

# MANUAL



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English-language Manual

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# PERFORMANCE VARIABLE

German Flight Technology—



Performance Variable, Saarlouis-Düren Airport

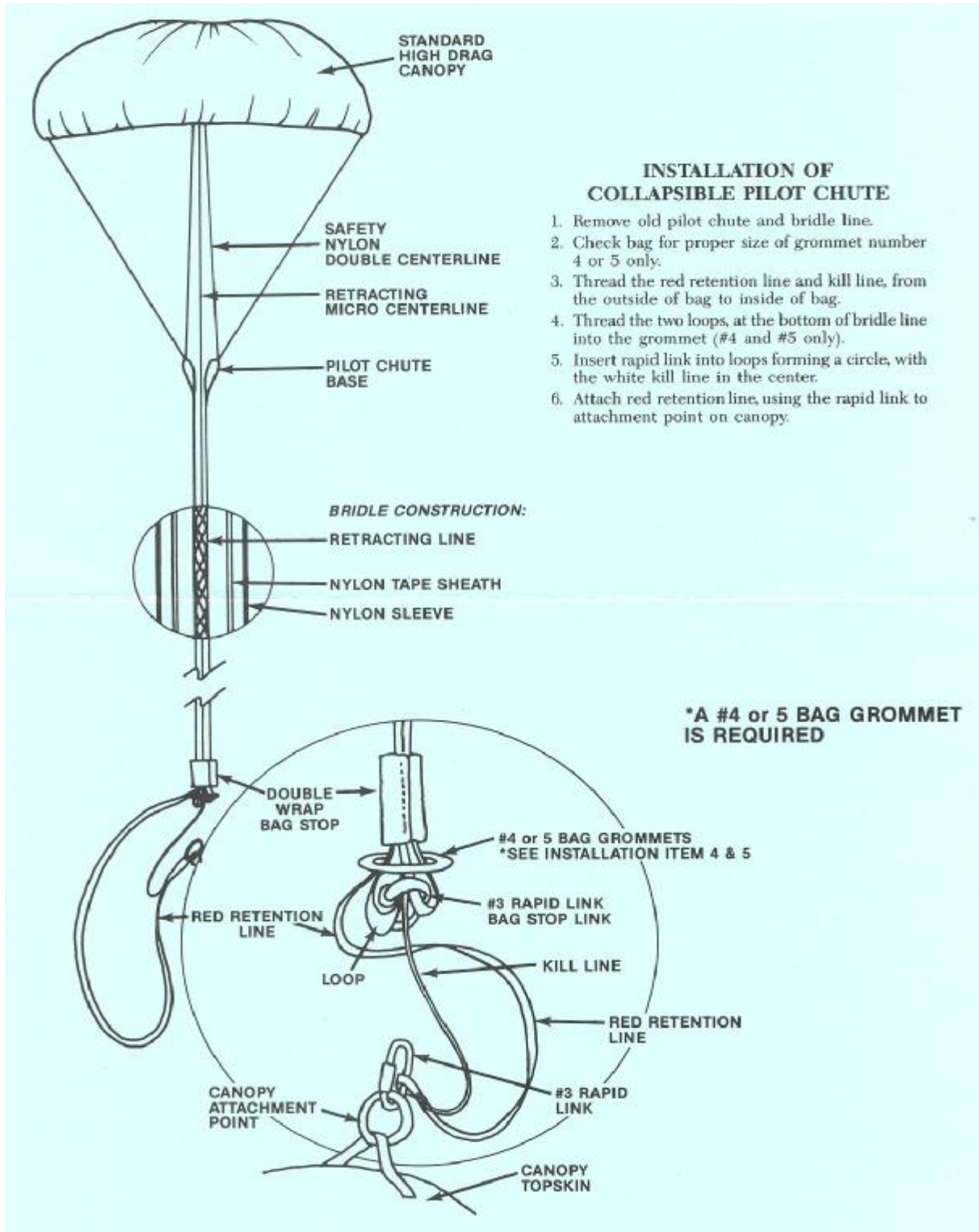
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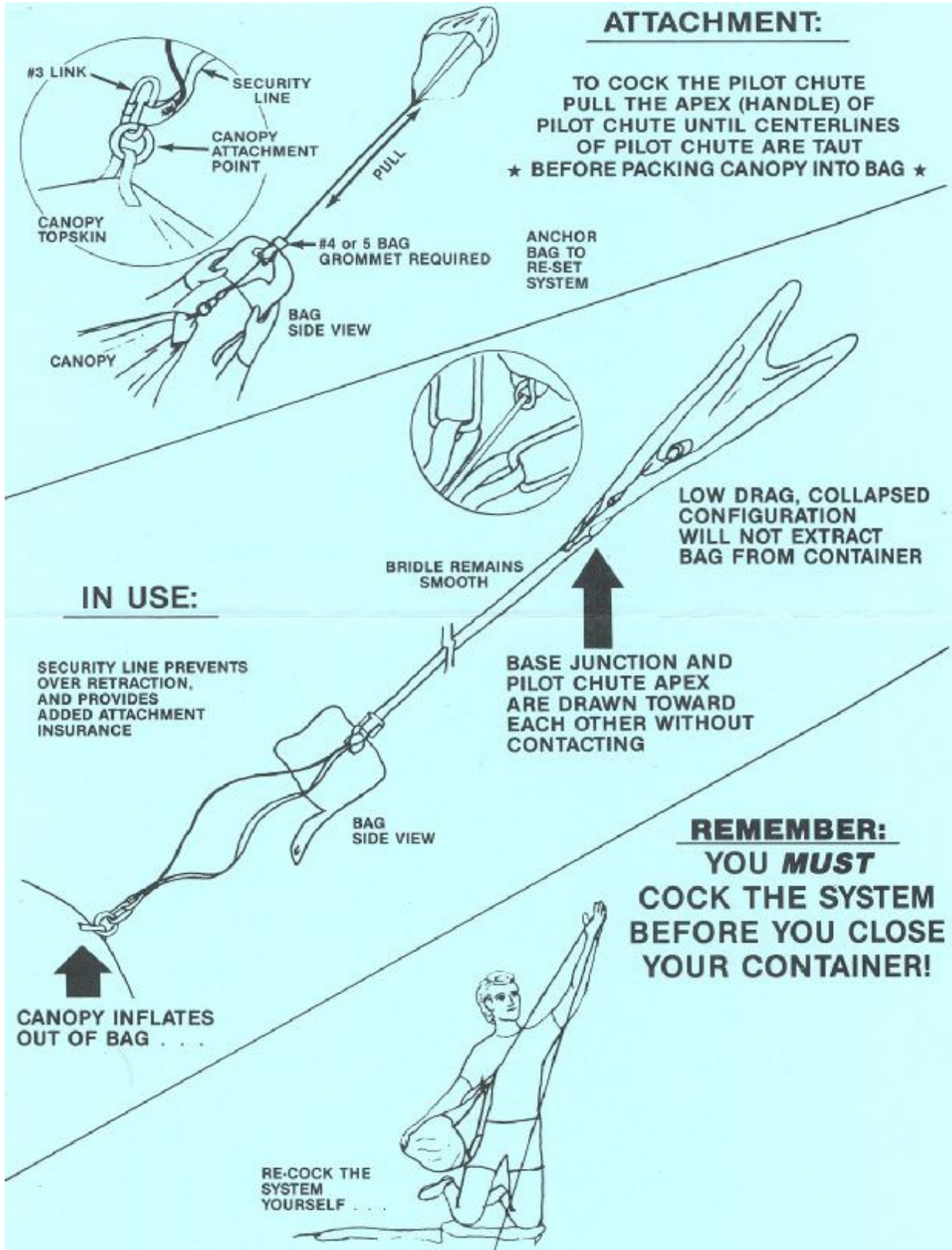
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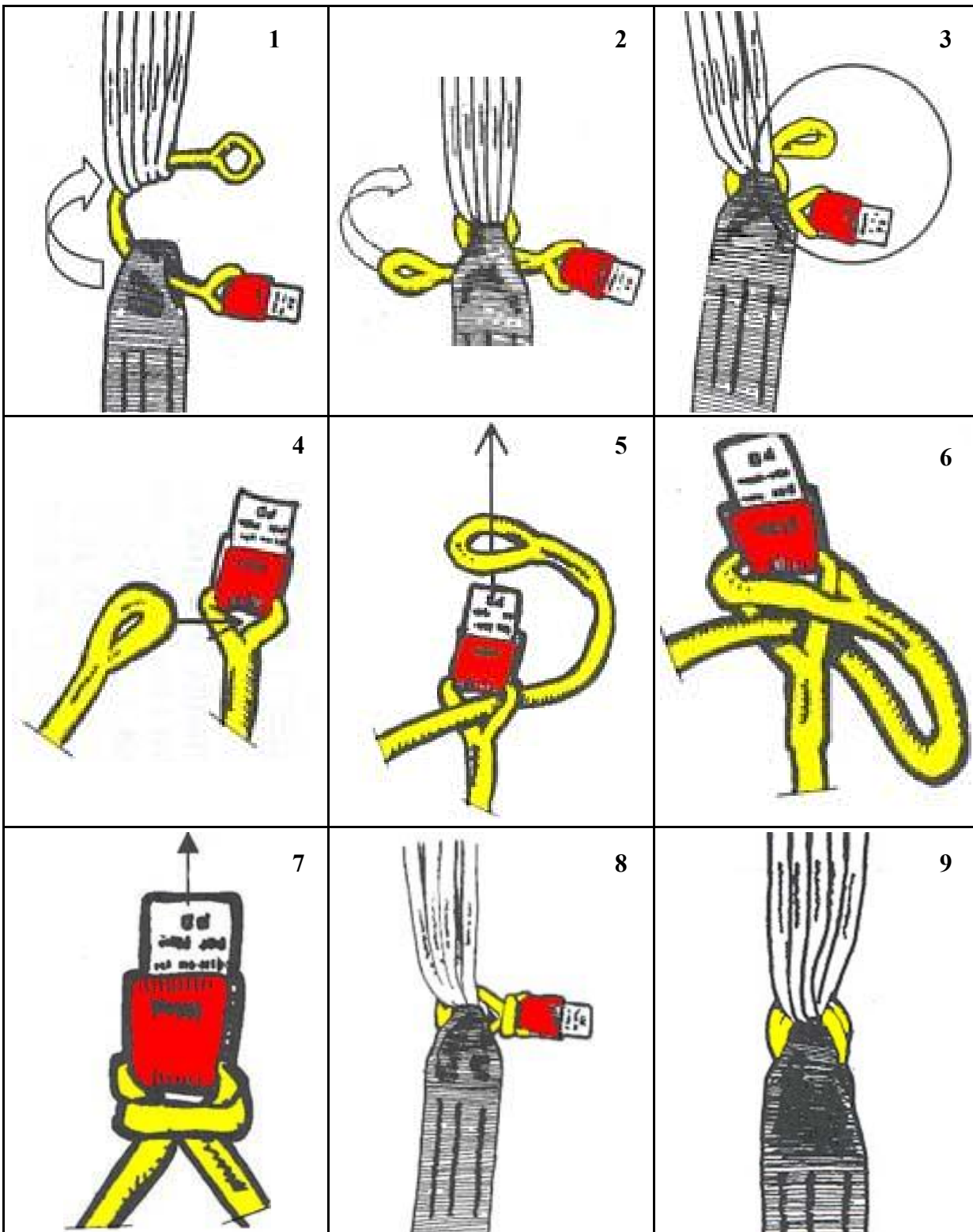
# Pilot Chute Attachment



