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Parachute Equipment
Manufacturing, Sales, Service

Safety Information Sheet: Control System Malfunctions

I. Introduction:

When setting the deployment brakes on a ram-air canopy, it is important to set the brakes correctly and stow the excess steering line properly on the risers. Setting the brakes incorrectly, stowing the excess steering line incorrectly, or leaving the excess steering line unstowed may cause a control system malfunction.

Although these types of control system malfunctions have been relatively rare in the past, it appears that they are starting to occur more frequently. It is extremely important for skydivers, riggers, and others in the skydiving community to understand nature of these malfunctions and how they can be prevented.

Accidents involving control system malfunctions have resulted in serious injury and death.

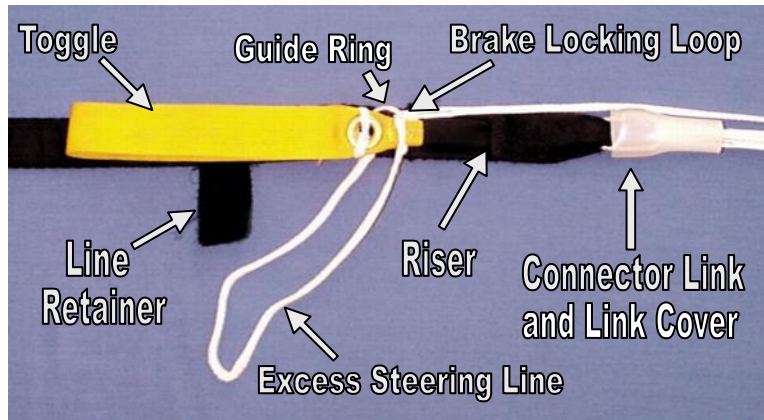


Figure 1. – Rear riser and lower control system components.

Note: Performance Designs, Inc. does not manufacture toggles or risers. These components are considered part of the harness and container system, not the parachute assembly, and are normally built by the harness and container manufacturer or a third-party manufacturer. The information provided here is based on feedback from our customers and other individuals in the skydiving community, as well as the results of our own testing.

Since there are a variety of different riser and toggle configurations being used today, if you have any questions about a specific set of risers, or how the information in this document applies to those risers, we recommend that you contact the riser manufacturer or a qualified parachute rigger.

II. Causes of control system malfunctions:

Several types of control system malfunctions can occur if the excess steering line is either left unstowed or is stowed incorrectly when the deployment brakes are set.

Premature brake release - If the excess steering line is left unstowed it can momentarily snag on some part of the container system, the jumper's helmet, or some other protruding object and cause a **premature brake release**. If one deployment brake releases prematurely, the canopy may appear to inflate correctly but might stay in a diving turn until both brakes are released. In some cases, a premature brake release may cause a fast, diving spin, severe line twists, or a similar situation that requires the use of emergency procedures.

Steering line entanglement - Leaving the excess steering line unstowed, or stowing the line incorrectly, may allow the line to become **entangled with the slider, a connector link, some other part of the riser assembly, or even with the jumper's helmet or hands**. The jumper may not be able to release the brakes or may not be able to control the canopy correctly, and may need to execute emergency procedures.

Another type of control system malfunction can occur if the brakes are set with the steering line misrouted:

Misrouted steering line - *Figure 2* shows two examples of **misrouted steering lines**: the steering line half-hitched around the guide ring (*top*) and looped around the riser itself (*bottom*). If the brakes are set with the steering line misrouted, the jumper may experience problems controlling the canopy. Many jumpers, both experienced and novice, occasionally make these mistakes. We advise all jumpers to pay special attention to the routing of the steering lines when setting a canopy's deployment brakes.

If a steering line is misrouted, you will usually notice increased friction or drag when pulling on that line during flight. A misrouted steering line can be very dangerous because the canopy may seem to be fully controllable at first, but the steering line may suddenly "lock up" at any time during flight causing you to lose control of the canopy.

Attempting to land a canopy with misrouted steering lines may result in serious injury or death. You should always perform a controllability check after the canopy opens, and if you notice any problem with the control system, including unusual friction or drag on one or both steering lines, it should be considered a serious malfunction.

