down.



20. Flake the trailing edge neatly on each side as shown. The center portion of the trailing edge--the section between the left-hand and right-hand control lines--can't be flaked and will hang down. You'll straighten this out next.

21. Reach down and pick up the very middle point of the trailing edge (the ID panel is sewn to the top of the center cell near the trailing edge.) Lift it up and put the very middle seam up with the slider grommets, holding it in place with your thumb or finger.

If ***your canopy is new,*** *or* ***if*** *it tends to* ***open*** *uncomfortably* ***fast,*** *then follow steps* ***22*** *through* ***25.*** *Otherwise, skip to* ***26.***

Optional (For Slower Openings)

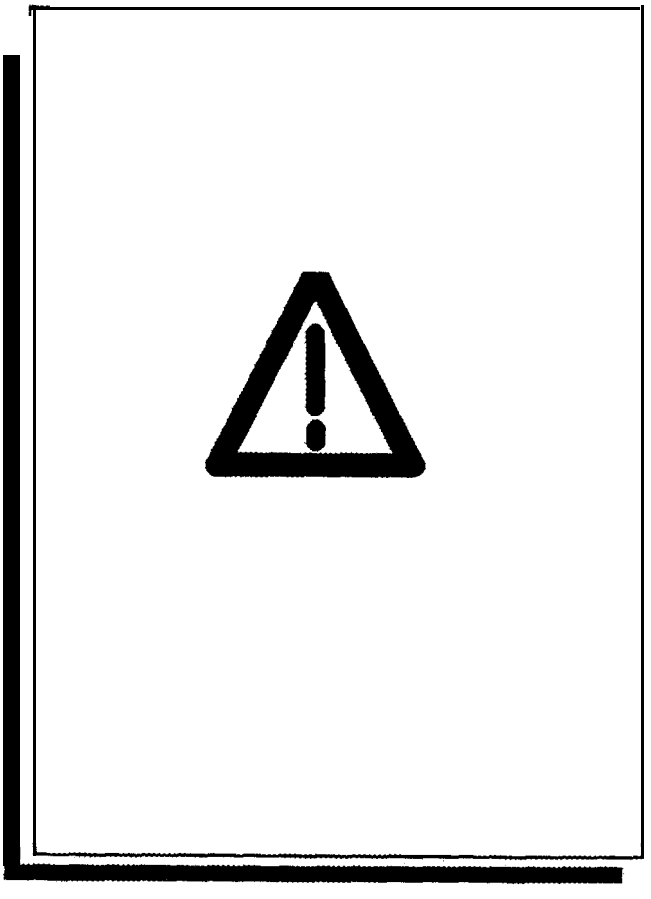
22. Loosen your knee grip on the leading edge of the canopy. Find the very middle of it. (It's easy. Just run your hand down between the front two slider grommets; exactly half the lines will be on one side and half on the other.)

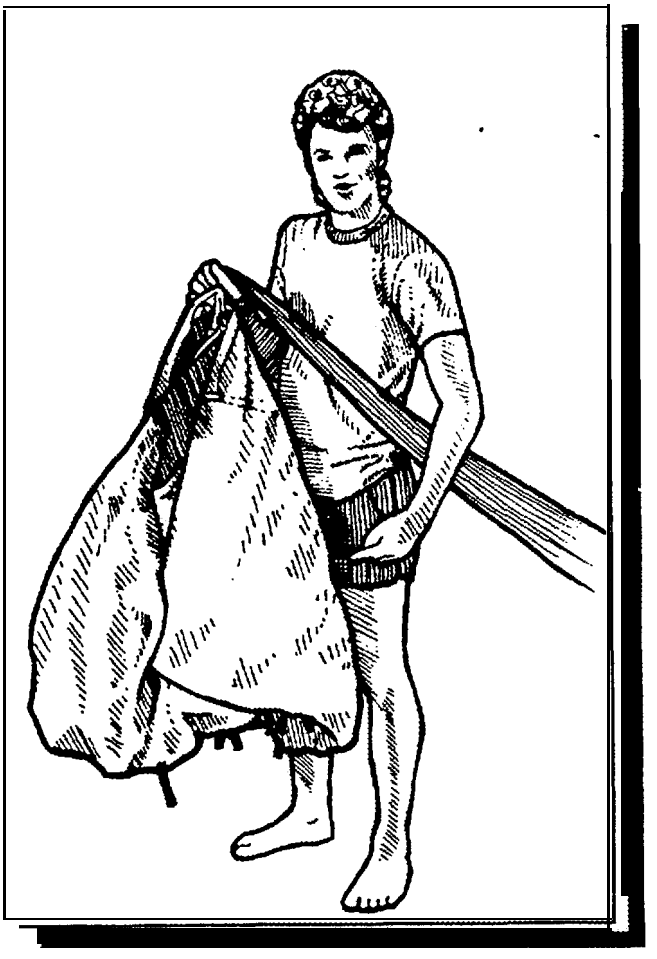
23. While leaving the very middle cell hanging, pick up all the others on one side and roll them in toward the middle.

24. Do the same on the other side. When you're done, this is how the leading edge should look.

25. This shows how steps 23 and 24 help siow down openings. As the canopy opens (remember, this illustration shows the canopy upside down), the center cell inflates and the sides are slowed somewhat by the fact that they are rolled separately. The result is more controlled, symetrical inflation.

If you want your canopy to open faster, just leave the leading edge hanging neatly flaked; don't roll it at all. (Skip steps 22 through 25.) This leaves the leading edge exposed to the airstream and will help the canopy inflate faster.





26. You have in your hand a neatly flaked canopy. The leading edge is brushing up against your legs and the middle of the trailing edge is still being held along with all the lines.

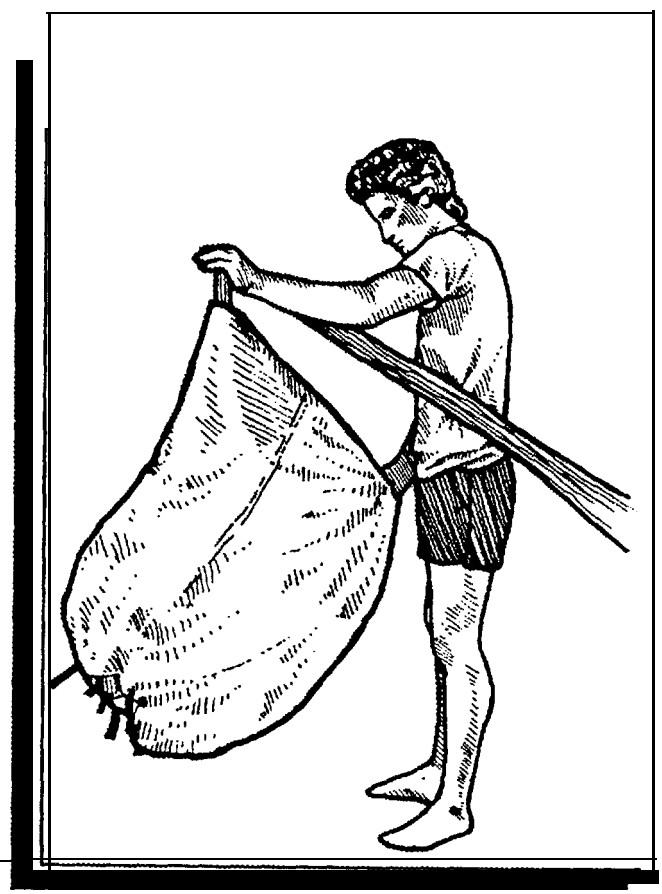
27. On one side, start at the middle of the trailing edge being held under your thumb and pull the excess material straight out. You're pulling out the trailing edge of the canopy that extends from the inside control line to the very center of the trailing edge.

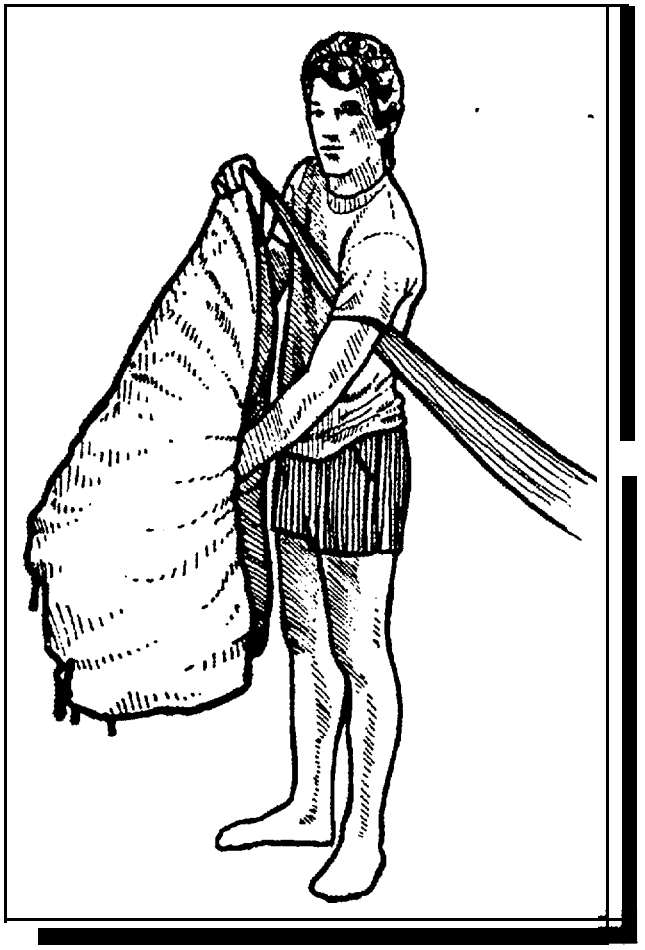
28. Holding the lines firmly with the other hand, wrap that part of the trailing edge halfway around the canopy. Hold it in place with your knees. Fold the trailing edge on the other side of the canopy in the same way.

!

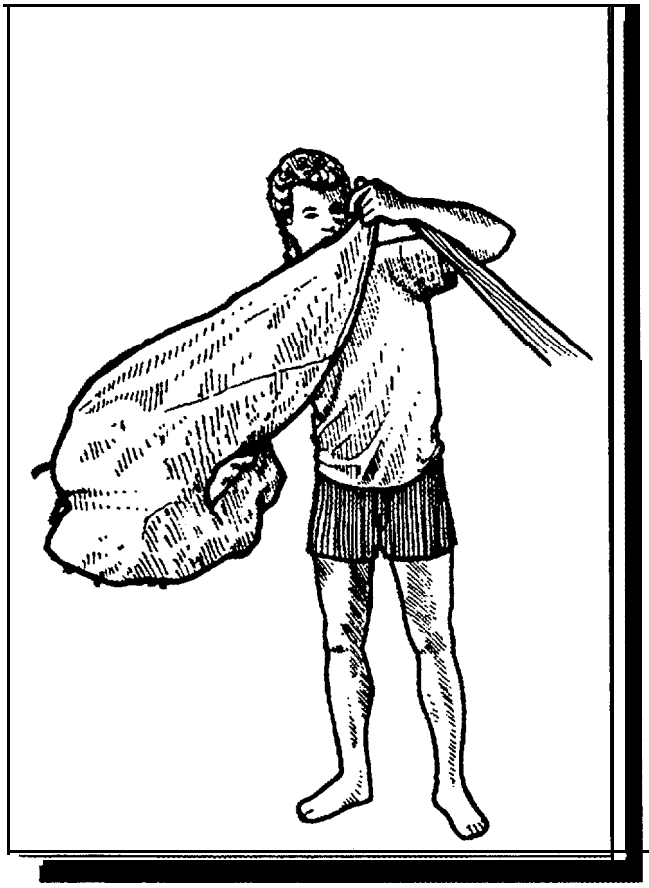
BE CAREFUL WHEN PULLING THE TRAILING EDGE AROUND THE BUNDLE. BE SURE TO LEAVE THE CONTROL LINES UNDISTURBED. IF YOU WRAP THE CONTROL LINES AROUND THE BUNDLE ALONG WITH THE TRAILING EDGE, YOU MAY INDUCE A LINEOVER MALFUNCTION.