# Cock Pilot Chute



Installation of Performance Designs Soft Links ©



## Spark Canopy Description

Type	Spark Main Canopy – Rectangular
Number of Cells	9
Production Technique	I-Beam Chord Wise
Manufacturer	Performance Variable, Germany
Suspension Line Links	Stainless-steel Mini Link or Soft Links
Canopy Material	Nylon (Zero-P & 0-3cfm Fabric)
Suspension Lines	Spectra/Micro & Dacron Lines
TSO Certification	DAeC 1995

## Technical Specifications

Type	Size	Span	Chord	Volume	Weight	Exit Weight	Lines Micro &
	ft <sup>2</sup>	ft.	ft.	in <sup>3</sup>	lbs.	lbs.	Spectra
Spark 105	105	16.33	6.52	260	5.1	116	500/725
Spark 120	127	17.18	6.87	328	5.2	133	500/725
Spark 135	135	18.14	7.28	315	5.5	149	500/725
Spark 150	150	19.16	7.64	340	6.3	165	500/725
Spark 170	170	20.34	8.04	365	6.8	187	725
Spark 190	190	21.62	8.66	418	7.6	209	725
Spark 210	217	22.73	9.09	527	7.6	241	725
Spark 230	230	23.75	9.51	523	8.3	253	725

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# Spark Trim Chart

Tolerance: plus/minus 0.5 cm

<b>Spark 105</b> Suspension Line Trim	
AB	5.00cm
AC	16.00cm
AD	34.00cm
BC	11.00cm
CD	18.00cm
SLIDER	
77cm x 50cm	

<b>Spark 120</b> Suspension Line Trim	
AB	5.00cm
AC	19.00cm
AD	38.00cm
BC	14.00cm
CD	19.00cm
SLIDER	
77cm x 50cm	

<b>Spark 135</b> Suspension Line Trim	
AB	5.20cm
AC	20.50cm
AD	40.70cm
BC	15.30cm
CD	20.20cm
SLIDER	
77cm x 50cm	

<b>Spark 150</b> Suspension Line Trim	
AB	6.00cm
AC	22.00cm
AD	43.00cm
BC	16.00cm
CD	21.00cm
SLIDER	
77cm x 50cm	

<b>Spark 170</b> Suspension Line Trim	
AB	6.00cm
AC	23.00cm
AD	46.00cm
BC	17.00cm
CD	23.00cm
SLIDER	
77cm x 50cm	

<b>Spark 190</b> Suspension Line Trim	
AB	6.00cm
AC	24.00cm
AD	48.00cm
BC	18.00cm
CD	24.00cm
SLIDER	
77cm x 50cm	

<b>Spark 210</b> Suspension Line Trim	
AB	6.50cm
AC	25.50cm
AD	51.00cm
BC	19.00cm
CD	25.50cm
SLIDER	
77cm x 50cm	

<b>Spark 230</b> Suspension Line Trim	
AB	7.00cm
AC	27.00cm
AD	53.00cm
BC	20.00cm
CD	26.00cm
SLIDER	
77cm x 50cm	

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## Our Suggestions to Help Your Canopy Open Better

When jumping heavily loaded, elliptical-wing canopies, consistent, on-heading openings become exponentially more important. We recommend loading Spark rectangular canopies at about 1.30 pounds per square foot and Contrail semi-elliptical canopies at 1.65 pounds per square foot. Heavier doesn't seem to give any longer swoop. (The faster descent rate and resulting higher fear factor just makes it seem that way.)

While not extreme some DZ standards, this loading is high enough that bad packing and/or bad body position on opening could induce unrecoverable line twists and a potentially difficult cutaway.

When jumping smaller canopies, it's very important to be extremely careful to have a good body position during deployment. If it's necessary to look up at the canopy during opening, look straight up and not over a shoulder. **Looking up over a shoulder drops the opposite shoulder, which makes the risers uneven and will usually cause an off-heading opening or line twists.**

**A test jumper intentionally looked up over his right shoulder as he tossed the pilot chute on one recent jump and can confirm that you should avoid doing this if you don't like spinning on your back while frantically untwisting your lines.** (He deployed above 4,000' and was out of the twists at about 3,000'—mere seconds later—but that might not always be the case.)

Bad line-stow and messy packing techniques are the other primary causes of off-heading openings and line twists. Problems in these areas are chiefly operator error but can be aggravated by equipment design.

The drawback of high performance is that faster canopies respond quickly even when you don't want them to. Sloppily packing a tiny pocket rocket is much more likely to result in a cutaway than a larger version of the same parachute.

Over the past few years, more and more canopies are being designed with naturally soft opening characteristics—without the need for any special packing requirements. This design feature becomes essential when you start jumping faster (or smaller) canopies.

**The more you roll the nose, wrap the tail, etc., the less likely your canopy will open symmetrically. A super-snivel pack job that rocks you around as it twists and inflates can actually feel harder than a faster, more even deployment.**

We recommend pro-packing the main almost the same as the reserve, leaving the nose exposed, slider quartered between the canopy's slider stops and all fabric flaked neatly between the A, B, C, D and brake lines. The only difference is that when packing the main, bring the tail around and roll it just enough to keep the slider situated and the pack job together as the canopy is gently laid on the floor.

All of the newer canopy designs we've jumped recently open soft when the canopy is packed like this—a feature we're happy to see. Softer deployment also puts less strain on the parachute, though some jumpers who are used to fast openings say it takes a little getting used to.

If your canopy opening goes something like, "snivel, snivel.... Thwack," you may have over-rolled the nose or tail, allowing the canopy to inflate too much before pushing the slider down your lines. Stainless-steel grommets could also be a culprit; perhaps the weight of these heavier grommets allows them to build up more momentum than their brass counterparts, thus allowing your slider to travel down the lines faster.