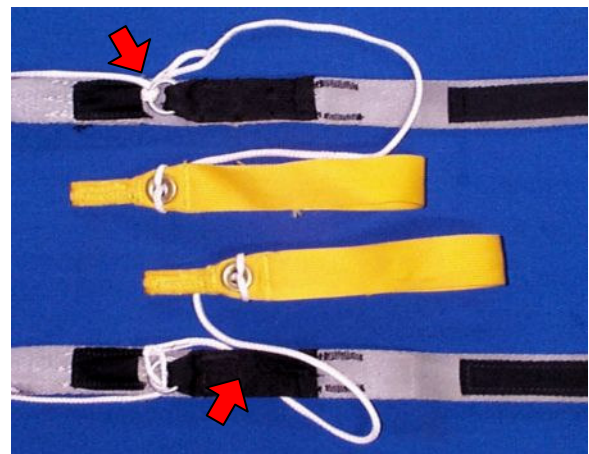


Figure 2. – Misrouted steering lines.

III. Preventing control system malfunctions:

The routing of a canopy's steering lines must be checked every time you set the deployment brakes. **The steering lines must pass straight through the guide ring on the riser and be able to move freely when the toggles are pulled.** The steering line must not be looped around the guide ring or around the riser itself as in *Figure 2*.

After the brakes are set, the excess steering line must be securely stowed in a way that reduces the risk of the line snagging or becoming entangled, but still allows it to unstow easily when the deployment brakes are released. If the risers have retainers to hold the excess steering line, as shown in *Figure 3*, they should be used every time the deployment brakes are set. If you are not sure how to stow the excess steering line correctly, you should consult the instruction manual for the harness and container system, seek advice from a qualified rigger, or contact the riser manufacturer.

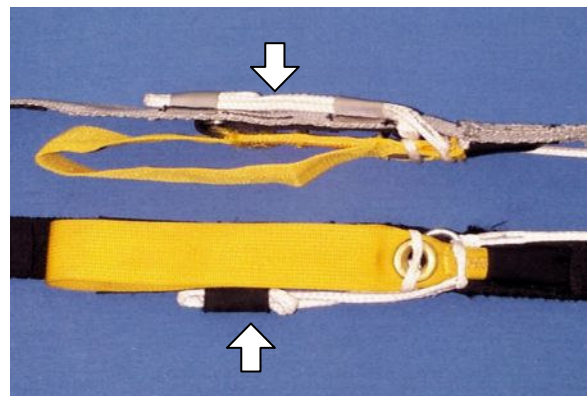


Figure 3. – Common methods of stowing excess steering line. Your risers may differ.

III. Preventing control system malfunctions (continued):

If the risers do not have line retainers, the following may be an acceptable method of stowing the excess steering line:

1. Cut a large or small rubber line stow band in half lengthwise. Thread the half rubber band through the fabric loop that connects the metal guide ring to the riser and secure it with a larks-head knot as shown in *Figure 4*.
2. Set the brakes as normal. S-fold the excess steering line and stow it in the half rubber band as shown in *Figure 5*. The S-folds should be made as short as possible to avoid leaving large loops of line exposed near the toggle.

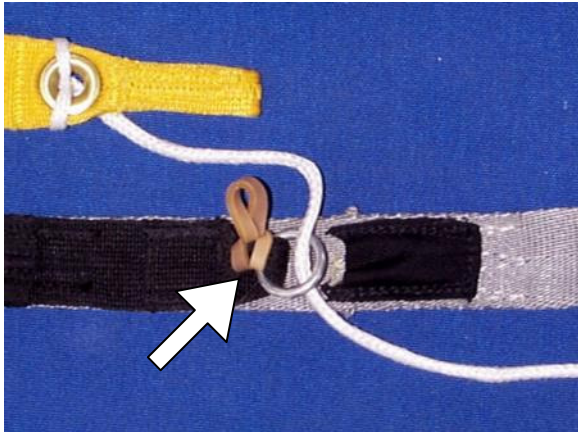


Figure 4. – Attaching the half rubber band.

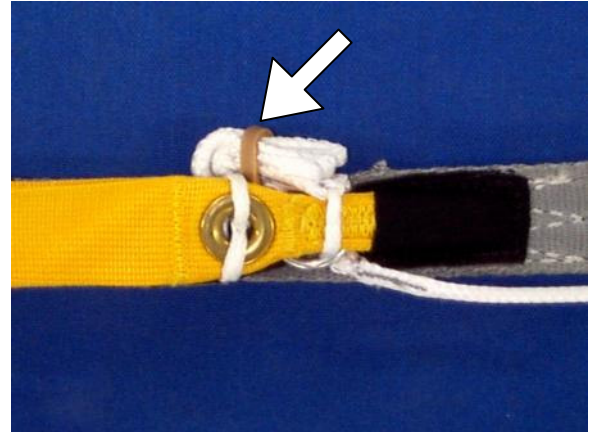


Figure 5. – Excess line stowed in rubber band.