29. Take both trailing edge pieces in one hand and. , .



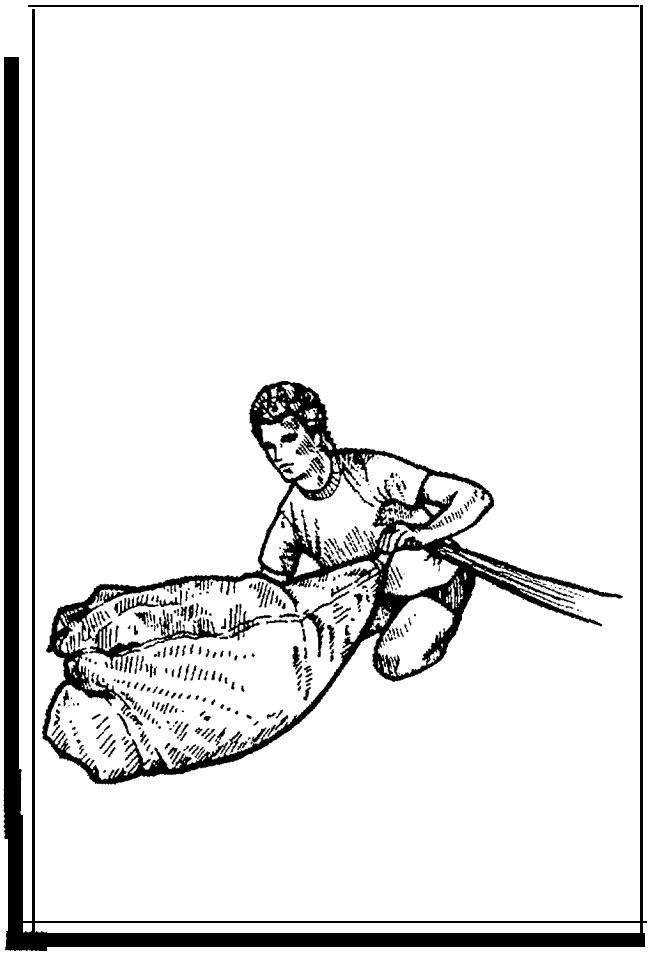


30. . . . roll them together in to the middle so they completely encase the rest of the canopy.

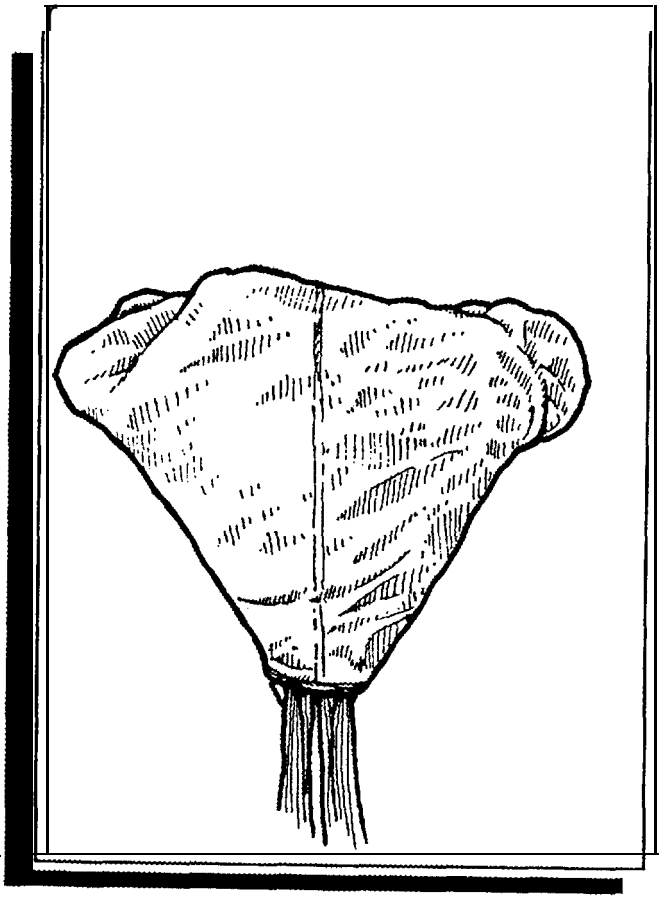


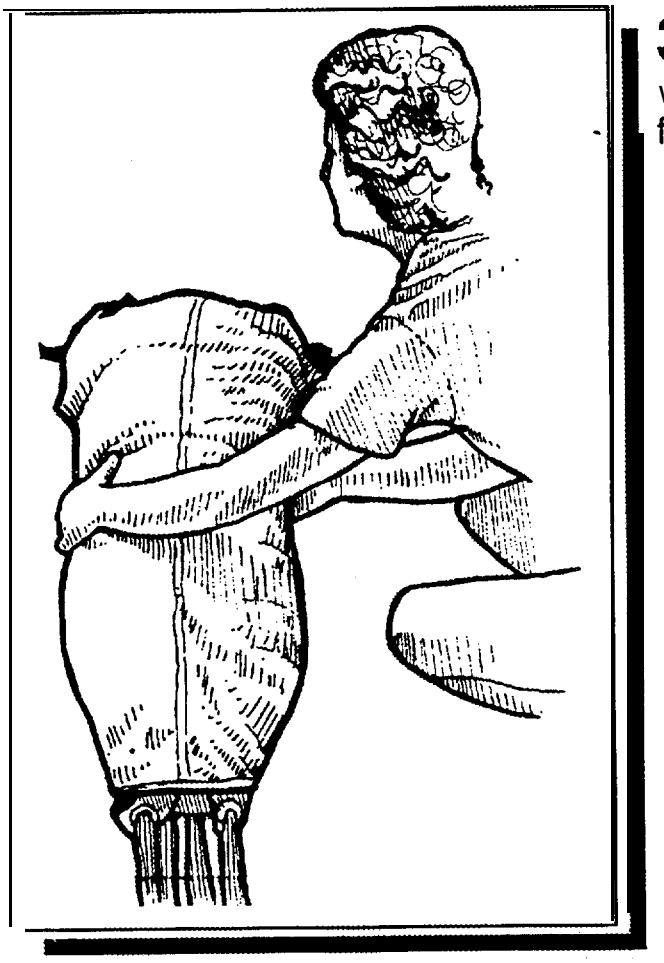
31. Place your free hand carefully under the bundle.

32. Swing it out slightly so that lines stay taut and gently lay it on the floor.

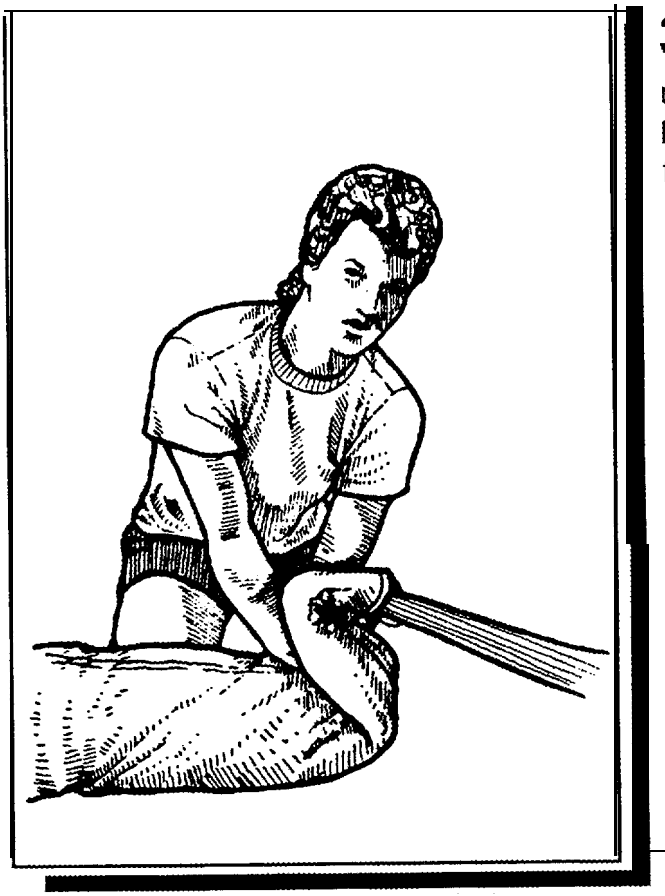


33. As it rests on the floor, the canopy should be triangular in shape as shown.



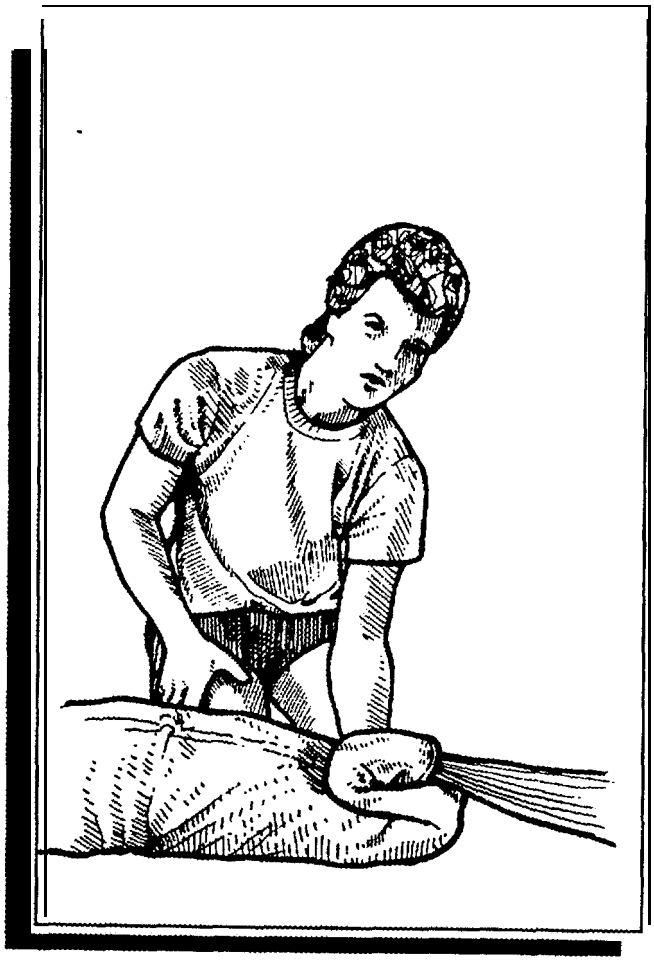


34. Tuck the sides under, starting at the slider and working up, making the canopy into a flattened cylinder shape.

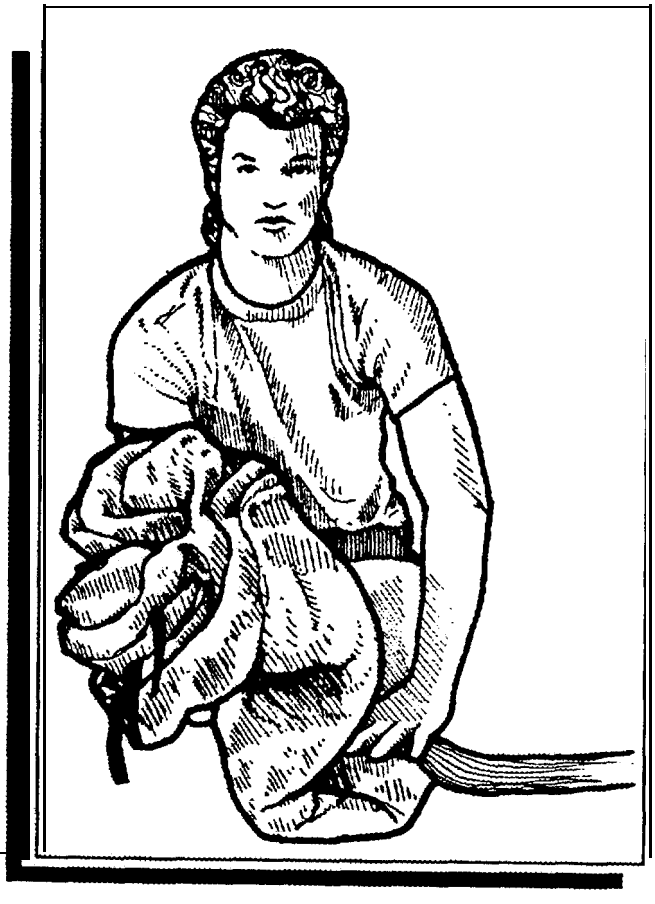


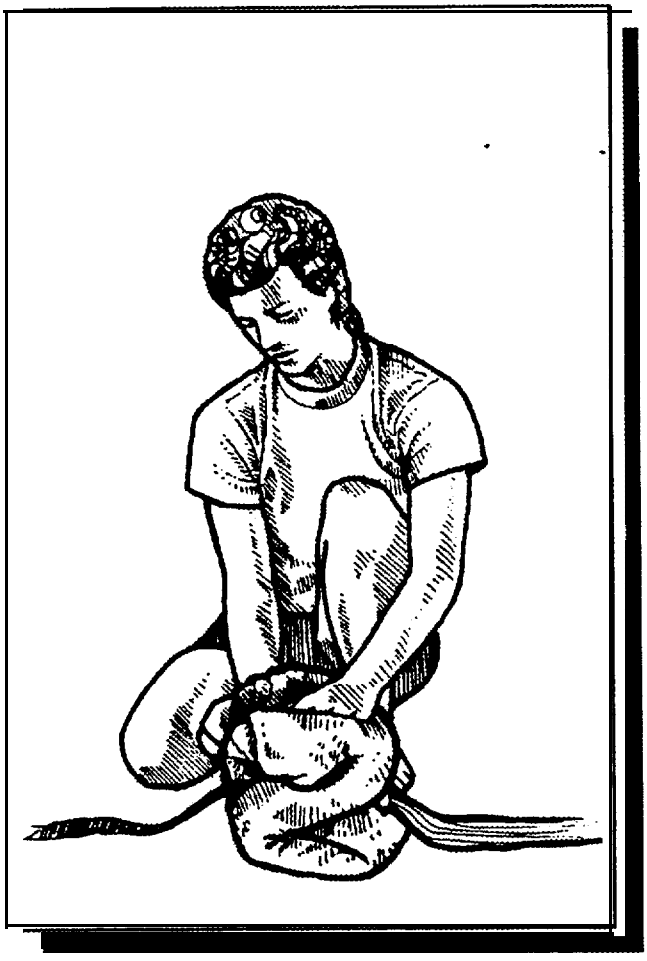
35. Move to the side of the canopy and put one hand under the slider edge of the bundle. Place the other hand on top a little farther up.