Some canopies have gotten a reputation for snivel openings 99 percent of the time, with the occasional neck-jarring thwack. This could be because the slider wasn't kept securely against the slider stops while laying the canopy down or putting it in the bag. This allows the canopy to push the slider down the lines faster than usual.

Since canopies usually do as they're told, off-heading openings and line twists are often operator induced as well.

Perhaps the most common cause of line twists severe enough to require a cutaway is making the last line stow closer than 18 inches to the main risers. This can cause the lines to grab the bottom of the reserve container as the pilot chute lifts the main D-bag out of the main container, causing the bag to spin while the lines unstow.

Some local riggers and a few manufacturers now offer a modified main D-bag where line-stow rubber bands attach closer to the center of the D-bag instead of the sides. This places shorter line stows closer to the center of the bag and keeps the lines further from the top edges of the main container. This also makes the D-bag more stable as the lines unstow during deployment.

Even using the 18-inch rule, one local jumper used to get frequent (though minor) line twists. He modified his main D-bag about 700 jumps ago and hasn't had a line twist since.

**Remember: "DO NOT LOOK AT YOUR PILOT CHUTE!"**

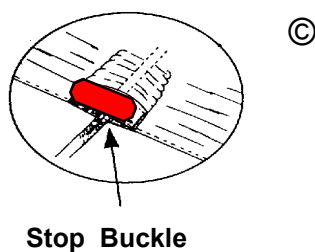
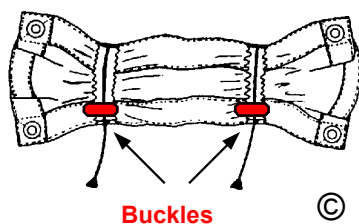
# For Soft Spark Openings

**On your first jump with your new canopy –  
Please do not go to terminal !  
We recommend making only a 3-sec. delay!!**

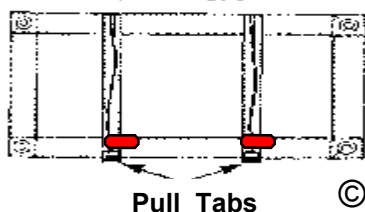
- 1) Don't forget to cock the slider.
- 2) Make sure slider is right up against the canopy and stays there!!!
- 3) Roll each side of the nose 4 complete turns towards the center...
- 4) then tuck both sides into the center cell.
- 5) Make sure that the slider is "quartered" between the line groups but that more is in front of the nose.
- 6) Make large line stows—about 2 - 3 inches.
- 7) Roll the tail.
- 8) Use tight elastic bands
- 9) Only use our low-drag 24" kill-line pilot chute!
- 11) Do not use Tube Stows.

Your canopy is equipped with a **State-Of-The-Art** collapsible  
**Doublestring Stop Buckle Slider**. ©  
 Please read and understand the operating instructions!

### Slider collapsed



### Slider Reset



## COLLAPSING THE SLIDER

- A)** After deploying your parachute, check the canopy and surrounding air space. **Locate the two pull tabs at the rear of the slider.**
- B)** Grasp both tabs and pull down and back with a quick movement to the pullstring's full length. This will allow the **stop buckles** to "lock" the slider in the collapsed position.
- C)** Release the tabs and fly normally. The slider will remain collapsed.

## RESETTING THE SLIDER

- 1)** Press the release button on the side of the cylindrical stop buckle!
- 2)** Grasp and pull the fabric channel from opposite ends, extending the slider to its full length and reseating the pull tab against the stop buckle!

This is best accomplished by grasping the bar tacks located at each end of the channel and pulling them apart. **Make certain to extend the slider back to its full length, with the pull tab seated against the stop buckle.**

- 3)** Repeat steps **1)** and **2)** for the second pullstring.

A Performance Variable Product ©

## WARNING !

**DO NOT PACK WITH SLIDER COLLAPSED. FAILURE TO RESET SLIDER COULD RESULT IN HARD OPENINGS, DAMAGE TO EQUIPMENT, BODILY INJURY OR DEATH!**

Read this manual completely before assembling, packing or using your *Spark Canopy*.

# Spark

Differentials may vary +0.25 inch or -0.25 inch from the original dimensions. Other canopies of the same size may have different trims, and this manual may not be applicable to them.

This manual may be revised at any time by [Performance Variable](#). The only way to be sure this manual is current for your canopy is to check periodically with [PV](#).

[PV](#) welcomes suggestions of ways to improve this publication. If you feel parts are incorrect or hard to understand, please let us know in writing.

## Disclaimer - No Warranty

Because of the unavoidable danger associated with the use of this parachute, the manufacturer makes no warranty, either express or implied. It is sold with all faults and without any warranty of fitness for any purpose.

The manufacturer also disclaims any liability in tort for damages, direct or consequential, including personal injuries resulting from a defect in design, material or workmanship or manufacturing whether caused by negligence on the part of the manufacturer or otherwise.

By using this parachute assembly, or allowing it to be used by others, the user waives any liability of the manufacturer for personal injuries or other damages arising from such use.

If the buyer declines to waive liability on the part of the manufacturer, buyer may obtain a full refund of the purchase price, by returning the parachute before it is used to the manufacturer within 15 days from the date of the original purchase, with a letter stating why it was returned.

## **! Warning !**

Each time you use this parachute you risk serious bodily injury or death.

You can substantially reduce this risk:

- 1) By assuring that every component of the parachute system has been assembled and packed in strict compliance with the manufacturer's instructions.
- 2) By obtaining proper instruction in the use of this canopy and the rest of your equipment.
- 3) By operating the system in strict compliance with the owner's manual and safe parachuting practices.

However, parachute systems sometimes fail to operate properly even when properly assembled, packed and operated, so you risk serious injury or death each time you use the system!

## *About This Manual*

It is beyond the scope of this manual to teach you how to deploy, fly, land or maintain this parachute. The U.S. Parachute Association publishes recommended procedures on learning to jump and using skydiving equipment. We urge you to learn and follow these procedures. We also recommend you obtain instruction from a competent USPA-rated instructor before using this parachute for the first time

Other countries have similar organizations for instruction. If you are not in the USA, get instructions from a competent instructor who is rated by your country's organization.

Jumping this parachute without first receiving thorough and personal instruction increases the risk of serious injury or death.

Sport parachuting technology and procedures continue to develop and change rapidly. Although reasonable care has been made in the preparation of this manual, **Performance Variable** cautions that it may contain information that may be incorrect or behind the current *state-of-the-art* parachute use.

For these reasons, we urge you to work closely with qualified experts (**riggers and instructors**) to help you inspect, assemble, pack, use and maintain this parachute. We also welcome your comments, positive or negative, about our products.

## Read Before Assembly or Use

Since parachutes are manufactured and inspected by people, **there is always a possibility this parachute contains defects as a result of human error.** Therefore, the entire parachute system—main and reserve canopies, harness, container and other components—must be thoroughly inspected before its first use and before each subsequent use.

Parachutes get weaker over time for a number of reasons. They receive wear during packing, deployment and landing. Exposure to many agents, including sunlight, heat and household chemicals, significantly weaken parachutes. The damage may or may not be obvious.

To help minimize the risk of parachute failure and possible serious injury or death, the entire parachute system should be thoroughly inspected at least every 120 days or 50 jumps, whichever comes first. It should be immediately inspected if at any time it is exposed to a degrading element or unusually hard opening or damage is suspected.

Remember that some chemicals will continue to degrade the parachute long after initial exposure. Regular and thorough inspections are necessary to insure the structural integrity, reliability and flight characteristics of the system are maintained.

Always know the entire life history of every part of your parachute system. That way you will know no part has been exposed to an element that may seriously weaken or damage it.

## Picking the Right Canopy

It is important for your safety and enjoyment that you match your canopy with your ability and weight. **PV** canopies are built in several models that span a wide range of canopy surface areas. Any canopy's descent rate and forward speed increases as the weight it is carrying—the so-called **exit weight**—increases. The canopy also becomes more responsive as forward speed increases. It also reacts more radically when it is stalled or turned.

Because of these aerodynamic facts, it is unsafe to put **too much weight** under any particular canopy. Safe and comfortable landings will be difficult to obtain, even for experienced jumpers under ideal conditions. Less experienced jumpers will have even a harder time and be at greater risk.

Determining the **wing loading** of the parachute you intend to jump or buy is a good guide to match your weight to a particular canopy.

Wing loading is easily calculated by dividing the total **exit weight** in pounds by the surface area of the canopy in square feet. Total exit weight is the weight of the jumper plus all his clothing and gear, including the main parachute itself.

The surface area of **Performance Variable** canopies is printed on the data panel, on the center cell rib or on the center cell top surface near the tail. (Be sure to actually check the data panel—canopies of different sizes may look the same.)