Several methods of stowing the excess steering line, although commonly used, can potentially cause a steering line entanglement as described in Section II of this document. **We do not recommend using any method of stowing the excess steering line that involves passing that line through the space at the top of the risers or through the connector link itself, as in the examples shown in Figures 6 and 7 below.** These methods may increase the chances of the excess line entangling with the slider, connector links, or some part of the riser assembly. If Performance Designs' removable soft links ("Slinks") are used, these methods may allow the excess line to entangle with the tab on the Slink; **however, these methods can increase the possibility of entanglement even if metal "Rapide" links are used, the Slink tabs are tacked in place, or Slink Riser Covers are used.**

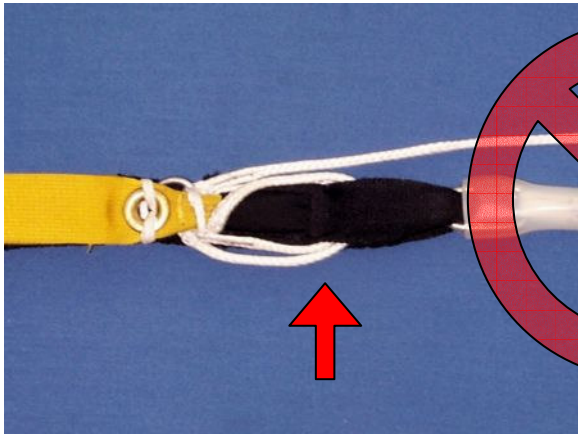


Figure 6. – Excess line stowed **incorrectly**.

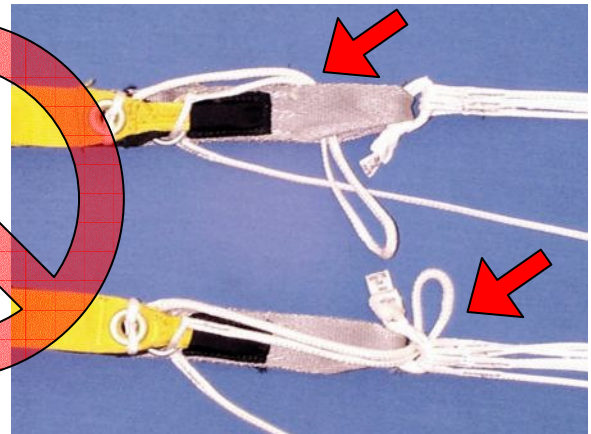


Figure 7. – Excess line stowed **incorrectly**. See Section IV for information about position of Slink tabs.

IV. Additional information about PD Slinks:

PD removable soft links (“Slinks”) have a fabric tab that allows them to be installed and removed by hand without using tools. **This tab must remain inside the riser as shown in Figure 8 below.** Allowing the tabs to stick out from the sides of the risers may cause abnormal wear which can lead to unexpected failures. This also creates a potential area for lines to become entangled.

The *Installation Instructions* included with each set of Slinks state that the tabs should be positioned inside the risers during the first 15 – 20 pack jobs after the Slinks are installed. The Slinks will then develop a “set” with the tabs in the correct position.

Slink Riser Covers (SRC’s), shown in *Figure 9*, were designed for jumpers who want to leave their sliders at the top of the risers after opening. These covers prevent the slider from sliding down past the tops of the risers, but they also help keep the Slink tabs in place. SRC’s are included with each set of Slinks.

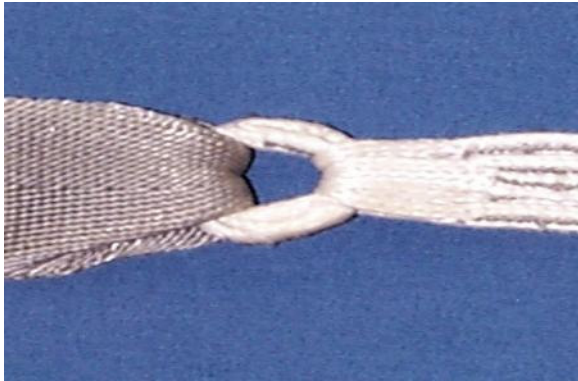


Figure 8 – Slink tab in correct position.



