



HEAD RUSH TECHNOLOGIES WHITE PAPER

zipSTOP Manual Update

November 2018

In an effort to provide the most comprehensive tools to mitigate risk for customers, Head Rush Technologies has recently released a new manual for all zipSTOP zip line brakes. The requirements of this new manual and subsequent editions will affect all new zipSTOP Installations using product purchased after November 8th, 2018.

Since the initial launch of the zipSTOP zip line brake Head Rush has continued to test the product line and develop best practices to enhance the overall usability and effectiveness of the zipSTOP brakes. The new manual has been split into Installation and Operations manuals for ease of use by the parties responsible for different phases of design, installation, and operation. An overall simplification and clarification of requirements and supporting images was one of the main driving forces of the manual re-write, as was the launch of the zipSTOP SPEED. Another large contributing factor was the Head Rush zipSTOP Installer's Course, where much is learned about the inner workings of the devices and how that relates to real world installation and performance.

In the chart below many of the more impactful changes have been summarized, and as always please find and read the latest version of all our manuals at: <https://headrushtech.com/resources/manuals.html>

zipSTOP Manual Changes

Type of Change	Previous Manual	New Manual	Reason
Nomenclature	Serious Injury not defined.	"The threshold for a serious injury includes any of the following: fractures, amputations /dismemberment, permanent loss of the use of a body organ / member / function / system, injury likely to lead to permanent loss or reduction of sight, any crush injury to the head or torso causing damage to the brain or internal organs, serious burns, any scalping, any loss of consciousness caused by head injury or asphyxia, significant disfigurement, loss of a fetus, or other significant injury / illness that requires immediate admission and overnight hospitalization and observation by a licensed healthcare professional. Serious injury is also commonly determined by the Authority Having Jurisdiction; the more conservative definition applies. Definition from EN15567 and ASTM F2959"	Provide clarity on minimum threshold.
Information/Requirement Addition	Use of an independent EAD is required.	Further clarity regarding necessary function of an EAD: must prevent serious injury, make the system fail-safe, must be rated for rider weight/arrival speed range, tested by a qualified person in accordance with ASTM 2959.	Provide additional information and clarity on EAD function and requirements.
Standard Compliance	N/A	All zipSTOP models comply with ASTM F2959-18 and F1193. Certification statement with serial number reference added to back cover page of Installation Manual.	F2959 is prevailing standard, all requirements have been satisfied.
Nomenclature	Not specified	Operating Envelope - the documented set of limits and conditions which zip line operations must stay within to ensure proper operation of the zip line and braking systems. The operating envelope must include criteria to prevent and overspeed. An operating envelope may include such criteria as maximum allowable wind velocity/direction, min/max rider weight, rider position, etc.	Defining operating envelope more clearly conveys that there are limits of operating that account for many variables.
Requirement Addition	Device weight, speed, other limits specified.	"The documented operating procedure must include provisions and procedures to prevent operation outside the operational envelope. This should include, but is not limited to: wind speed, wind direction, environmental and other conditions which effect the arrival speed or other established limits."	Ensuring provisions and procedures are in place to prevent overspeed (or exceeding other limits) are necessary.
Removed Specification	Maximum Speeds of ZS125-08 note 3:1 and custom ratios	3:1 and custom ratios removed. 3:1 explicitly prohibited.	3:1 superseded by ZS Speed. Custom Ratio not relevant.
Information Addition	zipSTOP base could only be mounted with thru bolts	zipSTOP Base can be attached with thru bolts, ratchet straps, metallic banding, etc.	Ratchet straps and metallic banding have been proven to be good mounting options when installed per manufacturer's instructions.
Requirement Addition	Type: no restrictions	"In order to meet all redirection rope requirements, gorilla rope or a direct equivalent kernmantle construction (sheathed) rope with a balanced, braided core of ultra high molecular weight polyethylene meeting all requirements must be used."	Gorilla rope or direct equivalent required.
Requirement Modification	Redirection Rope Maximum Diameter: 10mm, 6mm recommended	Redirection Rope Maximum Diameter: 6mm	Gorilla rope or direct equivalent required.
Requirement Modification	Material/construction: no restrictions	UHMWPE Core balanced/braided kernmantle construction. Aramids explicitly forbidden.	Gorilla rope or direct equivalent required. Aramids are a poor choice for the application and cannot be adequately inspected.
Requirement Modification	All models, minimum strength = 13 kN	All models, minimum strength = 18.7 kN	Gorilla rope or direct equivalent required
Requirement Modification	Redirection rope Stretch quantification: <3% at 13 kN, <4% at 15 kN	Replaced with "low stretch / static"	Stretch quantification information often not available from manufacturer. Ropes frequently classified as low stretch or static have sufficient performance.
Requirement Modification	No material restrictions	Aramids not allowed	Aramids are a poor choice for the application and cannot be adequately inspected.
Requirement Modification	No restrictions	"In order to meet all requirements, the Head Rush Technologies' Redirection Pulley or a direct equivalent which is compatible with the redirection rope and meeting all requirements must be used."	HRT Redirection Pulley or direct equivalent required.
Requirement Modification	Not specified	Pulleys must have a minimum breaking strength of 15 kN	HRT Redirection Pulley or direct equivalent required. Not previously addressed. Specification in accordance with EN12278: Mountaineering Equipment - Pulleys - Safety Requirements and Test Methods