A typical ready-to-jump sport piggyback (rig and both canopies) weighs 20 to 30 lbs. Add this, plus the weight of your jumpsuit, clothing and accessories to your body weight to get the total suspended weight. For example, a jumper who weighs **165 lbs.** wearing his jumpsuit and who jumps a packed rig that weighs **25 lbs.** would have an exit weight of **190 lbs.**

Here is an example of how to calculate wing loading of a 150 ft<sup>2</sup> canopy and the jumper used in the example above: **190 lbs. : 150 ft<sup>2</sup> = 1.27 lbs /ft<sup>2</sup>**

### **Calculate the wing loading now for the *Spark* canopy you intend to jump.**

**If this figure** is **below 1.1 lbs/ft<sup>2</sup>**, the parachute will be relatively docile and easy to land. It will also have reduced penetration into the wind and **reduced inflation pressure** in the entire canopy. The profile will not be as rigid as it should be. A figure **below 1.0 lbs/ft<sup>2</sup>** is as **dangerous** as a figure **above 1.4 lbs/ft<sup>2</sup>**!

**If this figure** is **between 1.2 and 1.35 lbs/ft<sup>2</sup>**, the canopy will turn fast and have a higher airspeed. It will require skill to land well in many weather conditions or at higher altitudes. Be sure your skill level is up to the demands of these situations. The inflation pressure is increased – the canopy profile is more rigid!

**If the wing loading** is **greater than 1.4 lbs./ft<sup>2</sup>**, you are exposing yourself to a **dangerous situation**. Turn rates forward speed and rate of descent will all be very high. Control range may be very short with stalls happening very abruptly with little warning. Normal landing techniques may not work. Extra airspeed on final approach may be required to get enough flare to stop your rate of descent. A front riser approach or hook turn may be required, either of which are **very dangerous especially under turbulent conditions**.

**PV** does not recommend that anyone jump a *Spark* canopy that will result in the wing loading exceeding **1.4 lbs/ft<sup>2</sup>**.

**The best average wing loading for expert skydivers on a *Spark* is 1.30 lbs/ ft<sup>2</sup>.**

It also is useful to compare the wing loading of a canopy you intend to jump with the wing loading values of parachutes you have been jumping. If the difference is great, you should expect the new canopy to perform very differently from the ones you have jumped before.

## Introductory Jumps

Even if you are familiar with ram-air parachutes, including PV canopies, your new parachute may handle differently. Therefore always make several jumps with the purpose of getting to know your new parachute. Pick a day with favorable wind conditions and jump by yourself.

Open high and find out how the canopy flies. Try slow turns and fast turns from no brakes, quarter brakes, half-brakes, three-quarter brakes and full brakes!

Determine if the canopy helicopter turns (stall turns) and, if so, under what conditions. Find out how the canopy recovers from various types of stalls.

Stall the canopy several times and see how this happens both from full flight and minimum air speed. Turn the canopy by pulling on the front or rear risers rather than the toggles.

Fly some practice approaches and flare the canopy as you would when you land it. Notice how far you must depress the toggles to get a landing stall and how quickly this stall occurs.

Keep track of your location relative to your intended landing area as you "wing out" your canopy so you won't drift too far away. **Discontinue your experimenting when you've descended to 1000 ft. above the ground.**

Plan and execute a conservative landing approach into a large unobstructed landing area. Steer, flare and land the canopy as you were taught by your instructor.

Since you might misjudge your early landings, be prepared to do a safe parachute landing fall rather than a stand-up!

Most jumpers underestimate how far they will travel over the ground during the landing flare. Make sure you have enough open area ahead of your intended touchdown point.

Such introductory jumps will help you discover what makes your canopy respond violently. The canopy will let you know that it is about to do something violent by its "feel." You must be experienced in these flight modes to know what it is telling you!

Knowing this will help you avoid these situations close to the ground when they can be quite dangerous.

## Swoop Landings

At most drop zones there are some jumpers who like to do high-approach-speed (swoop) landings. These landings look impressive—traveling long distances inches off the ground and then going backup before landing. The problem is that these landings can be very dangerous for the jumper and anyone else around the jumper.

Many of these swoop landings are started by a low turn. If timed incorrectly the jumper can hit the ground hard enough to be fatal. Many jumpers have been hurt by having another turn into them. To minimize the danger involved in skydiving, you should avoid all turns close to the ground and turns that could bring you close to another jumper in the air.

**PV** recommends that all jumpers limit turns to only minor course corrections below 500 feet. If you insist on performing a swoop landing, make sure you are alone in the air. Do not attempt a swoop landing if there are other jumpers in the air or the landing area.

The following advice is not intended to recommend that you try swoop landings, rather, it is only included because we recognize that some people will try to do swoop landings, even though **PV** recommends not to. We have included this section to minimize the risk to those who are going to attempt swoop landings.

Do not try any swoop landings until you are very familiar with your canopy and the landing area. Even people who are very skilled occasionally hurt themselves. Start out slowly. You do not need any more speed than full glide when first learning. Never try a swoop landing unless the weather conditions are suitable. As you become more familiar with your canopy, you may want to start using a faster approach. If so, increase your speed in small increments over many jumps. Most people get hurt by trying too much too soon.

Try several practice approaches while at high altitude going through everything up to landing. Do not attempt a high speed landing until you are sure you can deal with the high initial sink rate.

The best weather for practicing is a smooth, calm, low-wind day, when the canopy will be relatively stable and responding only to pilot control. It is important to avoid any possibility of the canopy being influenced by changes in wind direction or speed.

The idea in a swoop landing is to skim your feet across the ground or to make the canopy go back up. There is a very small section of the control range of the canopy where this is possible. If you pull the toggle down just a little beyond what is necessary to skim across the ground, the canopy may climb. However, just a little more toggle may cause the canopy to do a high speed stall.

In other words, if you pull your toggle down any more than it is necessary, you will pass right through the control range you want. The result of this could be dangerous. **The exact position of this small area of the control range of the canopy is different on almost every jump.**

You must have a complete and intrinsic understanding of your canopy to know exactly what to do for every approach.

Remember that the last thing you do in a swoop landing is land. If you let yourself get in where the **canopy does not have enough air speed to fly**, you drop from that altitude. If that happens to be ten feet high, you fall ten feet!

Once you have mastered the canopy, you may decide to try approaches at high air speeds. It's logical that the faster you go, the harder you will hit, so be careful. There are three methods to gain extra airspeed on approach: front risers, front riser hook turns and toggle hook turns.

**Pulling down both front risers** on a straight-in approach is the least dangerous method. A minimal pull down on the front risers (less than two inches) will result in a very large increase in airspeed (increasing the flare power on almost any landing). The flare then begins with a smooth release of the front risers and is continued by smoothly pulling the toggles down as much as necessary.

The altitude to begin the flare varies with each approach and how fast the flare is executed. It takes practice to determine these factors. **This practice can be hazardous to your health!** When using front risers to gain extra speed, never let go of the toggles for any reason.

Also, be sure **not to use front risers in gusty or turbulent winds**. Pulling on front risers in these conditions could cause your canopy to collapse.

**Front riser turns are very dangerous.** The forward speed gained with this maneuver is much more dramatic than with a straight front-riser approach, and you may undercut the airflow. A collapsed canopy (A-line stall) may be the result.

The big disadvantage is that it is much more difficult to judge correctly. If you misjudge this type of approach, you could seriously hurt yourself. **PV** recommends that you **do not try** this.

**Toggle hook turns are the most dangerous** of the three options and offer no advantage in performance. Because both the bank angle and the altitude at the start of the turn must be exact, toggle hook turns are very difficult to perform correctly. They are also very unpredictable in turbulence. **Do not try** a toggle hook turn under any circumstances.

## Improving the Performance of your Canopy

The most effective methods of increasing performance involve reducing drag or wind resistance. The following factors will, to a large extent, determine the performance you get out of your canopy.

**1.** Three decisions you made at the time of purchase determine the performance of your canopy. (1) The **size** was the most important. Smaller canopies are faster but have a noticeably lower glide ratio. (2) **Microline** improves the performance over standard Dacron line. (3) Being able to pull the slider down below the links allows the canopy to spread out more.

**2.** The performance of your canopy is greatly affected by how it is setup. The most effective thing that you can change here is the **pilot chute drag reduction**. There are several systems available for collapsing the pilot chute. The cheapest and most reliable method is to remove the main bridle bag stop and have a large grommet installed in the main deployment bag. However this method causes components to wear faster. Another method used is a pilot chute with a bungee center line. This method usually works, however, if the pilot chute fabric increases in porosity, the pilot chute may fail to open at deployment time. This can be a very dangerous malfunction. Also the pilot chute may open while in flight causing unpredictable changes in flight path. Yet another method is a retracting center line system. This method works well, however, it requires the center line to be replaced regularly and may fail to open at deployment time if packed incorrectly. The resulting malfunction is very dangerous.