36. Make a small S fold as shown.

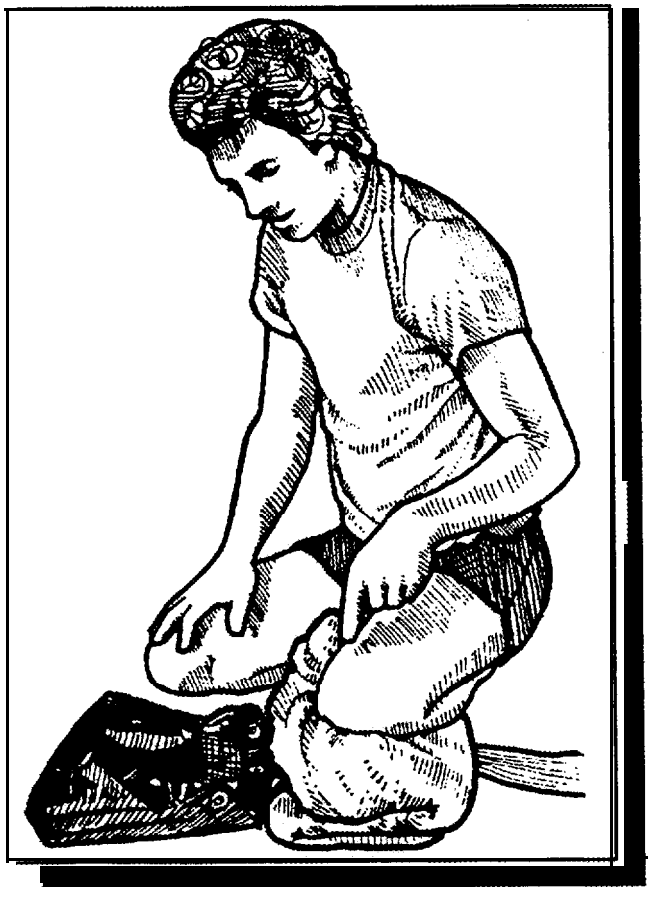


37. Now put one hand under the top of the bundle and make an S fold in the opposite direction, as shown.



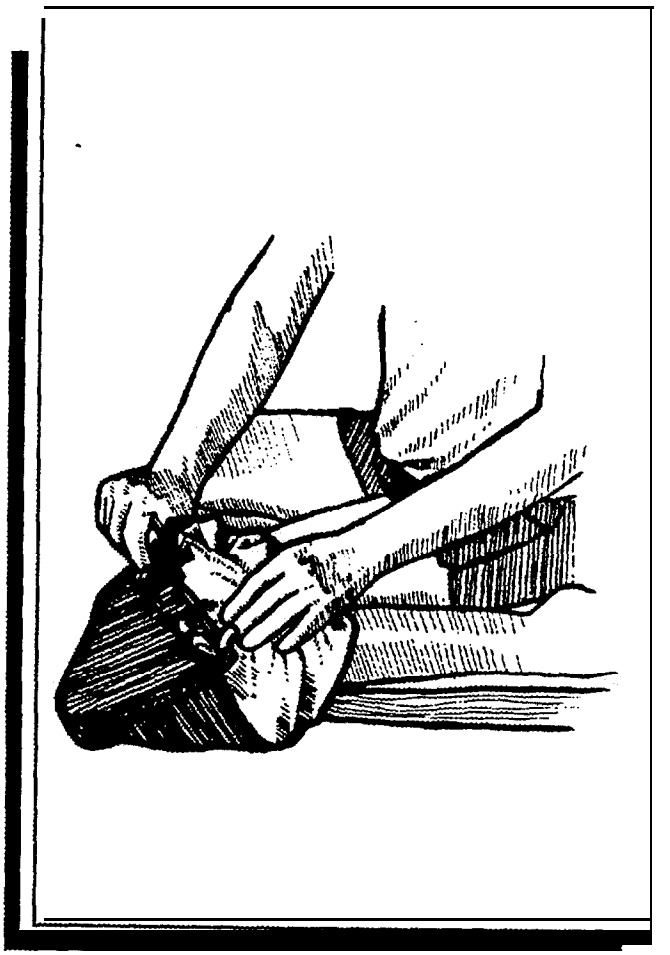


38. You should now have a neat, compact bundle. Try to make the folds so that the bundle ends up being just a little wider than the deployment bag.



39. Place your knee in the middle of the canopy to keep it together while you pull the bag over it.

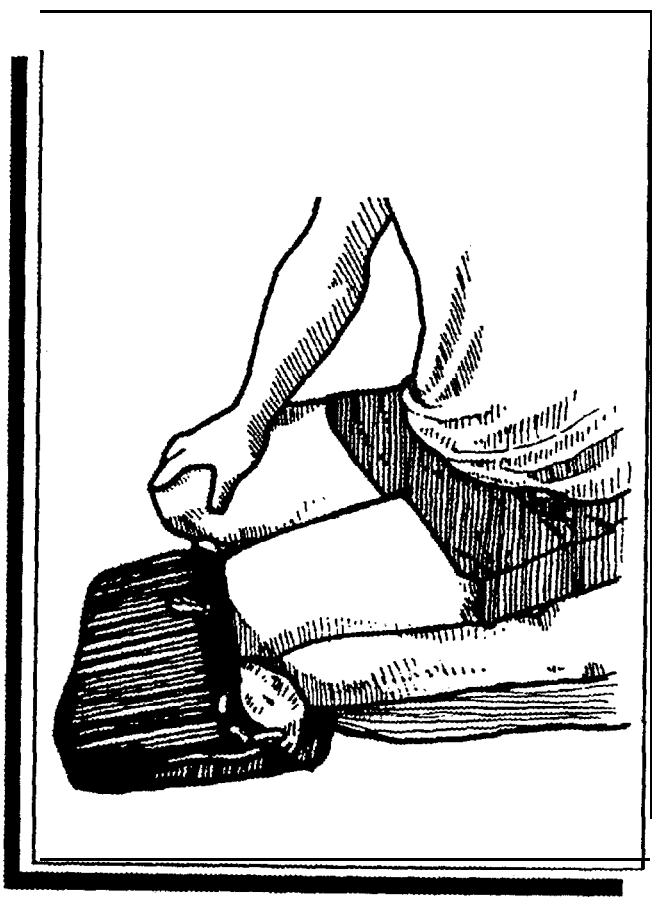
40. With your knee still in place, pull the bag over the canopy one side at a time. Hold the corner of the canopy bundle up while you pull the bag over it; then roll the canopy into the corner of the bag. This helps get the canopy firmly into the corners, making a neater pack job.



41. The whole canopy should be in the bag before you remove your knee.

Follow your harness/container manufacturer's instructions for closing the bag, stowing the lines, placing it in the pack tray and closing the Container.

It takes practice to pack bofh quickly and neatly. Every jumper has their own "system" to make the job easier, and you'll quickly develop one of your own.



Toggles and Control Line Information

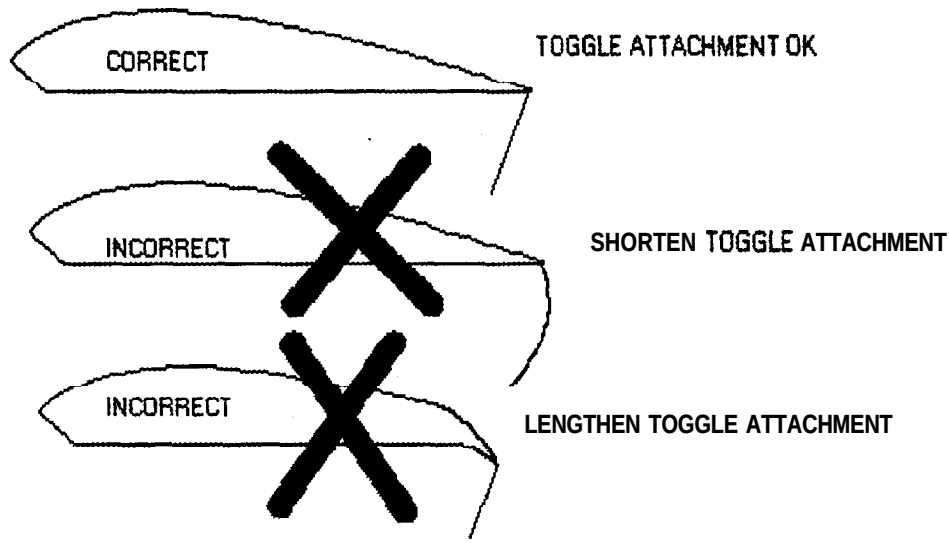
You should attach the toggles to the canopy control lines according to instructions provided by Precision and the manufacturer of the harness/ Container System. Marks are provided on the controi lines which indicate the proper attachment point for most Standard length risers.

Jhe toggles are properly installed if the control lines just become taut with the canopy in full forward drive. Jhe trailing edge should form a continuous line with the lower surface.

Don't Reposition the Toggles to Adjust Control Stroke!

Jhe toggles should be attached so the canopy trailing edge forms a continuous line with the lower surface and the control lines are just taut when the toggles are released, with the parachute in full glide. Do not use toggle location to adjust control travel. You will distort the airfoil shape and degrade flight Performance.

Canopy Side View, In Right With Toggles Released



Care

In addition to regular inspections of every detail on your Precision canopy, proper care requires you treat it carefully during everyday use. The fabric used in its construction is amazingly strong and lightweight--but will lose both strength and porosity if it suffers physical abuse. Any abrasion, fluid contact, extreme temperatures or exposure to sunlight will cause some degradation in its strength and/or porosity. Avoid subjecting your canopy to any of these conditions.

Icarus' Bane: Run from the Sun

The Sun warms us and feeds us and lights our way. Perhaps the negative effects of sunlight can best be recalled after an unintentional afternoon nap on a stark-white sandy beach. The same UltraViolet radiation that flogs the shoulders of a sleeping tourist seriously weakens everything it shines upon. One of the most effected materials is nylon.

In fact, according to Dan Poynter's *The Parachute Manual,* "Many sport parachutists pack outside in the sun. If we assume that their canopies are exposed 15 minutes each time, then after 280 jumps, the assembly has been in the sun the equivalent of seven IO-hour days which is probably enough to lower the strength 50%. And this does not include the 2 minutes per jump when the entire parachute is exposed."

Do not expose your canopy to the sun's harmful UV radiation any more than absolutely necessary--it will last longer and retain more of its strength when shielded from UV.

Keep it Up

It has been said that the only substance not harmful to a nylon canopy is air (specifically, dark air). One very bad habit is that of dragging the canopy from the landing spot to the packing mat. Don't be guilty of such careless treatment, because the penalty can be a severely reduced canopy life, as well as a possible loss of structural integrity due to the abrasion.

Always pick up the entire canopy and all the lines after landing, and carry them to a clean storage or packing area, away from sunlight. Protect the canopy from any contact, especially abrading or contaminating environments.