Figure 9 – Slink Riser Covers.

It should not be necessary to tack the tabs in place if the Slinks are allowed to set properly as described in the *Installation Instructions*, or if Slink Riser Covers are used. However, we have found that some risers constrain the Slink tabs better than others. If you find that your risers do not keep the Slink tabs constrained well enough, you should have the tabs tacked. This operation should be performed by a rigger or other qualified person in the following manner:

The Slink tabs may be tacked using a single turn of waxed hand tacking cord, 50 to 100 lb. tensile strength.

The tack should pass through the **identification label** on the Slink tab and be secured with a surgeon’s knot and overhand locking knot, with the knot on the inside face of the riser (*Figures 10 and 11*).

The Slink must still be able to move up and down slightly, so that the Slink itself loads against the riser without the tack loading when the canopy deploys.

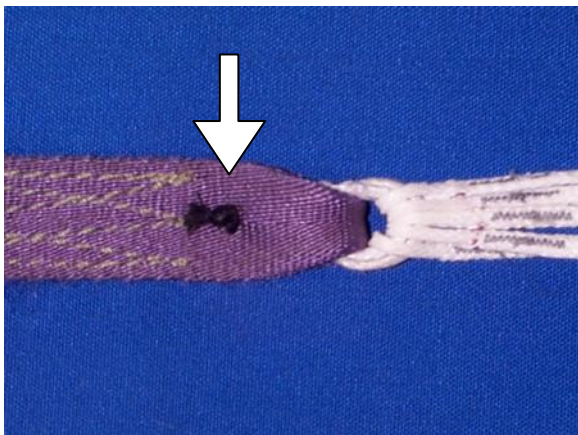


Figure 10 – Tacking the Slink tab.

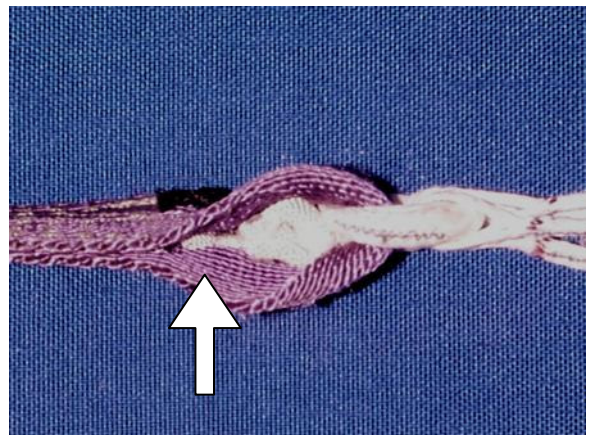


Figure 11 – Tacking the Slink tab (side view).

V. Conclusion:

Setting a canopy's deployment brakes correctly, which includes the proper stowing of the excess steering line, is an important part of the packing process. Failing to do this correctly may cause a control system malfunction or other type of equipment malfunction.

Every time you deploy a canopy you must make sure it is fully controllable, with no unusual friction, binding, or drag on the control system. You must perform this check at a high enough altitude to allow the use of proper emergency procedures if necessary. Many jumpers do not perform control checks on every jump, and some even wait to release their brakes until they reach a fairly low altitude. If you do not perform a full controllability check after opening, or if you wait to reach lower altitudes before releasing your brakes, you may not discover a control problem in time to respond correctly.

If you need to let go of your toggles in flight after releasing the brakes, you should place them on the risers against the guide rings before releasing them from your hands. Letting go of the toggles suddenly while they are pulled away from the guide rings may allow the toggles or steering lines to entangle with part of the riser assembly or some other object.

A misrouted steering line, entangled steering line, or any other type of problem involving the control system may severely limit your ability to control the canopy and should be considered a serious, life-threatening malfunction. As with any malfunction, you must follow proper emergency procedures if you experience this situation. Jumpers have been severely injured and killed while attempting to land canopies with malfunctioning control systems. Even if you are using a canopy size or wing loading that is considered "conservative," you may be severely injured or killed if you attempt to land a canopy that you cannot fully control.

You should understand how to properly use every component of your parachute system, and understand any instructions, manuals, or other information supplied by the manufacturer. If you have any questions about a particular component of your parachute system, seek the advice of a qualified rigger or contact the manufacturer. If you have any questions concerning canopy deployment, canopy control, or emergency procedures, ask a qualified instructor for assistance.