**3.** How you use the canopy will effect the performance you get out of it. The slider drag may be reduced by keeping it from fluttering. On our models, a tie strap is installed on the slider for this. If you use this or a similar method, be sure the slider is freed before you start to pack the canopy. **PV** recommends that you leave the slider above the links. Some jumpers bring the slider past the toggles, down to the bottom of the risers, and stow it behind their neck. This does result in a slight increase in performance, however, it is dangerous. If the slider should inflate or move from its stowed position it can obstruct your vision.

## Assembly

Your canopy should be assembled by a certified rigger. Before you begin, be sure the risers, toggles, bridle, deployment bag, pilot chute, harness, container and other items are compatible with your **PV** canopy and each other. Some toggles, for example, will not work properly on certain type of risers. Assemble your system in accordance with the owner's manual for your rig.

These instructions will work for Dacron/Micro-lined canopies. Please follow the rig manufacturer's instructions for toggle attachment.

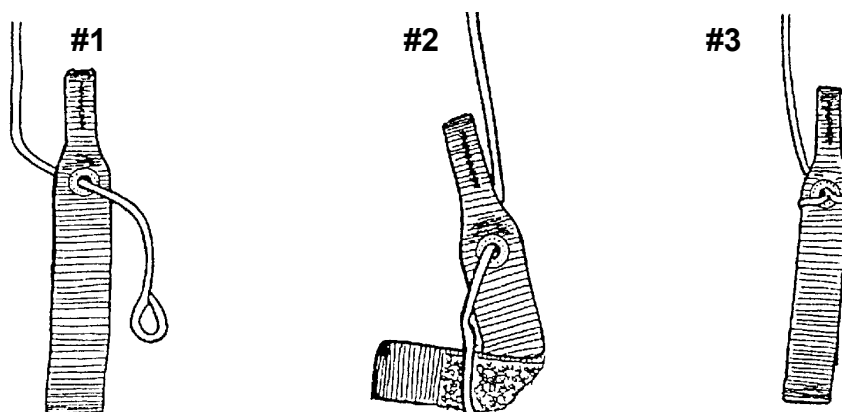
Two common problems that may happen if the toggles are installed improperly are:

A) The toggle knot may get caught on the guide ring, and

B) The knot may slip.

Be sure that your installation is safe and that you have followed the container manufacturer's instructions.

Recommended attachment of Velcro-backed toggles on Spark steering lines with finger-trapped loops:



Route the steering line through the slider, then the toggle guide ring and then the toggle. **See drawing #1.** Thread the toggle through the loop in the steering line. **See drawing #2.** Pull loop up to the toggle grommet. Note that the loop of the steering line guide is going through and around the toggle. **See drawing #3.**

## Periodic Inspection Procedure

*Performed at assembly and after every 50 jumps or 120 days, whichever comes first.*

As mentioned above, your PV canopy must be inspected thoroughly before it is jumped the first time and periodically thereafter. This procedure is more thorough than the inspection which should be completed each time the parachute is packed. Your rigger should inspect your parachute system in a clear, well-lighted area that will allow you to spread the main canopy out.

Here is one recommended procedure for inspecting your PV main canopy. Consult the owner's manual for your rig and other components for instructions on inspecting them.

It's best to inspect your canopy in a careful, systematic way. We recommend starting at the top of the canopy and working down to the risers. You should leave the canopy attached to the rig.

- 1) **Bridle attachment:** Check to be sure the bridle is correctly attached to the canopy. Check the integrity of the canopy fabric and reinforcement tapes in the area where the bridle ring is attached.
- 2) **Top surface:** Spread the canopy out on its bottom surface and inspect the top surface. Look for rips, stains or failed seams. Check the fabric strength.
- 3) **Bottom surface:** Turn the canopy over and spread it out to inspect bottom surface. Check for rips, stains and failed seams. Check the fabric strength. Check the line attachment points.
4. **Inspect each** rib from the leading edge to the tail by looking inside each cell. Pay extra attention to line and bridle attachment points.
5. **Lay the canopy** out neatly on one side, stacking each rib on top of the others. Check that all lines in each line group are the same length and that the trim differential between each line group is correct for this canopy. Check the condition of the stabilizers and slider stops.
6. **Suspension lines:** Check the full length of each line for damage and wear. Look for fraying at all cascades (the Y-shaped junction of two lines) and where each line attaches to the connector link.
7. **Slider:** Be sure the fabric isn't torn and that the grommets are undamaged, have no sharp edges and are securely attached to the slider.
8. **Risers:** Be sure the barrels of the connector links are tightened and the slider stops are properly positioned.
9. **The toggles** must be installed correctly and must match the guide ring and Velcro on the risers. A rigger should check this installation. Be sure the riser release system is assembled correctly and that it will function when activated.
10. **The rest of the assembly:** Follow the instructions in the rig manufacturer's owner's manual to inspect the rest of your parachute system.

## Cleaning your Canopy

### Standard Materials

Avoid washing or cleaning your canopy if at all possible. Cleaning the material will increase the porosity, causing reduced performance. Only clean areas that are contaminated with a substance that will degrade the material. Mild soap and water will remove most contaminants. If necessary, mineral spirits may be used for grease or oil. Do not use any other cleansers. Do not use cleansers that contain bleach. Avoid agitating the canopy, especially when wet. Agitation will cause a reduction in canopy performance.

### Fabric

The NYLSILK fabric is not affected by water. However, the reinforcement tapes may be. All tapes used in these canopies are pre-shrunk at the factory to make them more dimensionally stable.

However, if they get wet this does not mean that they will return to the exact same size when dry. Small changes in lengths may make a large difference in canopy performance. To maintain the best performance, avoid getting the canopy wet.

### Water jumps are not recommended.

If you need to clean your canopy, please wash only dirty or contaminated areas. Use a mild soap and water only. Oil and grease usually do not penetrate the coating surface so solvents are not normally necessary. Also, some solvents may affect the coating. Avoid getting tapes wet if possible. Do not machine wash.

## Storage

Store your parachute in a cool, dry place in a container through which light will not pass. This will prevent the permanent and difficult-to-detect damage caused by ultraviolet light from sunlight and other sources.

Certain other agents—notably acids—will quickly cause great damage to your parachute. Do not store your parachute where it might come into contact with such substances. For example, automobile trunks contaminated long ago with battery acid have destroyed many parachutes.

## Pre-Packing Instructions

Today's ram-air canopies are very reliable parachutes. If a ram-air has straight lines—that is, if it is assembled correctly and untangled after the last time it was jumped—it will usually inflate even if folded in ways that are quite unusual. In other words, it is difficult to pack a ram-air main canopy so it won't open.

We're not saying other packing methods won't work with your [Performance Variable](#) canopy. But the method shown here will probably help your canopy open more consistently.

### Before You Begin

Where you pack your Performance Variable canopy is important.

Since sunlight irreversibly damages nylon parachutes, an indoor shady area is best. Packing in the sunlight is unavoidable at most places, so try to reduce your canopy's exposure to direct sunlight as much as possible. Cover it with a packing mat or jumpsuit while you "debrief" a jump or critique a student.

Packing on concrete and asphalt should also be avoided because they will wear the fabric, lines and fittings that are used to build your parachute system. A dry lawn is best.

Packing behind a building or van will make packing easier because it blocks the wind.

**FAA regulations require that a main parachute be packed by either an FAA-certified rigger or the person who will jump it. Other countries may have similar regulations.**

### A Word About Help

When you're learning to pack, never hesitate to ask a rigger or your instructor for help. They will show you tips that will make the process faster and easier.

Be sure they refer to this manual, however, as they might not be familiar with our packing method.

## Read the Manual First

Read these packing instructions completely before you begin. Doing so will give you a better idea of what you are doing, and it will help you go a little faster.

### *Packing Canopies Made of NYLSILK Fabric*

Canopies made from NYLSILK can be packed just like any other similar canopy. If you prefer to flat pack and have been getting good results with a similar canopy, this method should work with your new canopy. There are many different pack jobs currently being used. We recommend the pro-pack detailed in the owner's manual.

This pack method consistently results in soft, on-heading openings, with minimum risk of canopy damage. Others may not work as well. If you try a different pack method, you do so at your own risk. If you use a side or book pack, start at the tail and work forward to squeeze the air out.

Packing a canopy made of NYLSILK is a new skill that must be learned. At first, it will be more difficult to pack than canopies made out of conventional materials. However, with practice it will become just as easy. You can make the pack job considerably easier by getting a bag that is slightly larger than your main container. It is easier to squeeze a small amount of the air out after the canopy is in the bag. (Consult the container manufacturer about this.)