Keep it Dry

Precision recommends you never allow the canopy to get wet. Do not wash the canopy. Washing increases the fabric's porosity substantially, which can slow down openings and degrade Performance. Do not intentionally jump the canopy in the rain or into water.

If your canopy becomes soiled, you will have to decide whether washing or the presence of dirt is the most harmful. If you get the canopy wet, hang it to dry in a low-humidity area away from sunlight.

"The Trunk Ate My Canopy."

Be careful where you choose to store your canopy for long periods. Never store your gear where prolonged heat is a factor, such as the trunk of a car. Nylon is very unforgiving of high temperatures.

Maintenance

Preflight Inspection

Prior to packing the canopy, check the following items:

Bridle Attachment Point-Check the bridle attachment to the canopy, and check all seams and reinforcing tapes in the bridle attachment area.

Canopy-Free from holes, rips or snags. Check for broken stitch rows along the seams and on the tapes. All reinforcement tapes must remain well secured.

Slider Stops-Missing or damaged stops can trap the slider during deployment, and prevent it from traveling down the lines.

Links-Connector links must be secure and undamaged. It is important to check the links frequently. Do not overtighten the links, as overtightening could strip the threads and split the barrels.

Slider Bumpers--Check the bumpers to make sure they are properly secured with tacking thread (page 16). Missing or damaged bumpers may allow the inside of the slider grommets to rub against the links; when this occurs the grommets can develop abrasive inside edges which can weaken or cut through lines as the slider travels up and down.

Siider-Check the slider to make sure the grommets remain smooth and firmly in place within the reinforcement tape. Also watch for tears or picks in the fabric, broken stitch rows, and loose reinforcement tape.

Unes-Check the lines for areas which are frayed or "fuzzy." Pay special attention to the line attachment points (on the airfoil) and the link attachment points.

Control Line Locking Loops-The finger trapped brake-set loops deserve careful scrutiny for signs of wear. Watch for picks or snags in the line and loose or broken stitches in the bartacks.

Repairs

Small rips or tears in the open area of the canopy may be repaired in the normal manner. (See your rigger or loft.) For more extensive darnage or if you are in doubt, contact Precision.

Modifications

Owner modification of Precision canopies is not approved under any circumstances.

How to Contact u s

Precision is very proud of its products, and we place the highest priority on providing you with the very best of Service as the owner of a Precision ram air canopy. If you need to contact us for any reason, use the following procedure.

For Help:

1. Read this manual first. You may find the answer to your question.

2. If you have read the manual and still need to contact us for any information or with specific questions about your canopy, you will need:

a. The serial number and model of your canopy (see inside front cover)
b. The make, model and serial number of your harness Container system

3. Phone us at: (615) 949-4688. Tell the person answering that you are a canopy owner, and ask to speak to the Product Support Desk.

For Information:

For general information, phone us at: (615) 949-4666. Explain the nature of your question and you will be directed to the appropriate department.

To Order Parts and Equipment:

You may order Precision products from your nearest authorized Precision Aerodynamics dealer. Phone 1-800-222-3933 and ask for the name of the dealer nearest you.

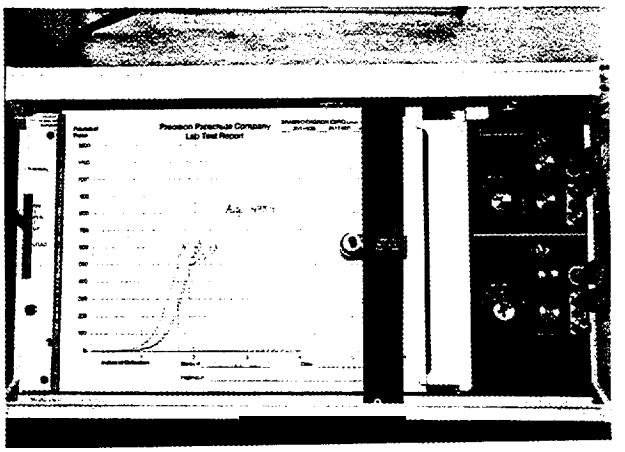
About Precision

Founded in 1982, Precision Parachute has built a reputation that lives up to our name, by providing the utmost quality in sport and military parachutes. Precision canopies are built one at a time, individually cut from specified materials which we test ourselves--every single lot of fabric, tape, webbing, thread, grommets, links, or rings. We test them all ourselves, and absolutely reject materials which do not meet our rigid Standards. Precision's lab now tests materials for most of the parachute industry, including our competition.

At Precision. we test the strength of wery bolt of fabric received from the mill. We measure porosity to verify resistance to airflow. Fabric is tested for thread count. tensile strength. elongation, weight, shrinkage, pH factor, heat and Ultra Violet resistance.

A Cut Above

After testing in our laboratory, fabric for each canopy is individually cut from precise Patterns, not Stack-folded and cut in mass quantities. The result is a more consistent construction phase, preserving the original airfoil and reducing built-in stress on the canopy.

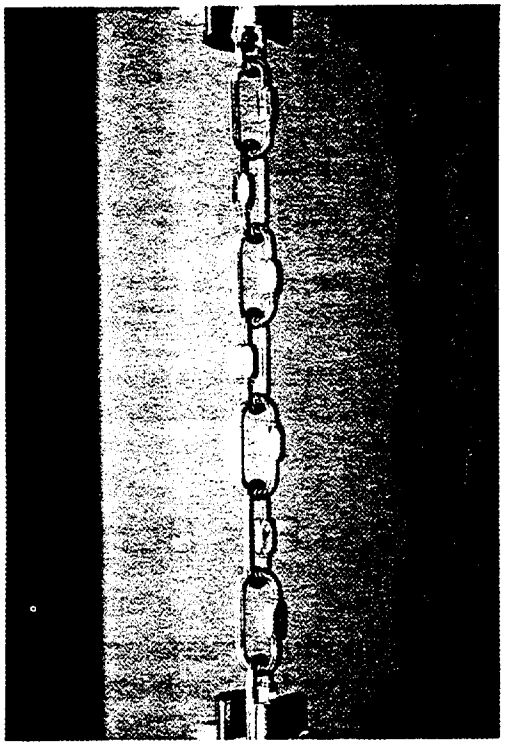


Color Choice

Since we cut each canopy component individually, there is little extra cost involved in furnishing custom colors. So we include a total choice of color schemes for every owner--at no additional charge.

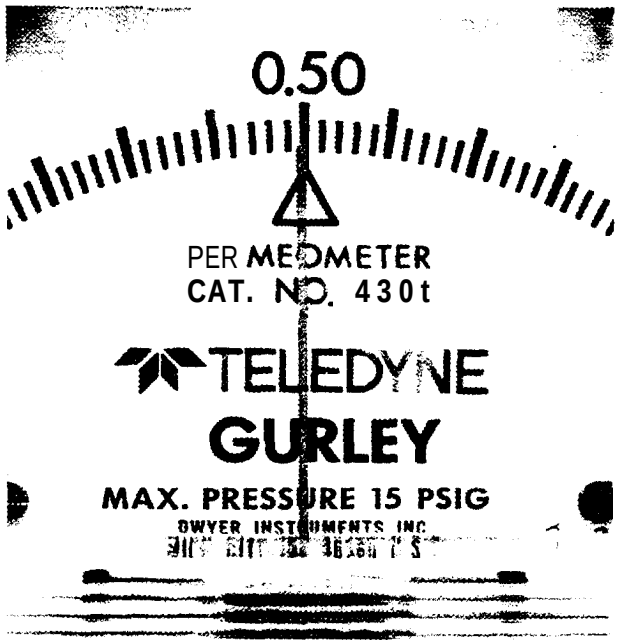
TSO

The FAA's Standard for certification of reserve parachutes is a rigorous test of a canopy's integrity and Performance (see page 57). Precision was the first manufacturer to certificate a canopy (the Raven) under the newer, tougher C-23c standard- It's our philosophy that a main



canopy, which sees constant use compared to a reserve, needs to be tested and certified to at least the same Standards as a reserve. So we believe in certificating each model, to provide further assurance that your canopy will last a long time and perform to your satisfaction. Even though federal law allows parachute manufacturers to build main canopies with none of the expense associated with reserve testing and certification,

FAA approved manufacturing procedures and recordkeeping methods are followed for all our products, whether they are TSOed or not.

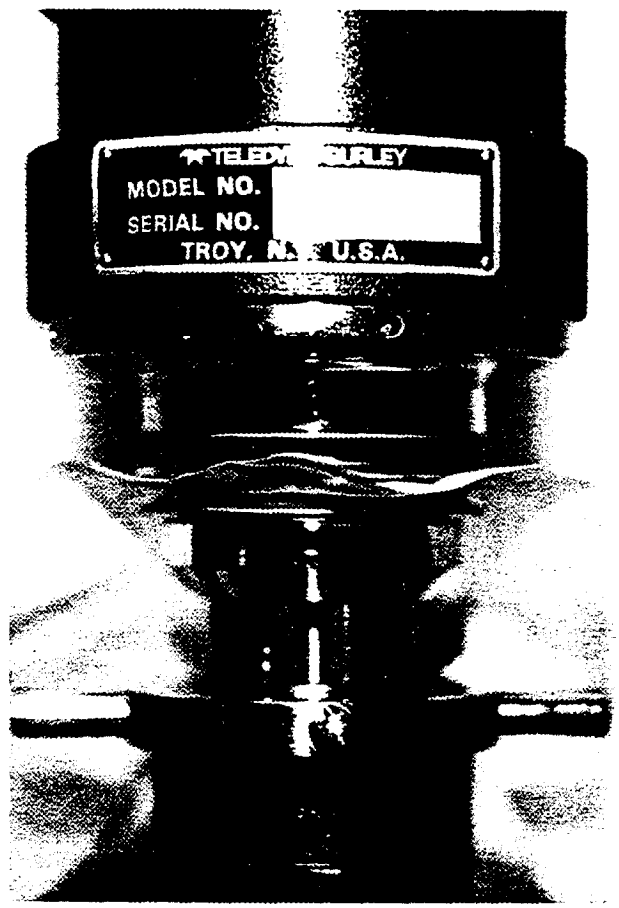


One Size Fits Some

Ram-air parachute manufacturers have long provided each canopy model in a single size. Other sizes were available in other models. Precision began by offering a wide range of choice in canopy size, which allows the jumper to select a canopy most suited for his or her own weight. Weight, we know, is the greatest factor affecting canopy Performance. Precision was the first manufacturer to offer a choice of sizes designed to "normalize" performance among jumpers of different weights.

Performance Gains

In developing the technology to accomplish these goals, we have also improved Overall construction methods. This has resulted in cleaner, more consistent canopy airfoils and reductions in stress between canopy components during use. Although it can be argued that the certification procedure adds to the cost of a canopy, our experience indicates the opposite is true. The greatest evidence of that is in comparing the price and Performance of our products with others.



Appendix A

FAR Part 105: Parachute Jumping

Current as/of May 1, 1988

Subpart A - General

105.1 Appiicabiiity.

(a) This Part prescribes rules governing parachute Jumps made in the United States except parachute Jumps necessary because of an in-flightemergency.

(b) For the purposes of this Part, a "parachute Jump" means the descent of a person, to the surfacefrom an alrcraft in flight. when he intends to use, or uses, a parachute during all or part of that descent.

Su bpart B - Operating Rules

105.11 Applicability.

(a) Except as provided in paragraphs (b) and (c) of this section, this subpart prescribes operating rules governing parachute jumps to which this Partappiies.

(b) This subpart does not apply to a parachute jump necessary to meet an emergency on the surface, when it is made at the direction, or wlth theapprovai, ofan agency ofthe United States, or ofa State, Puerto Rico, the District of Columbia, or a possession of the United States, or of a political subdivision of any of them.

(c) Sections 105.13 through 105.17 and paragraphs 105.27through 105.37 ofthis subpart do not appiy to a parachute Jump made by a member ofan Armed Force -

(1) Over or within a restricted area when that areaisunderthecontroi ofan Armed Force; or

(2) In military operations in uncontroiied airspace.

(d) Section 105.23 does not appiy to a parachute jump made by a member of an Armed Force within a restricted area that extends upward from the surface when that area is under the controi of an Armed Force.

105.13 General.

No person may make a parachute Jump, and no piiot in command of an aircraft may ailow a parachute jump to be made from that aircraft, if that jump creates a hazard to air traffic or to persons or propertyon thesurface.

