head rush technologies

HEAD RUSH TECHNOLOGIES WHITE PAPER

WEBBING RETRACTION

MAY 2017

Head Rush devices utilize unique magnetic braking technology to create thrilling and reliable adventure experiences. The magnetic braking regulates the release of the webbing, but what about webbing retraction? Our TRUBLUE Auto Belay requires retraction to allow a climber to ascend a route, our zipSTOP Zip Line Brake requires retraction to reset the brake trolley, and QUICKjump and FlightLine Free Fall rides require retraction to pull the tether back up and allow the next participant to leap. The retraction spring is responsible for retracting webbing, however it is not the only aspect of the device that may affect retraction. This white paper will outline information to help resolve inconsistent webbing retraction as well as an in depth look at the retraction spring.

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MY WEBBING WON'T RETRACT

There are a number of factors to consider if you are experiencing inconsistent webbing retraction. A simple test can determine if the issue can be resolved in the field, or if your device may need to be serviced.

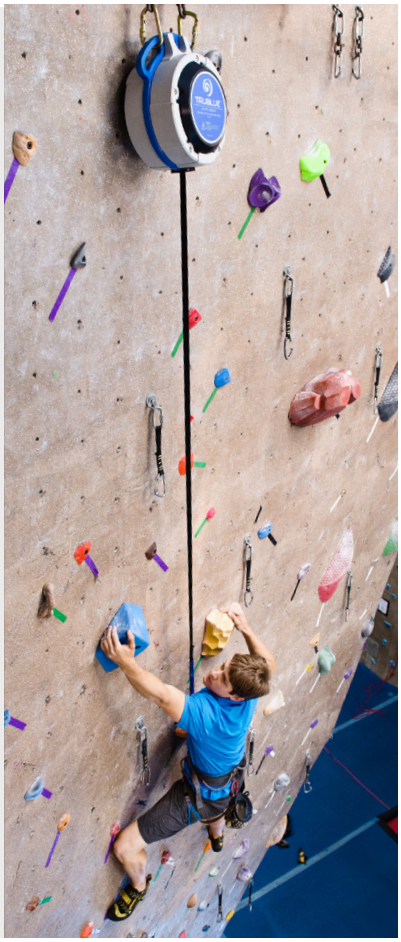
Troubleshooting

Head Rush devices are built to be very robust and typically retraction issues can be diagnosed in the field. There are three easy tests to determine what is causing the issue:

- Slowly pull webbing from the device. Is there resistance?
- When the webbing is extended, hold the webbing and feel for tension. Is there tension?
- Fully extend the webbing and release it. Does the webbing retract into the device?

Head Rush devices are built to be very robust and typically retraction issues can be diagnosed in the field

If the answer to ANY of the above questions is "yes", there are several steps you can take to likely resolve the issue in the field. However, if the answer is "no" to all three, the retraction spring may be broken. Immediately remove the device from use, and send it to your Head Rush Technologies Service Center.



Likely Causes

Below are possible causes for incomplete retraction. If you follow these directions and still have issues with webbing retraction, remove the device from use and contact your Head Rush Technologies Service Center:

- **LOOSE WEBBING STACK**: A loose webbing stack often occurs when webbing retracts into a device with little to no tension. As the webbing spools within the device, tension is required to synch down the webbing to insure consistency in the stack. If there is limited tension during retraction, the stack may become loose resulting in dead space and an inconsistent stack. Luckily, it's easy to fix this issue. How to reset the webbing stack:
  - First, fully extend the webbing. Next, allow it to slowly retract while maintaining constant tension on the webbing. Maintain tension on the full length of the webbing until it is fully retracted. This will ensure the webbing stack lays flat inside the drum without any dead space. Do this any time poor retraction is suspected or incomplete retraction is noticed.
  - If the webbing still does not fully retract after three (3) attempts of resetting the webbing stack, remove the device from service and contact Head Rush Technologies or your Head Rush Service Center.
- **WIND**: Wind can play a large factor in incomplete retraction. Outside installations in windy areas may experience slow or incomplete retraction due to wind resistance.
  - If operating in a windy environment, operators adjacent to the device can provide tension to the webbing to help it retract. Never manually feed webbing into the device.
- **WORN WEBBING**: A much more serious cause for incomplete retraction may be worn webbing. Torn or frayed strands can cause the webbing to jam in the nozzle, inhibiting retraction. Inspect webbing daily and replace when wear or damage is seen. Complete webbing inspection details are in the device's Operators Manual.

SHOWN: QUICKJUMP FREE FALL DEVICE RETRACTION SPRING

WHAT IS A RETRACTION SPRING?