The key to making the job easy is to pack fast and accurately. Each fold or roll must be done quickly and correctly the first time. This will only come with practice. Packing does not hurt the canopy, so please practice until you are good at getting a neatly folded canopy into the bag before you start jumping the canopy.

The fabric has a memory and always tries to open back up. Once you start, you must continue until the canopy is in the bag and the first locking stows are secure. You can't waste time at any point in the packing procedure because this gives the canopy time to move around, form a big mess, and you will have to start over.

After the folding and organizing portion (which is done while standing) is complete, you should roll the tail as tightly and as far as possible. Be careful not to let the tail unroll while squeezing the air out. If you kneel on the canopy facing the pilot chute attachment just above the warning label, you will be in a better position to control this. Slowly lay down on the canopy while still containing it with your hands. The only place for the air to leak out is the stitch holes, so go slowly. If you go too fast, the air will blow the pack job apart.

Spark canopies are designed for a slow-to-medium speed, two-step opening when packed as described in the PV manual—with each side of the nose rolled four complete turns towards the center. Bring plenty of slider in front of the nose and flake it in and between the stabilizers!

## Inspection

*Performed before each packing*

You must inspect your parachute system each time you pack it. The inspection takes only a few moments and will help prevent malfunctions and other problems. The inspection is best done when the rig and canopy are stretched out on the ground prior to packing. The procedure outlined below is different than the thorough inspection that must be performed periodically and when the parachute is first assembled or if damage is suspected. The thorough procedure was presented earlier.

**If you discover any worn or improperly rigged components, bring them to the attention of a FAA-certified rigger before jumping the system again.**

During your inspection of the entire system, pay special attention to the items listed below. Any damaged or worn parts must be repaired or replaced before jumping the system again. Start with the harness and container and work up to the canopy and pilot chute. Although the owner's manual that came with the rig contains specific inspection procedures, be sure to check the items listed below!

**Reserve:** It must be sealed and in date. The ripcord pin(s) must be seated properly and not bent. The cable must move freely in its housing. The ripcord handle must be properly stowed in its pocket. If the rig is equipped with an automatic opening device, it must be installed and calibrated correctly.

**Harness:** Inspect the entire harness for broken stitches and excessive wear.

**Main Container:** The locking loop must not be worn, as a problem with the locking device can result in a premature opening or a locked container.

**Risers:** Check the riser releases carefully. They must be installed and assembled properly. If your harness has 3-ring releases, be sure the white locking loop is not worn (it passes only over the smallest ring).

Be sure the release cables are inserted correctly in the white loops. Check the steering lines and toggles. Look for damage, loose knots and slipping toggles. (Serious injuries could result if an incorrectly attached toggle detaches from the steering line during the landing flare—don't let it happen to you).

## Check VELCRO for wear!

**Connector links:** The threaded barrels must be securely tightened and not cracked. Check Soft-Links for damage.

**Slider:** Be sure the slider isn't twisted and that its grommets are free of nicks or burrs that can damage the suspension and steering lines.

**Suspension and Steering Lines:** Inspect these lines for wear. Be sure they are "continuous" (not tangled). Each must go straight from its link to the canopy without wrapping around other lines. The risers must not be twisted either.

**A Tip:** Pick up your canopy neatly after each landing, and lay it down neatly when you reach the packing area. Doing this will make your packing go faster because the lines will most likely stay "continuous" (or not passed through each other, as can happen if you walk through some lines after landing). If you find any incorrectly routed or twisted lines, it is usually better to leave the risers attached to the harness while you correct the problem (unless the risers were attached incorrectly to begin with). Disconnecting the risers usually makes it more difficult to straighten things.

**Canopy:** Be sure the canopy is not on backwards. Inspect it for tears, especially where the lines and pilot chute bridle attach. (You should periodically look inside the center cell to inspect this junction.)

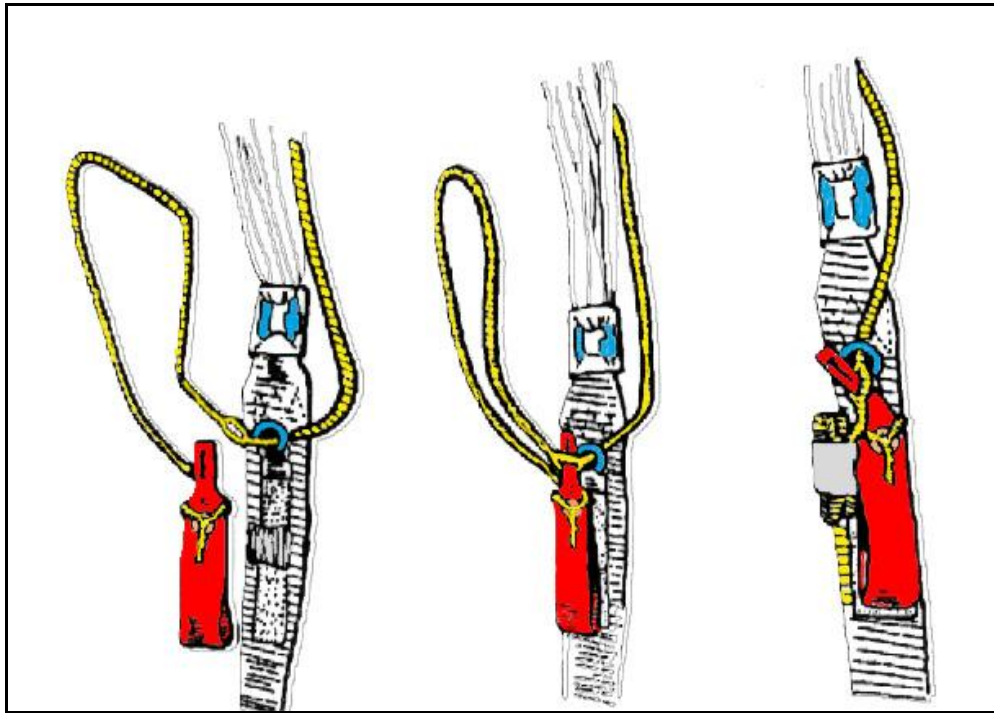
**Deployment Bag, Bridle and Pilot Chute:** The owner's manual for these items is the best source of inspection information. Tears or failing seams in the main pilot chute are especially hazardous—as is a worn bridle or one that is too short.

After packing your canopy a few times, you'll be able to combine the above inspection procedures with the packing procedures—you'll inspect it as you pack it.

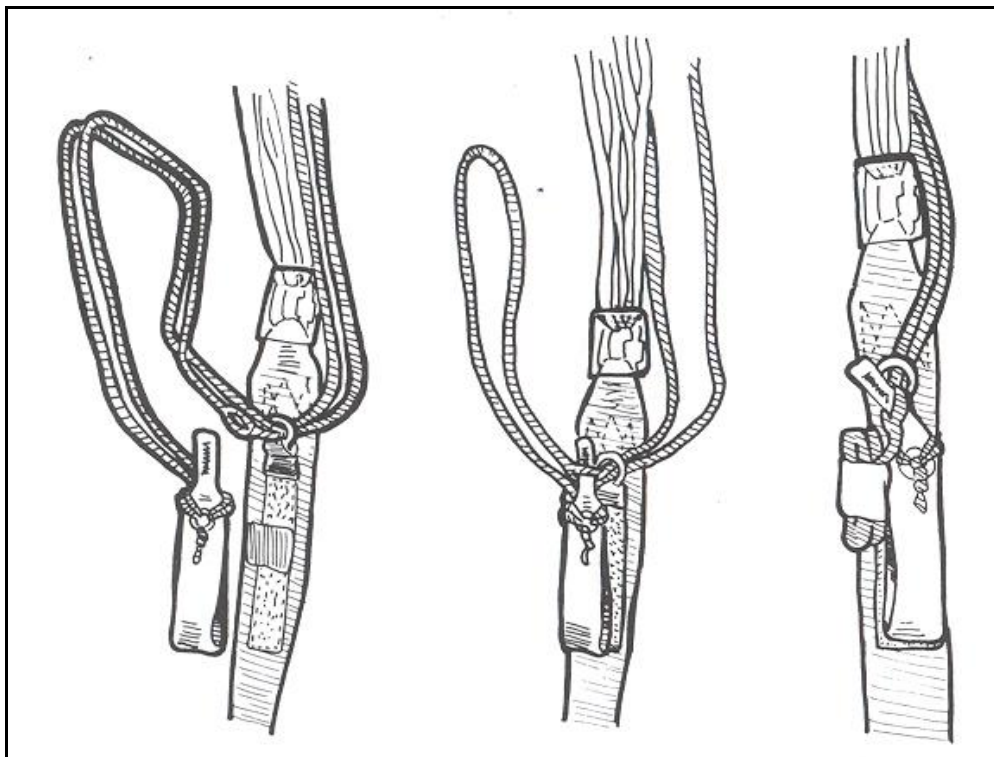
## *Packing Procedures*

Stretch your parachute system out on the ground with the rig laying with the containers facing up. (If someone were wearing your rig at this point, he'd be lying face down with his head towards your canopy.) Pull the lines straight before setting the rig down.