105.14 Radio equlpmentand use requirements.

(a) Exceptwhen otherwise authorized by ATC-

(1) No person may make a parachute jump, and no piiot in command of an aircraft may allowa parachute jumpto bemadefromthat aircraft, in or Into controiied airspace uniess. duringthatflight-

(i) The aircraft ie equipped with a functioning two-way rad lo communications system appropriate totheATCfacilitiesused;

(ii) Radio communicationo have been established between the aircraft and the nearest FM Air Traffic Controi Faciiity or FM Fiight Service Station at least 5 minutes before the jumping activity is to begin, for the purpose of receivlng Information in the aircraft about known air trafflc in the vicinity of the jumpingactivity; and

(iii) The Information described in subdivision (ii) ha8 been received by thepilotIncommandandthejumpersin thatfiight; and

(2) The pilot in command of an aircraft used forany jumping activlty In or into controlled airspaceshall, duringeachflight-

(i) Maintain or have maintained a continuous watch on the appropriate frequency of the alrcraft's radio communications system from the tlme radio communicatlona are first established between the alrcraft and ATC. until he advlses ATC that the

jumping activity is ended from that filght: and

(ii) Advise ATC that the jumping activity is ended for that filght when the last parachute Jumper from the aircraft reaches the ground.

(b) If, during any fllght, the requlred radio communlcatlons system is or becomes inoperative, any jumping activity from the aircraft lnor lntocontrolled alrspace shall be abandoned. However, if the communlcations system becomes inoperattve in flight after receipt of a requlred ATC authorlzation, the jumping activtty fromthatflightmaybecontlnued.

105.15 Jumps over or into congested areas or openalrassemblyofpemons.

(a) No person may make a parachute jump, and no pilot in command of an aircraft may aiiow a parachute jump to be made from that aircraft. over or into a congested area of a city, town, or settlement, or an open air assembly of person8 uniess a certiflcate of authorlzation for that Jump has been issued under thls section. However, a parachutist maydrift overthat congested area or open alr assembiy with a fuiiy depioyed and properly functlonlng parachute if he is at a sufflcient altitude to avoid creatlng a hazard to pemonsand property on the ground.

(b) An appiicatlon for a certlficate of authorizatlon issued under this section lsmade in a form and in a manner prescribed by the Adminlstratorand must be submitted, to the FAA District Office having jurisdiction over the area in which the parachute Jump is tobe made, at least four days before the day of that jump.

(c) Each holder of a certificate of authorization lssued under this section shali present that certiflcate for lnspection upon the request of ths Admlnlstrator, or any Federal, State or locai offlcial.

105.17 Jumpsoverorontoairports.

Uniess prior approvai has been given by the airport management, no person may make a parachute Jump, and no pilot in command of an aircraft mayaiiow a parachute jump to be made fromthat aircraft-

(a) Over an airport that does not have a functloning controi toweroperated by the United States; or

(b) Ontoanyairport.

However, a parachutist maydrift over that airport with a fuliy depioyed and properly functlonlng parachute if he is at least 2.000 feet above that airport's trafflc pattern, and avoids creatlng a hazard to air traffic or to persons and property on the ground.

105.19 Jumps in or into controi zones wlth functloning control towers operated by the United States.

(a) No person may make a parachute jump, and no pilot in command may allow a parachute jump to be made from that aircraft, in or into a control zoneinwhichtherelsafunctionlngcontrol tower operated by the United States without, or in vidation of the terms of, an authorization lssued underthis section.

(b) Each request for an authorizatlon under this sedion must be submltted to ths controi tower having jurisdictlon over the control zone concerned and must inciude the lnformation prescribed In 105.25.

105.21 Jumps in or into positive controi areas.

(a) No person may make a parachute Jump, and no piiot in command of an aircraft may allow a patachute jumpto be madefrom thataircraft, In or Into a positive controi area without, or in vlolatlon of, an authorlzatlon lssued under thls section.

(b) Each request for an authorization issued under thls section must be submltted to the nearest FM Alr Traffic Control Faciiity or FM Flight Service Station and must inciude the lnformation prescribed In paragraph 105.25(a).

105.23 Jumps in or into other alrspace.

(a) No person may make a parachute Jump, and no pliot in command of an aircraft may aiiow a parachute Jump to be made from that aircraft, in or into alrspace uniess the nearest FAA Air Trafflc Control Faciiity or FM Flight Service Station was notified of that Jump at least 1 hour before the jump isto be made, but not more than 24 houm before the jumping is tobe compieted, and the notice contained the Information prescribed In Paragraph 105.25(a).

(b) Notwlthstanding paragraph (a) of this section, ATC may accept from a parachute jumping organization a wrltten notification of a scheduied series of jumps to be made over a stated period oftime not iongerthan 12 calendar months. The notification must contain the informatlon prescribed by paragraph 105.25(a), identify the responsibie persons assoclated wlth that jumping activity, and be submitted at least 15 days. but not more than 30 days, before the jumping is to begin; ATC may revoke the acceptance of the notlflcatlon for any faiiure of the jumping organization to compiy with its terms.

(c) This sectlon does not appiy to parachute

jumps in or into any airspace or place described in Paragraphs 105.15.105.1 9, or 105.21.

105.25 Information required, and notice of canceiiation or postponement of Jump.

(a) Each person requesting an authorizatlon under paragraph 105.10 or 105.21, and each person submitting a notice under paragraph 105.23, must inciude the foliowing Information (on an individual or group basis) in that request or notice:

(1) Thedateand time jumping will begin.

(2) The size of the Jump zone expressed in nautical mile radius around the target.

(3) The iocatlon of the center of the Jump zone in relation to -

(I) The nearest VOR facility in terms of the VOR radial on which it is located and its distance in nautical miles from theVORfacliltywhenthatfacliityis30 nauticai miles or less from the drop zone target; or

(II) The nearest airport, town or city depicted on the appropriate Coast and Geodetic Survey WAC or Sectionai Aeronautlcai Chart, when the nearest VOR facliity is more than 30 nautical miles from the drop zone target.

(4) Theaititudesabovethesurfaceatwhich Jumpingwiiitake place.

(5) The tlme and duration of the intended jumping.

(8) The name, address, and telephone number of the person requesting the authorization orgiving notice.

(7) The identlflcation of the aircraft to be used.

(3) The radio frequencies, ff any, avaiiabie in the aircraft.

(b) Each person requesting an authorizatlon under paragraph 105.19 or 105.21. and each person submitting a notlce under paragraph 105.23. must promptiy notify the FAA Air Traffic Controi Faciiity or FM Fiight Service Statlon from which It requested authorization orwhich it notified, if the proposed or scheduled jumping actlvlty is cancelled or postponed.

105.27 Jumps over or within restricted or prohiblted areas.

No person may makea parachute Jump, and no pilot in command may allow a parachute Jump to be made from that aircraft, over or wlthln a restricted area or prohibitad area unless the controlling agency of the area concemed has authorlred that jump.

105.29 Flight visibility and clearance from clouds requirements.

No person may make a parachute Jump, and no pilot in command of an aircraft may aliow a parachute jump to be made from that aircraft -

(a) intoorthroughacloud; or

(b) When the flight visibility is less, or at a distance from douds that is less, than that prescribed In thefoiiowingtabie:

Altitude	Flight Visibility	Distance from Clouds
1,200 feet or less above the surface regardless of the MSL altitude.	3 statute miles	500 feet below 1,000 feet above 2,000 feet hprizontal
Hore than 1,200 feet above the surface but less than 10,000 feet MSL	3 statute miles	500 feet below 1.000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface and at or above 10.000 feet MSL	5 statute miles	1.000 feet below 1,000 feet above 1 mile horizontal

105.31 [Deleted]

105.33 Parachute jumps at night.

(a) No person may make a parachute Jump, and no pilot In command of an aircraft may ailow any person to make a parachute Jump from that aircraft, at night, uni888 that person is equipped with a means of producing a light visible for at least three miles.

(b) Each person making a parachute Jump at night shall dispiay the iight required by paragraph (a) of this section from the time hls canopyopens untii he reaches the surface.

105.35 Liquorand drugs.

No person may make a parachute jump while, and no pliot in command of an aircraft may aiiow a person to make a parachute Jump from that aircraft ifthat person appears to be, -

(a) Under the influence of intoxicating liquor; or

(b) Using any drug that affects his faculties in any way contrary to safety.

105.37 Inspections.

The Administrator may Inspect (Including inspections at the Jump site) anyparachute Jump operation to which this Part applies, to determine compliance with the regulations of this Part.

Subpart C - Parachute Equipment

105.41 Appiicabliity.

(a) **Except as** provided in paragraph (b) of **this** section, **this subpart prescribes rules governing** parachute equipment **used** in parachute Jumps towhlchthisPartapplie8.

(b) **This subparagraph does** not appiy to a parachute Jump made by a member of an Armed **Force using** parachute equipment of an Armed **Force.**

105.43 Parachute equipment and **packing requirements.**

(a) No **person** maymake a parachute Jump. and no **pliot** in command ofan **aircraft** mayaliow any person to make a parachute Jump from that **aircraft, unless** that person **is** wearing a **single harnessdual** parachute pack, **havingatleastone** maln parachute and one approved **auxiliary** parachute thatare **packed asfollows:**

(1) The main parachute **must** have been **packed** bya certlficated parachute **rigger,** or by the person maklng the Jump, wlthin 120 **days** before the date of it8 **use.**

(2) The auxiiiary parachute must have been **packed** bya certificated and appropriateiy rated parachute rigqerwithin 120 days **before thedateofitsuse.**

(b) **Nopersonmaymakeaparachutejumpusing** a **static line** attached to theaircraft and the main parachute **unless** an assist **device, described** and attached as foiiows, is **used** to aid the **pilot** chute in **performing** its **function,** or. if no piiot chute **is used,** to aid **in** the **direct deployment** of the main parachute canopy.

(1) **Theassistdevicemustbelongenoughto** aiiowthe **containerto** open beforea ioad is piaced on thedevice.

(2) The assist **devicemust have a static** ioad strength **of-**

(I) At least 28 **pounds** but not more than 160 **pounds, if** it **is used** to ald the piiot chute inperforming itsfunction; or

(ii) At least 56 **pounds** but not more than 320 **pounds, if** it **is used** to **aid** in the **di**rectdepioyment **ofthe** main parachute canopy.

(3) **Theassistdevice must** beattached -

(I) At one end, to **thestaticline** abovethe **static** iine **pins,** if **static pins** are not **used,** above the **static line ties** to the parachutecone; and

(ii) At the other end, to the piiot chute **apex,** bridiecordorbridleioop. or, ifno piiot chute la **used,** to the main **parachutecanopy.**

(c) No person may attach an **assist device re**quired by paragraph (b) of **this** section to any main parachute uniess he hae a **current para**chute **rigger certificate issued under** Part **65** of **this chapter or is the person who makes the jump** with that parachute.

(d) For the **purposes** of this section. an **"approved"** parachute **is-**

(1) **A** parachute manufactured **under** a type certificateoratechnicaistandard **order (C-**23 **series);** or

(2) **A personnel-carrying military** parachute (other than a high aititude, high-speed, or **ejection** kind) identified byan **NAF,** MF, or **AN drawing number, an AAF order number, or any military designation or specification number.**

TSO-C23c Performance Standards

Current as/of May 1, 1988

Aerospace Standard 8015A
Issued by:
Society of Automotive Engineers, Inc.
400 Commonwealth Avenue
Warrendale. PA 15096

AS 8015-A • Minimum Performance Standard for Parachute Assemblies and Components, Personnel.

This specification defines the minimum Performance Standards for personnel parachute assemblies to be carried in aircraft or worn by parachutists for emergency use.

1. Scope: 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: QO kg (198 lb) '130 knots.

1.2.2 Category 6: 115 kg (254 lb) /150 knots.

1.2.3 Category C: 115 kg (254 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 premaditated jumps.

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 a premeditated jump.

2.3 Tandem 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 purpose 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 workmanships 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 degrees to + 93.3 degrees C (-40 degrees to + 200 degrees 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., with 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 so 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's name and address
-Date of manufacture and/or serial number
-FAA TSO-C23c
-Category A. 6. or 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 lost but will be readily accessible.

4.2.2 Canopy: In addition to the above information, the canopy marking 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 tests 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 kom 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 function the actuation device without any undue difficulty while in a suspended harness. The ripcord or equivalent shall be sealed for these tests.

4.3.2.2 Pull Test: A load AT THE RIPCORD HANDLE of not less than 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 ehest-type parachute assemblies. the maximum pull 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 degrees C (+200 degrees 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 degrees C (-40 degrees 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 attenuate shock loads and is not an integral part of the parachute assembly or component being certified 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 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 made with only one attachment engaged to test the cross connector and hardware.