A Retraction Spring, commonly referred to as a power spring or mainspring, was originally developed for watches and clocks that required winding. As the clock is wound, the retraction spring twists tighter, resulting in energy being stored in the spring. As time goes by, the retraction spring unwinds itself, powering the hands to move until the clock needs to be wound again.

Currently, power springs are used for thousands of applications, not just clocks. Head Rush Technologies uses a power spring, aptly named a retraction spring, to retract the webbing into our devices. Whether the retracting webbing follows a climber up a route, resets a zip line brake trolley, or lifts a free fall tether after a participant has jumped, all Head Rush Technologies devices rely on a retraction spring. Just like a clock's spring is wound, the retraction springs in Head Rush devices are tensioned by Head Rush service technicians during manufacturing and during service.

HOW DOES THE RETRACTION SPRING WORK?

During operation, the retraction spring sits within a device in an enclosed spring drum. The retraction spring is fixed to the central shaft and to the outside perimeter of the spring drum.

When webbing is pulled from the device the spring drum begins to rotate around the central shaft resulting in energy being stored in the spring (like winding a clock). When the webbing has been extended and the operator or patron is ready to let the webbing retract, the retraction spring will begin to use its stored energy. The energy causes the retraction spring to unwind, which in turn rotates the spring drum the opposite direction. The rotating spring drum causes the webbing to retract back into the device by spooling the webbing around the central shaft.

RETRACTION SPRING LIFE

Retraction springs have an extremely high cycle life. However, like most mechanical devices, they may eventually wear out. Therefore retraction springs are replaced during recertification when certain wear limits are seen by the technicians.

Retraction springs have an extremely high cycle life

Retraction spring life is dependent on multiple factors, however the primary factors are the number of cycles and webbing extension distance. If the webbing is only extended to 50% of its max extension, it will result in longer retraction spring life (number of cycles) than if it were extended fully. The shorter the extension of the webbing, the longer the life expectancy (number of cycles) of the retraction spring. Therefore, Head Rush Technologies recommends not extending the webbing past the necessary operational length and to make sure the webbing is not extended beyond the lengths listed in the product manual (mounting height from nozzle to ground for the TRUBLUE, QUICKjump and FlightLine, and maximum braking distance for the zipSTOP and zipSTOP IR).

For example, if a climber is clipped into a TRUBLUE, it is not recommended to let the climber walk away from the route while clipped in. This will cause the webbing to fully extend or to over extend. While the retraction spring is designed to withstand full extension, it will decrease the life expectancy.

Broken retraction springs occur rarely. If this does happen the webbing will no longer retract into the device, or in the case of the zipSTOP, the brake will not reset. The device must be immediately taken down from service and sent to a Head Rush Technologies Service Center for repair. It is important to understand that the retraction spring is independent of the eddy current braking system and the braking system is not hindered by a broken retraction spring. The braking system will still engage if there is sufficient webbing still wound inside the device.

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How Mounting May Affect Retraction Spring Life

Head Rush recommends static mounting points for all our devices. Examples of static mounts include belay bars, steel I-beams, and wooden poles. Do not confuse a static mounting point with a rigid mounting system, though. The TRUBLUE, QUICKjump, and FlightLine devices should be able to move and rotate on their mounting hardware while the mounting point or structure is rigid.

Head Rush realizes that static mounts are not always viable. While Head Rush allows non-static mounts that meet all necessary requirements, it should be noted that mounting a device in such a way may decrease the life of the retraction spring.

The most common, but not the only, example of a non-static mount is a horizontal cable. A non-static mount will cause excess "bouncing" of the device during operation. The bounce is caused by the release of tension that occurs in the webbing when braking has ended (rider reaches the ground or has been successfully stopped on the zip line). Once the tension in the webbing is released, the non-static mount acts similar to a spring and causes the device to bounce up and down or side to side. The bounce not only rattles and shakes the device, which can create excess fatigue, but it significantly increases the number of cycles the retraction spring experiences. Each bounce causes the webbing to extend and retract. Even though the webbing extension is short, each bounce is adding another cycle to the retraction spring.

Webbing retraction is a key part of all Head Rush Technologies devices

In order to eliminate the excess cycles caused by bouncing, mount the device to a static mounting point. Or, if the device must be mounted to a non-static mount, make the mount as static as possible.

CONCLUSION

Webbing retraction is a key part of all Head Rush Technologies devices. The retraction spring is responsible for webbing retraction and is an extremely reliable component. There are multiple factors to consider if a device is having retraction issues, and action can be taken to identify and potentially resolve some of the underlying causes. Hopefully this white paper helps to diagnose and answer your webbing retraction questions.