After the parachute system has been inspected, stow the brakes according to the instructions provided by the manufacturer of your rig.



Canopies with dual steering lines (two lines per toggle) have brakes set on only the lines that contain brake loops. The line without a brake loop pull tight towards the tail. You will find dual steering lines on Spark 190, 210 and 230 ft<sup>2</sup> canopies!



## Cloth Link Bumpers

Check cloth slider bumper position. It must protect slider grommet from link damage.

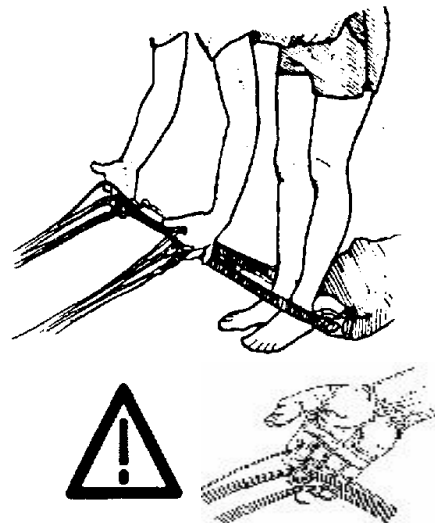


## Slider Preparation

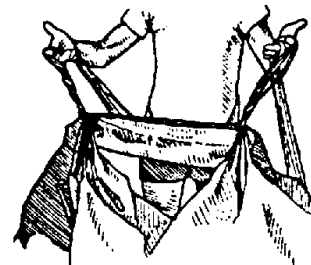
On some canopies there is a small piece of Velcro on the slider. This is to wrap up the slider during flight. It stops the slider from flapping, makes it quiet and improves the glide slightly. This Velcro must be stowed before packing. Failure to do so may result in an excessively hard opening, canopy damage, malfunction and/or severe injuries to the pilot.

## Folding the Canopy

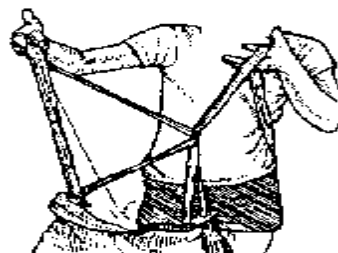
**1)** Crouch next to the risers and face your canopy. Slip the fingers of your left hand between the left-hand risers and between the left-hand steering line and the risers. Do the same on the right with your right hand. The idea is to have each line group and each steering line separated. Grasp the lines as shown. Be sure there are no twists in the risers. Start moving up the lines, allowing them to slide between your fingers. Push the slider ahead until you reach the bottom of the canopy.



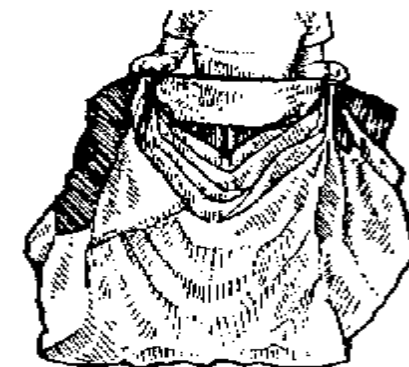
**2)** At this point, it's possible to determine if your canopy and lines are straight. If there are twists in the lines as shown, this means your rig did a "loop" through your risers at some point. To fix this, drop the lines, stretch the canopy and lines out again and straighten the entanglement out. Get help from a rigger if you have any questions. Do a line check again to make sure you have done it correctly.



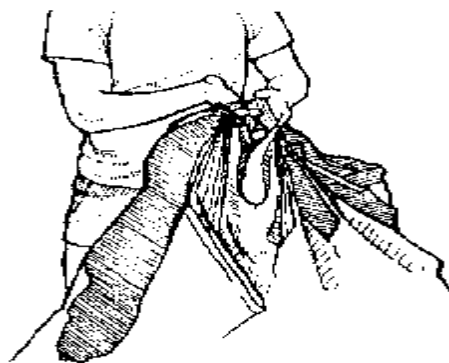
**3)** If the lines look something like this, then a steering line or riser group passed around everything else. A steering line that passes around everything else will result in a malfunction that will almost surely require a break-away. If you don't know how to fix this, get qualified assistance.



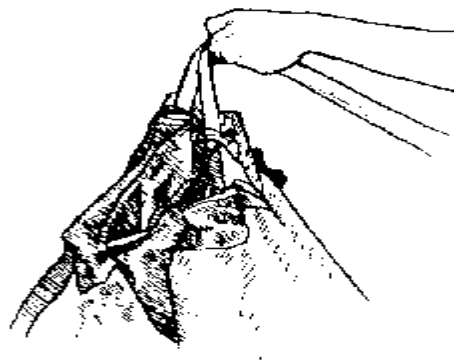
**4)** When you reach your canopy, pull both hands apart as far as the slider will allow. Shake the canopy a couple of times to settle everything. If the canopy is clear there will be four distinct line groups going all the way to the stabilizers with no lines crossing each other and no twisted lines.



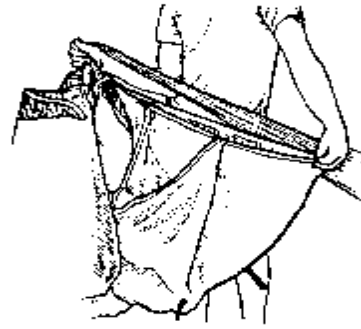
**5)** The nose openings should be facing the rig and the tail should be farthest from the rig. If the reverse is true, double check to be sure the rig is container-side up (the back pad is on the ground). If the rig is positioned correctly and the canopy is not oriented as described above, then the canopy was attached to the harness backwards!



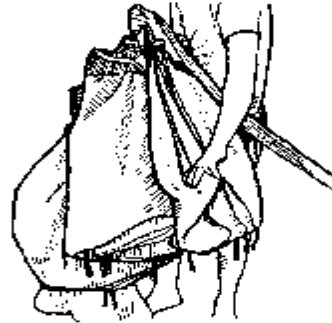
**6)** Now step to one side outside the lines and transfer the lines to one hand so that the left and right sides of the canopy hang at the same height. It is not necessary to keep the line groups separated by the fingers of your hands because you've already determined the lines and canopy are straight. Your canopy should look like the illustration. All lines should be kept taut and the nose should still be facing the rig. The slider should be against the slider stops on the stabilizers.



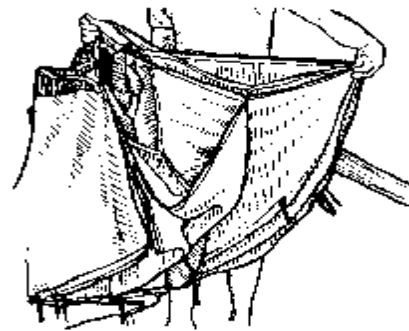
7) Starting with the end cell nearest your legs, flake the entire nose with one hand as shown.



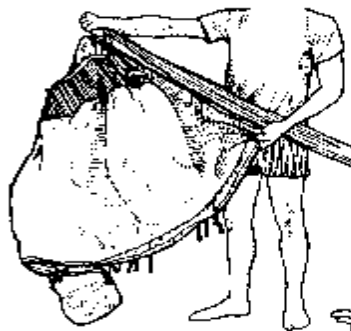
8) Pull each cell completely out, and keep it in your hand.



9) Then pick up the next, taking care not to miss any until all of them are in your hand.



10 / 11) When you have the entire nose flaked, tuck it between your knees and hold it there.

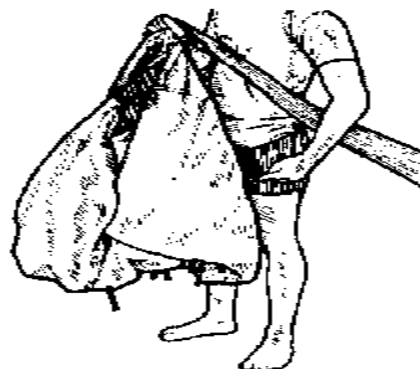


If your canopy is new, or if it tends to open uncomfortably fast, split the nose and roll each side 4 times tight towards the center and tuck it into the center cell !