4.3.4.2 Canopy (Alten-rate 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. 6. 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 air speed at the time of release shall be 60 knots. Three twists (360 degrees 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 time of pack release.

4.3.6 Functional Test (Normal Pack): There shall be a minimum of 46 drops from an aircraft with a 77 kg (170 lb) dummy or person. The indicated air speed 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 the breakaway. The parachute canopy must be fully open within three seconds from time of pack release. These tests may be live jumps by a 77 kg (170 lb) (min) individual except that at least two dummy drops shall be made at 66.85. 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 6.4m (21 ft) per second for the last 30m (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 30m (98 ft) from the time of ground impact of the weight to ground impact of the dummy. The oscillation shall not exceed 15 degrees 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 free fall of not more than three seconds and two drops shall include a free fall 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 the 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 Qualitication:

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 Section 4.3 when tested in conjunction with the assembly or component(s) being certified.

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

Table 1

Category A, B, or C Schedule

Category A Test: 136 kg (300 ib) at 150 knots. **Placard: Category A: This parachute is limited to use by persons up to 90 kg (198 Ib) fully equipped, and up to 130 knots.**
Category B Test: 136 kg (300 lb) at 175 knots. **Placard: Category B: This parachute is limited to use by persons up to 115 kg (254 Ib) fully equipped, and up to 150 knots.**
Category C Test: 136 kg (300 lb) at 230 knots. **Placard: Category C: This parachute is limited to use by persons up to 115 kg (254 Ib) fully equipped, and up to 175 knots.**

Speeds are given in keas, and are intended to be at pack opening.

Precision Parachute
Trouble Report Form

serial # _____ QC-8

PHOTOCOPY FORM, PRINT LEGIBLY OR TYPE, AND MAIL TO:
Precision Parachute, Highway 127 North, Dunlap, TN 37327

Description of malfunction or defect _____

_____

_____

_____

_____

_____

Extent of darnage _____

_____

_____

_____

_____

User's name _____
Address _____ Teiephone _____
City _____ State _____ Zip _____

Date _____ Signature _____

for office use:

Date received _____ by _____

MRB Date _____ by _____

Disposition _____

_____

_____

_____

Signed by Engineering _____ Date
Signed by Production _____ Date
Signed by Quality Control _____ Date

RAVEN

OWNER'S MANUAL

PRECISIONPARACHUTECOMPANY
P.O. Box 691
Dunlap, Tennessee 37327
(615) 949-4688

S/N 463033
DOM N O V - 1986

FAA TSO-C23c CATEGORY B:
THIS PARACHUTE IS LIMITED TO USE BY PERSONS UP TO 115kg (254LB) FULLY EQUIPPED, AND UP TO 150 KNOTS.

WARNXNG !

The Raven canopy is designed for high Performance, maxiizing speed and glide ratii. At higher canopy loadings (of more than about .78 pounds per square foot, the canopy will exhibit a rapid turn tendency if the toggles are depressed too rapidly, or too rar.

At lower wing loadings, the canopy will be more docile. Be sure to select the canopy you will jump based on loading (canopy area divided by the total suspended ueight. If you and your rig weigh 200 pounds, a loading of .78 would be achieved with slightly more than 250 square feet [Raven 3 or 4].)

Precision Parachute Company
P.O. Box 691
Dunlap, TN 37327
(615) 949-4688

Manufactures of Quality Deceleration & Recovery Systems

1 NOVEMBER 1983

PARACHUTE CONSTRUCTION AND PERFORMANCE SPECIFICATIONS

RAVEN SERIES

	RAVEN 1	RAVEN 2	RAVEN 3	RAVEN 4
SURFACE AREA	181 ft^2	218 ft^2	249 ft^2	282 ft^2
WEIGHT	5.8 lbs	6.5 lbs	7.2 lbs	7.9 lbs
FABRIC	1.102 0-3 cfm	1.1 oz 0-3 cfm	1.1 02 0-3 cfm	1.1 oz 0-3 cfm
WING SPAN	19.8 ft	21.6 ft	23.2 ft	24.8 ft
WING CHORD	8.8 ft	9.6 ft	10.3 ft	11.0 ft
ASPECT RATIO	2.25:1	2.25:1	2.25:1	2.25:1
MAX SUSP WT	166 lbs	198 lbs	229 lbs	261 lbs
TYPE CONSTRUCTION	1 Beam	I Beam	I Beam	I Beam
LIFT/DRAG RATIO	4:1	4:1	4:1	4:1
PACK VOLUME	412 in^3	454 in^3	564 in^3	646 in^3
SUSP LINES	525 Dacron	525 Dacron	525 Dacron	525 Dacron
REEFING SYSTEM	Slider	Slider	Slider	Slider
DEPLOYMENT DEVICE	Bag	Bag	Bag	Bag
FORWARD SPEED	25-30 mph	25-30 mph	25-30 mph	25-30 mph
CROSS PORTING	STD	STD	STD	STD
PACKING TABS	STD	STD	STD	STD
CONTINUOUS LINES	STD	STD	STD	STD
CUSTOM COLORS	STD	STD	STD	STD

DISCLAIMER

0.0.0.1 DISCLAIMER

Precision Parachute makes no warranty of any kind as to the fitness or suitability **for any purpose of the RAVEN canopy. Precision Parachute Company also disclaims any liabiiity in tort for damages, direct or consequential, including personal injuries, resulting from a malfunction or** normal use or from **defect in design, material, workmanship or manufacture whether caused by negligence on the part of Precision Parachute Company or otherwise. By using Precision Parachute's products or allowing them to be used by others, buyer and user waives any liability of the manufacturer for personal injuries or other damages arising from its use.**

Chapter 1

Flying the Raven Ram-air Canopy

1.1 DEPLOYMENT

1.1.0.1 Level deployment

Many square canopy malfunctions are caused by deployment in an improper attitude, as when the shoulders are not le l with the horizon or the jumper is not in control during deplo ymen t. **Initiate** your deployment with enough time to ensure a controlled posture as the canopy is extracted.

If you are not qualified to pilot this canopy, get qualified. Then return to this text and resume reading.

1.1.0.2 Canopy check

After deployment is complete, check the canopy by:

1. looking overhead for evidence that all cells are not fully inflated.

2. Check the routing of Suspension lines and the position and condition of the slider .

3. Check that the canopy is flying straight with no tendency to turn.

1.1.0.3 Releasing the Brakes

The brakes are released after the canopy check is complete.

1. Look at both steering toggles on the back of the rear fisefs.

2. Grasp the toggles firmly, and pull down positively on both at the same time until you feel both brake stows release.

3. Hold equal tension on the steering toggles and slowly allow them to retract up against the stops.

4. Check again that the canopy is flying straight with no steering input required.

1.2 PLANNING THE APPROACH

1.2.0.1 The Importance of Beginning Early

The ram-air sport parachuting canopy is truly a low-Performance glider. With its mobility, controllability and speed it represents a great improvement over traditional "drag–only" devices such as the conventional round canopy. But like a glider pilot, we are charged with one immutable law – you only get one chance at every landing. The m consistent success can be acheived only by carefully planning our approaches and allowing for changing conditions during the approach. Approach planning should begin the moment the canopy is flying properly.

1.2.0.2 Turns and Speed

The ram-air canopy achieves its Performance through the ability to change the canopy's angle of attack. The ram-air pilot thus controls the speed (and therefore the glide angle and sink rate) of his canopy by changing its angle of attack.

When the steering toggles (or “brakes”, as they are commonly called) are fully retracted ("up"), the canopy flies at its minimum angle of attack – producing maximum speed, maximum sink rate and maximum gliding distance. We don't really want to land the canopy under these conditions, but in order to achieve maximum Performance we must understand and be able to use the energy of the canopy differently at different times during each flight.

1.2.0.3 Fast and Slow Flying

The range of speed control goes from full glide to STALL. The greatest sink rate will occur at full glide. The most hazardous flying is that done close to the STALL. A Stall is produced when the steering lines are pulled far enough to incease the canopy's angle of attack beyond the point at which the smooth fiow of air is interrupted and the canopy deflates.

Stall recovery is accomplished by SLOWLY releasing the steering lines to allow the canopy to return to normal flying attitude. If recovery is not allowed, and the steering lines are kept extended, the canopy and jumper will begin a new descent without benefit of lift.

The middle of the road between full-glide Performance and the stall is a much more forgiving range as far as the canopy is concerned. The canopy will not glide as far at moderate

angles of attack (often called "half-brakes") as it will full–glide, but the sink rate is close to the minimum, and a decent "landing" can be accomplished at this speed and sink rate.

"Half-brakes" is acheived with the steering lines pulled about halfway down, at shoulder level or slightly below. This is the flight attitude to maintain in bumpy air or at any time you are unsure of conditions in the air or on the ground during landing.

1.2.0.4 Turning

Our ability to turn the ram-air canopy safely is limited by the altitude available to perform the turn; there must always be enough altitude. But the penalty for steep or sudden turns is always degraded Performance. Many ram-air pilots are injured seriously due to turns performed too close to the ground. We should make it a rufe never to turn more than gently (for the sake of small corrections) when we are less than 200 or 300 feet from the ground.

Turns are possible at any gliding speed, and those made at full glide will produce the greatest degradation of perf ormance. Those performed at lower speeds will result in slower turns as well as less of an increase in sink rate.

If we follow good practice, every approach should end where the landing phase begins – at about 100 feet of altitude, lined up with the landing target flying into the wind, flying at half-brakes. Flying at half-brakes will allow us to make corrections to either increase or decrease our glide. DO NOT allow yourself to get into DEEP brakes while trying to arrest a glide.

WARNING !.

A STALL AT LOW ALTITUDES IS POSSIBLY THE MOST HAZARDOUS CONDITION FOR THE RAM-AIR PILOT.

If an approach is properly planned, it will allow the pilot to return to full glide at no less than 30-40 feet and perform a graceful flare, arresting forward speed and sink rate simultaneously, arriving at touchdown with (ideally) no speed and no sink rate.

1.3 Landing

The landing of a ram-air canopy is no different from any landing in a heavier–than–air craft – it consists of arriving at the landing site with a good glide speed, and carefully coordinating an increase in angle of attack (called in this instance the FLARE) to arrest sink rate. A perfect landing results when the canopy stalls at the moment the pilot touches . the ground. Depending on Windspeed, the landing could be accomplished at zero forward speed or at 10 mph. With the average pilot and canopy combination, a flare should

be begun at about 10 feet of altitude when the windspt . i zero. Normally, the higher the Windspeed the longer you ca wait to begin a flare. Good technique here will result onl from consistent practice.

1.4 Landing at half-brakes

For the inexperienced ram-air pilot, or for experience pilots either impaired or subjected to harsh conditions, th landing can be accomplished at half-brakes. Choose th landing area and line up into the wind. Hold the brak setting through the landing, and perform a parachute landin fall (PLF) as you would for a round canopy. Do not att p the last-minute flare, and DO NOT release the brakes durin the approach at any time.

Chapter 2

Packing the Raven Canopy

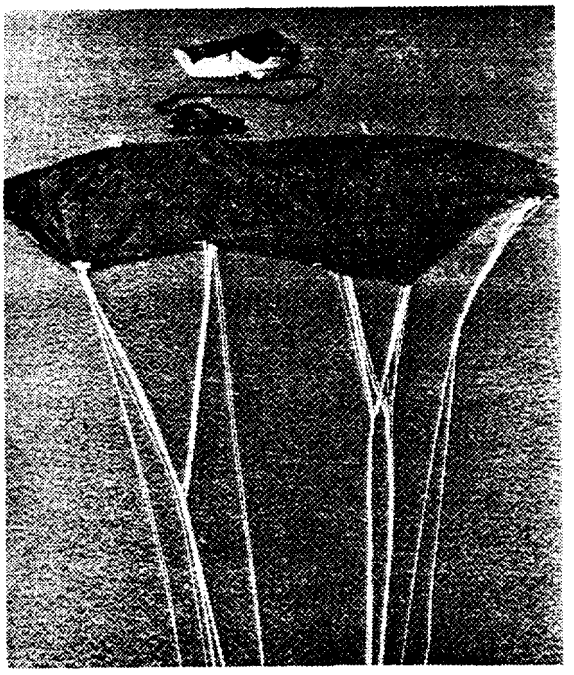
2.1 WARNING !