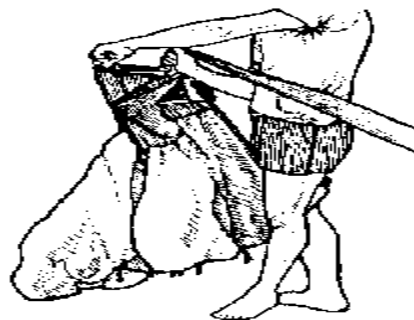
If it tends to open too slowly, do not split and roll the nose!



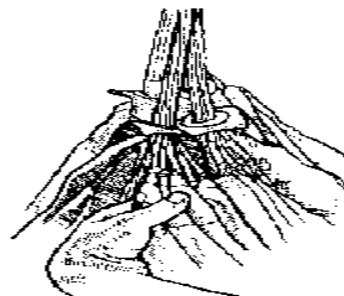
**12)** If your canopy opens too slowly, then leave the nose hanging neatly flaked; don't roll it at all. This leaves it exposed to the air stream and will help the canopy to inflate faster.



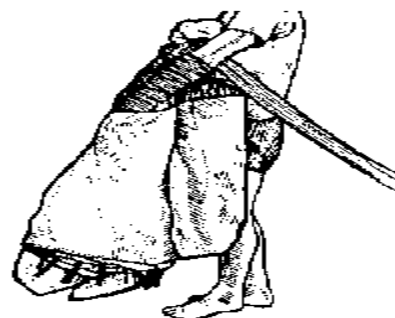
**13)** Clear the stabilizers. Since all lines are bunched up in the middle, pull each stabilizer panel out one by one into a loop until they form an irregular shape resembling the petals of a flower when viewed from the top. Be sure none of the lines are wrapped around a slider stop on a stabilizer.



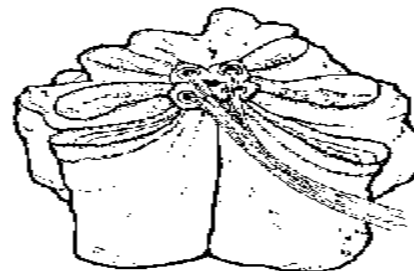
**14)** Find the group of A lines on one side of the canopy. With the canopy held in front of you as you have it now, the A lines are the front part of the line group that go through the front slider grommets, the ones that should be closest to you.



**15)** Since there is a lot of fabric between the A and B line attachment points, it is easy to separate the two line groups: Look down inside the first small S-fold of the stabilizer and find the "extra" bunch of fabric. Now make the rest of the canopy into S-folds 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 the side. This will give the cells on one side the correct type of flaking. Now repeat the process with the other A and B groups, pulling the fold out to the other side. (If you rolled the nose a lot in steps 12-15, you may skip this A-B S-fold since most of the fabric is probably rolled up in the nose.)



**16)** 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 of fabric between the two groups out to each side. When you look down in between the stabilizer folds after you've done your "flaking," the folds should look neat like this.



**17)** Now find the D-line group, the group of lines nearest the tail. (Not the steering lines—they are attached at the trailing edge.) Pull the left-hand steering lines off to the left (to get them out of the way). Follow the stabilizer down to the D lines and pick up all the D lines on the left side. The Spark is a 9-cell canopy, so you should have five lines. All lines in your hand should go through the same grommet. If they don't, you've picked up a wrong line.



**18)** Now that you are holding only the correct D lines, you may let go of the steering lines. Take the whole D-line group on one side and pull it out gently.



**19)** Fold the D-line group in 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.



**20)** Now grasp the steering lines where they attach to the tail, pull the entire tail out and drop it straight down.



**21)** Now organize the steering lines and tail so the canopy looks like this. (Even though it might seem like you've got a disorganized wad of canopy hanging down in front of you, it should actually be a neat pack job.)



## IMPORTANT

Be sure the stabilizers and their slider stops are correctly lying outside the suspension lines as described in Step 14. Canopy damage is likely if a stabilizer (or its slider stop) lies under a line.

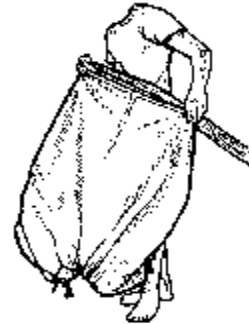
**22)** Reach down and pick up the very middle point of the trailing edge; an identification marker is sewn at the middle point to help you. Raise the tail a couple inches above the slider and hold it in place with the same hand that is holding the lines.



**23)** On one side, start with the middle of the tail 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 steering line to the very center of the trailing edge.



**24)** Wrap that part of the tail half way around the canopy. Hold it in place with your knees. Fold the tail on the other side of the canopy the same way.



**25 & 26)** Release your knee grip on the nose and tail. Take both tail pieces in one hand and roll them together into the middle so they completely encase the rest of the canopy.



## CAUTION:

The steering lines must stay positioned at the back of the canopy as shown in Fig. 21. If the steering lines are moved to the nose of the canopy (rather than being kept at the back), a line-over malfunction and canopy damage may result.



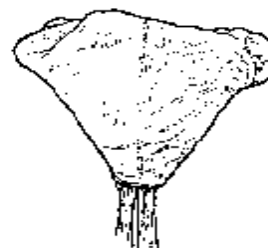
**27 & 28)** Place your free hand carefully under the bundle. Swing it out slightly so that the lines stay taut and gently lay it on the floor.



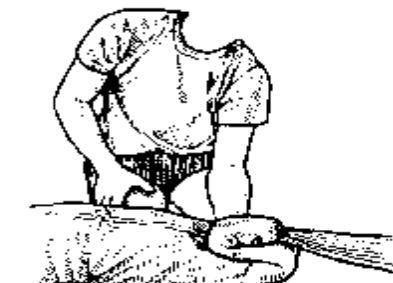
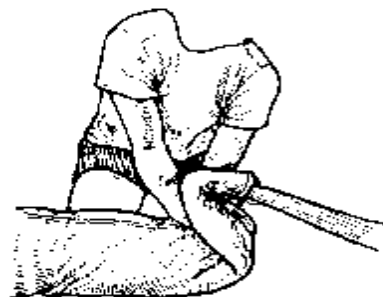
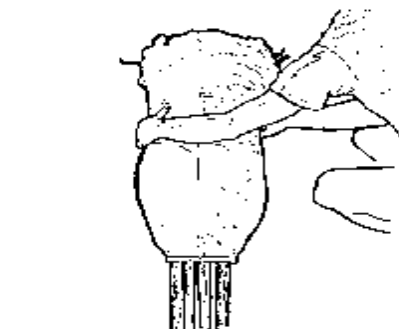
**29)** As it lies on the floor, the bundle should be triangular in shape, as shown. Note: The slider should be wrapped up in the tail and should stay that way as you stuff the canopy into the deployment bag.



**30)** Dress the canopy to a width slightly wider than the bag. All of the slider should stay inside the rolled tail. The slider must not be allowed to move down the lines—even the smallest downward movement of the slider may increase opening shock and decrease reliability. Pay extra attention to the position of the slider until the bag is closed.



**31 & 32)** Move to the side of the canopy and put one hand right under the slider edge of the bundle. Place the other hand on top a little farther up and make a small S-fold as shown. Be sure the slider stays up against the stabilizers; don't let it move down the lines.



**33)** Now put one hand under the top of the bundle and make an S-fold in the opposite direction as shown. The remaining material can be rolled under the fold.



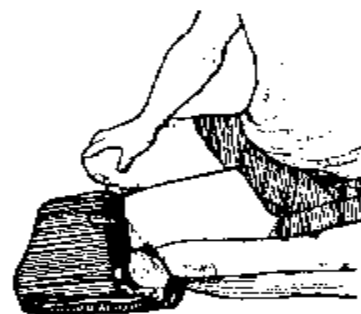
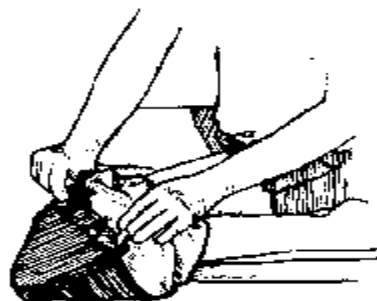
**34)** You should now have a neat compact bundle. Try to make the folds so that the bundle is only a little wider than the bag.



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



**36 & 37)** 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. The whole canopy should be in the bag before you remove your knee. This helps completely fill the corners of the bag by keeping the middle compressed. **Follow your rig manufacturer's instructions for closing the bag, stowing the lines, placing it in the pack tray and closing container.** It takes practice to pack quickly and neatly. Every jumper has his own **system** to make the job easier, and you'll quickly develop one of your own.



If you have any questions – feel free  
to call us at any time  
Ph: (49) 6837 – 91707

Thanks again for choosing our product!



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