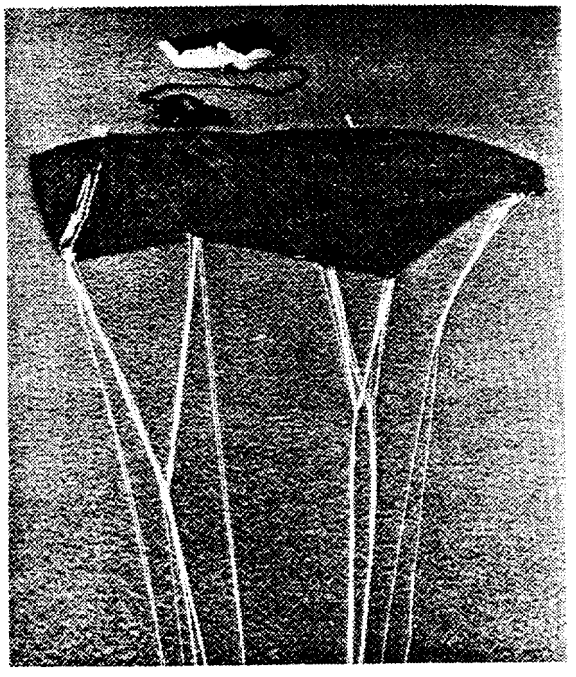
The Raven ram-air canopy is shipped uninstalled. It is the owner's responsibility to have it installed on the harness/container system by a qualified rigger, and to ascertain that the canopy is correctly installed and oriented according to the instructions of the harness manufacturer. This manual assumes proper installation and orientation has been completed.

ALL SQUARES CAN BE PACKED BACKWARD.

The factory recommends BAG DEPLOYMENT. This canopy has not been tested for other than BAG DEPLOYMENT.

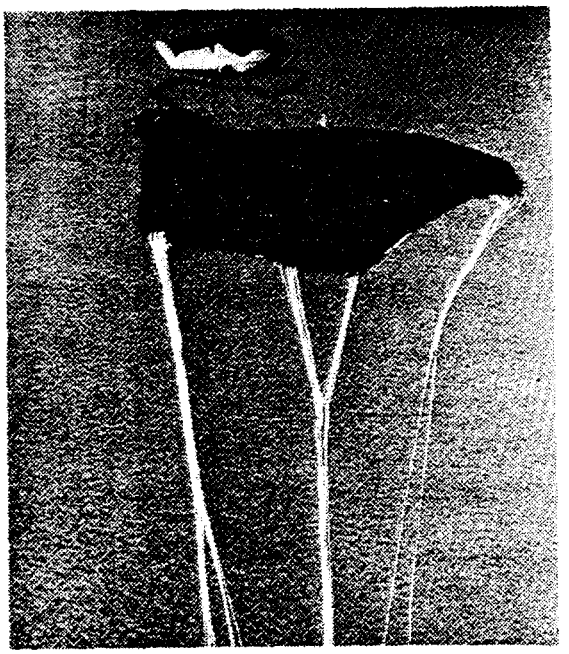
2.2 **Packing** Steps

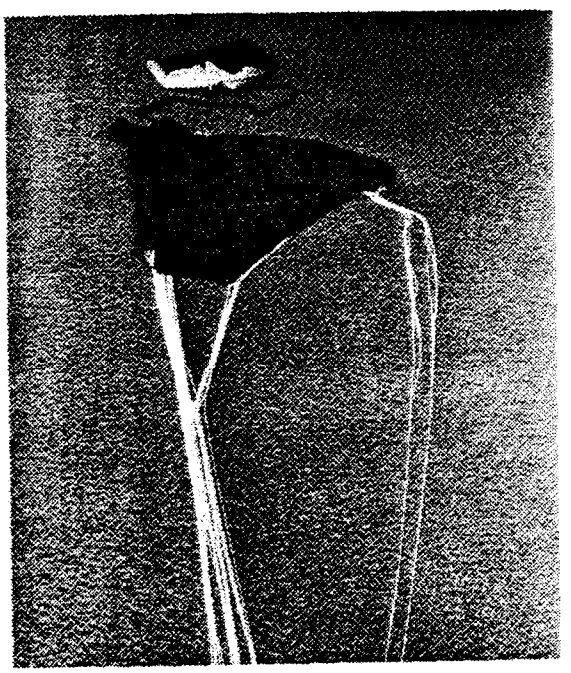


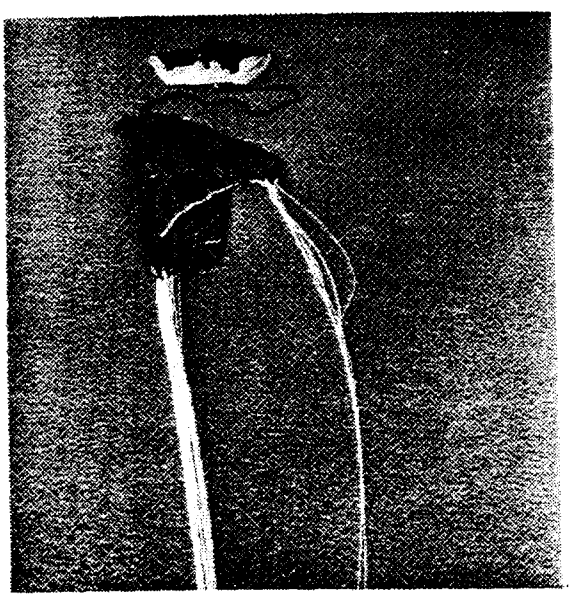


1. **Orient the canopy on its side as shown with nose left and the slider down. Flake the canopy by grasping the lower front and lower rear packing tabs and pulling the associated line group taut. Repeat for each cell un til all seven are pleated or "flaked" and all line groups are taut and stacked upon one another. Check the line orientation and the orientation of canopy to harness.**

2. **Fold the nose back as shown.**





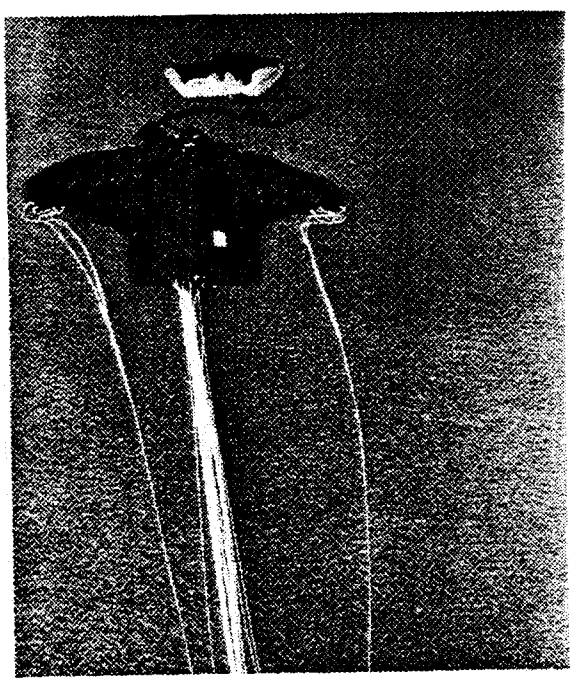


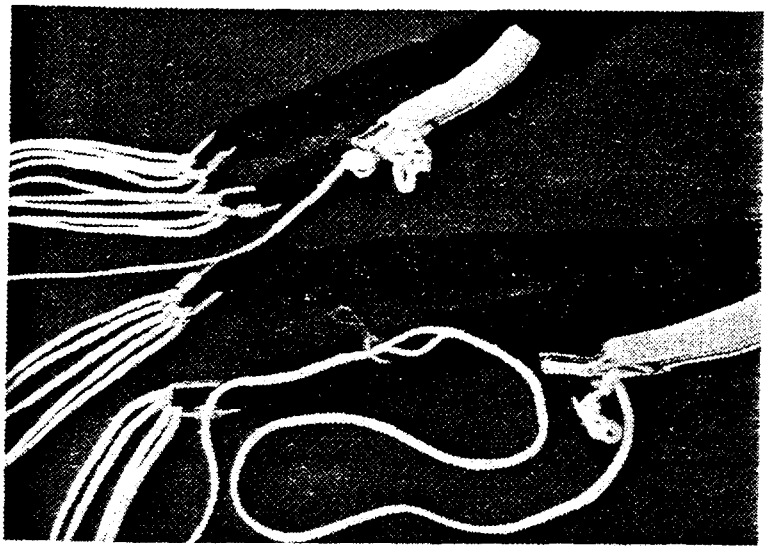
3. Grasp the canopy above "B" lines and stack "B" lines on top of "A" lines

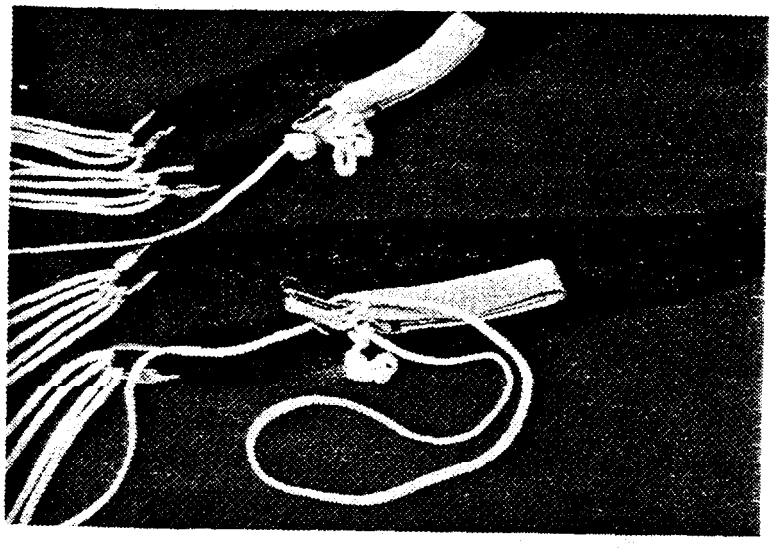
4. Grasp the "C" lines and stack them on top of the A - B stack.

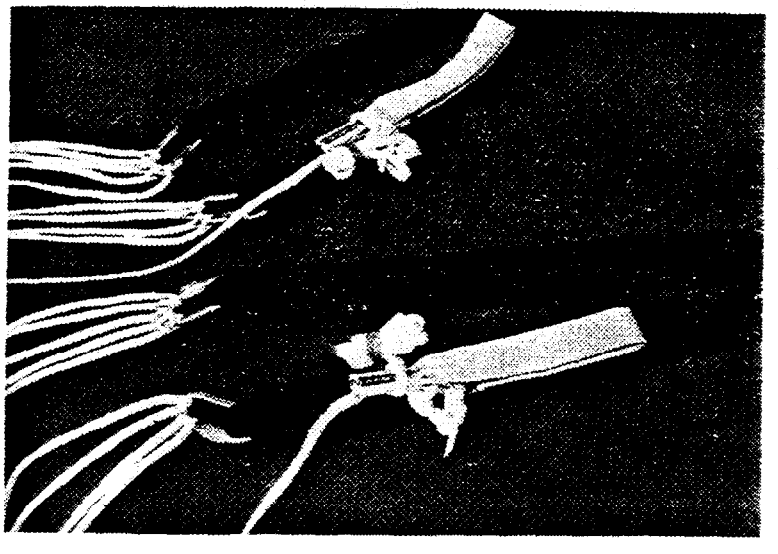
5. Stack "D" lines on top of the A-B-C stack

6. Split the tail as shown so the left and right control line group are on either side of the center cell.







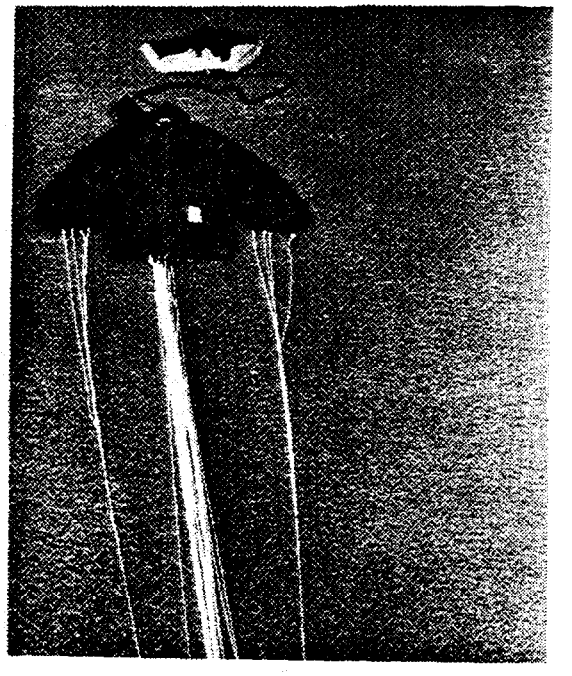


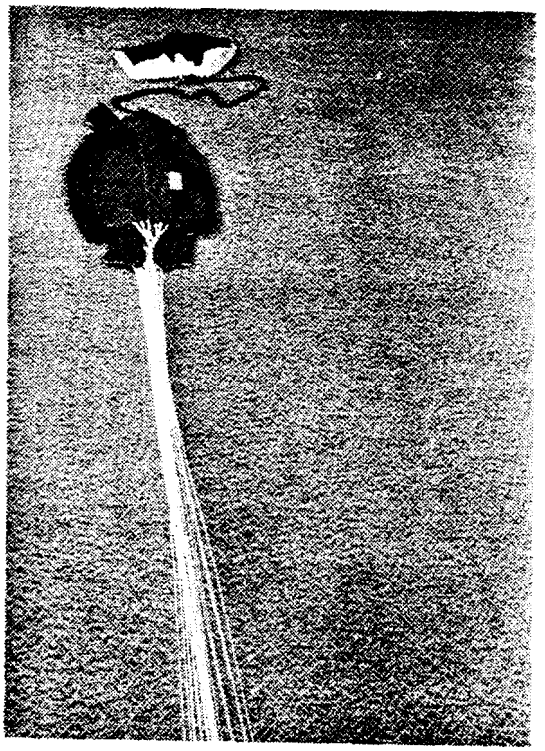
7. Set the brakes. Brake setting technique will vary according to the harness/container system. These photos show the Relative Workshop type system with one brake stowed, one unstowed.

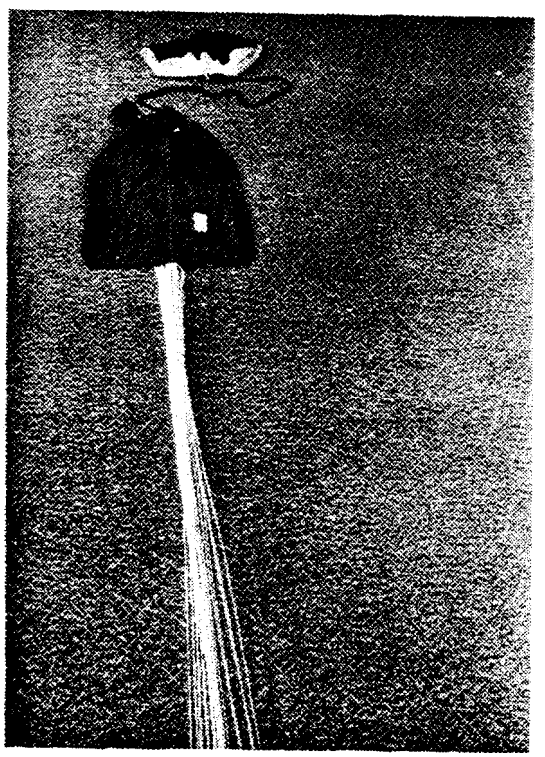
8. (Continued)

9. (Continued)

10. This photo shows the tail split after the brakes have been set.

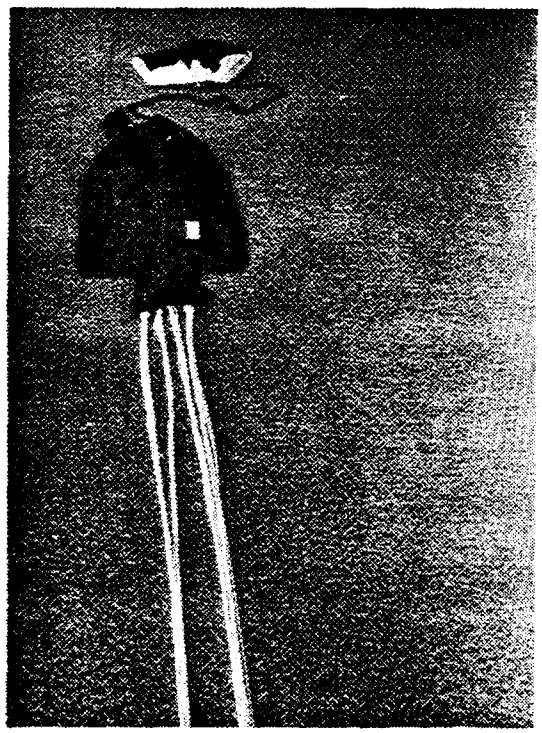


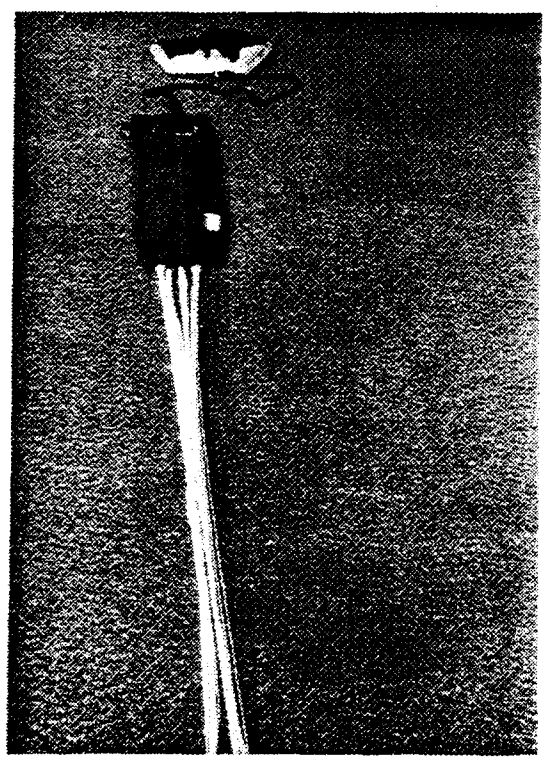




11. Flake the tail.

12. Pull down the center cell of the tail to cover the canopy as shown.



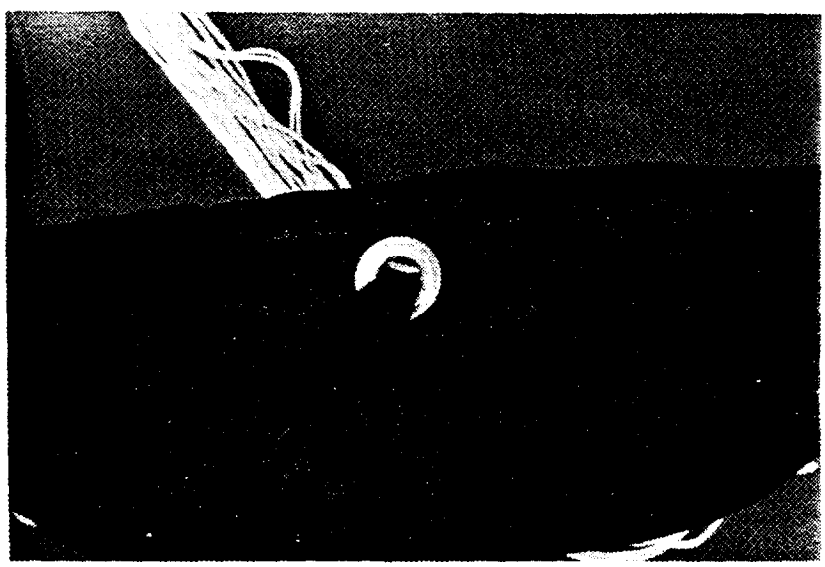


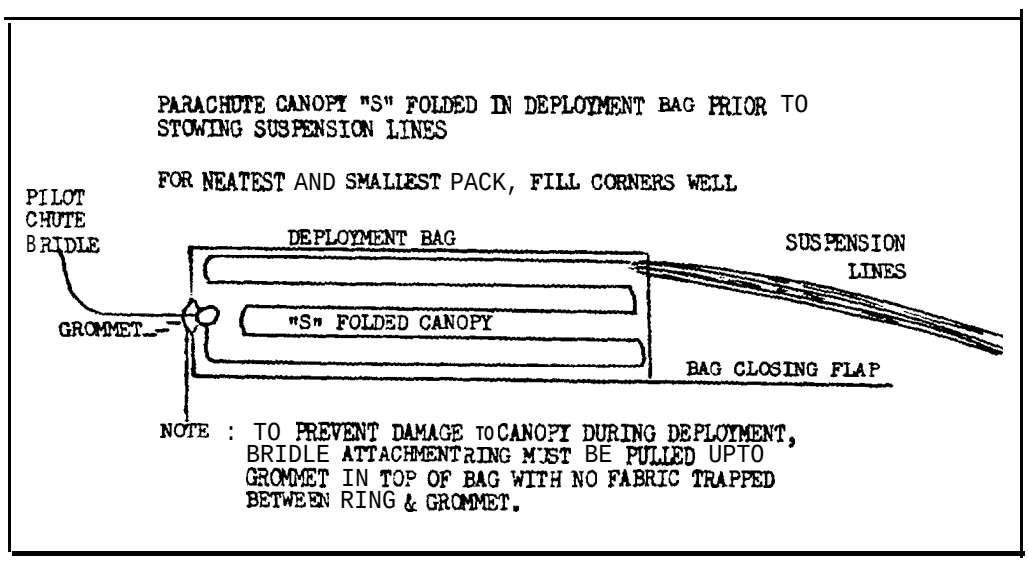
13. Pull up the slider.

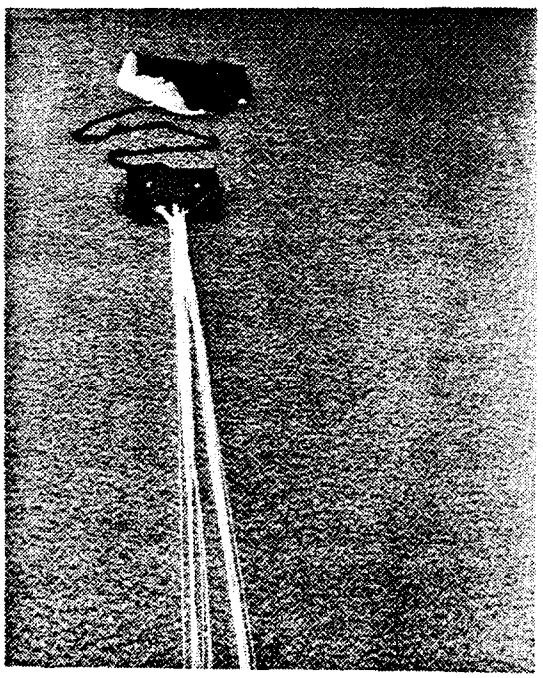
14. Tunnel the canopy (dress to the width of the deployment bag, with the slider UNDER the tail.) Pull the bag down over the top of the canopy.

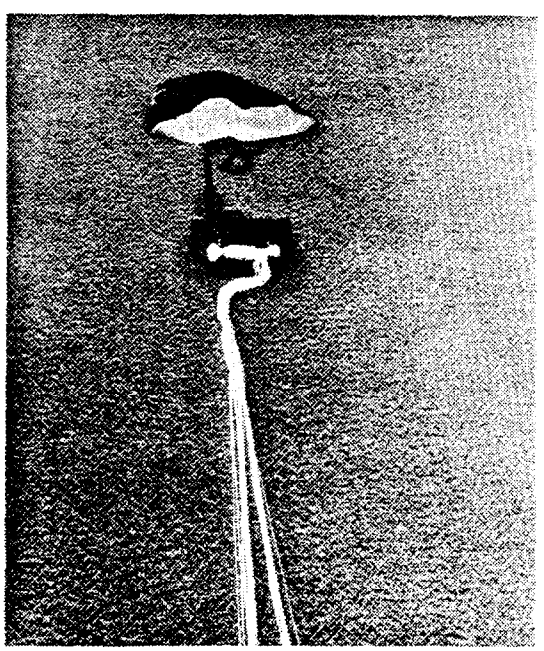
15. Check the bridle attach ring. The ring should pull up against the bag grommet and there should be no fabric between the ring and the grommet.

16. This illustration shows a cross-section of the canopy S-folded in the bag.









17. Dress the bag prior to stowing the lines.

18. Closing stows should be made in accordance to the bag configuration, with the f ollowing guidelines: Route the lines cleanly, and don't stow more than one inch of lines on the outside of the stowing bands.

19. **Stow lines to within no less than six inches, no more than 16 inches.**

2.2.0.1 Closing

Continue in accordance with Container maufacturer's instructions.