Requirement Modification	Not specified	"Pulleys with any sheave to side plate gaps, sharp edges or other features that are susceptible to binding, snagging, entanglement and rope damage are not permitted."	HRT Redirection Pulley or direct equivalent required.
Requirement Modification	All models: Primary anchor point In-line Braking Load = 6.0 kN	Primary anchor point In-Line Max Operational Load = 2.5 kN. "These values do not include a factor of safety and it is up to the responsible party to ensure an adequate factor of safety on the anchorages or structures is implemented as required by applicable design requirements or local, federal, state, or other regulations."	Modified to reflect max operational load with responsible party determined factor of safety
Requirement Modification	All models: Secondary Anchor Point In-Line: 11.0 kN, Right Angles: 3.5 kN	Model requirement below, "These values do not include a factor of safety and it is up to the responsible party to ensure an adequate factor of safety on the anchorages or structures is implemented as required by the authority having jurisdiction." ZS125-08 1:1 Ratio In-line = 4.7 kN, Right Angles = 1.4 kN ZS125-08 2:1 Ratio In-line = 3.8 kN, Right Angles = 0.6 kN ZSIR150-20A 1:1 Ratio In-line = 3.8 kN, Right Angles = 0.6 kN ZSSD150-20A 1:1 Ratio In-line = 3.2 kN, Right Angles = 0.4 kN	Modified to reflect max operational load with responsible party determined factor of safety
Requirement Modification	"Ensure that the zipSTOP braking line is fully retracted into the zipSTOP device at brake initiation."	"...the webbing should not be extended from the zip-STOP by more than 1m [3.3 ft] when the facility maximum weight is hanging at the reset position. On an unweighted zip line, prior to a rider descent, the braking line may be extended from the zipSTOP a maximum 0.3m [1ft]."	0 extension while maintaining tension in redirection ropes and for zip cable deflection due to rider weight is challenging. A small amount of extension is permissible.
Specification Addition	N/A	Greyed area to braking distance charts added to show area of potential abrupt braking, higher g-load and swing up. Areas in the grey region should be tested and evaluated as part of ride commissioning.	Information in addition to Badmin line. Because brake performance varies between installations, installers should be cautious here.
Requirement Addition	N/A	A zipSTOP which does not achieve reliable, automatic reset is not configured correctly and must not be commissioned for use. Use of supplemental systems which add resistance to the braking function, such as counterweights, or clotheslines, etc. are prohibited.	Previously manual reset was allowed. Addition of supplemental systems affects zipSTOP performance, adds complexity and should be unnecessary.
Requirement Addition	N/A	Cannot send more than one rider simultaneously	Not previously addressed.
Information Addition	"Fixed support pulley(s) can be used to ensure that Redirection Lines are kept free and clear."	Section on Fixed Support Pulleys added with illustrative graphics. Position relative to maximum webbing extension noted.	Section added for succinct explanation. Graphic added for information.
Information Addition	N/A	Example graphics of 2:1 configuration methods added for information.	Previously left up to designer/installer to configure. Additional information provided for reference only.
Information Addition	N/A	Alternate mounting configurations added for information/reference only (graphics): vertical mount, non-terminal mount.	
Information Addition	N/A	Chart on how to adjust braking performance added	Succinct explanation of adjusting performance provided for information.
Requirement Addition	N/A	Arrival speed measuring equipment must have an accuracy within +/- 4 kph [2mph].	Accuracy of arrival speed is critical to ensuring device limits are not exceeded. Use of smart phone based GPS applications is common but not capable of reliably or accurately capturing this information.
Requirement Addition	N/A	When used as a primary braking system, in order to maintain independence between braking systems, the zipSTOP cannot tether to or be used to reset the EAD or other components.	Not previously addressed. Provision to ensure independence between EAD and zipSTOP primary brake. Lack of independence is lack of redundancy; i.e. if an EAD is dependent on the zipSTOP to reset and the zipSTOP fails to reset so does the EAD and both brakes are susceptible to a single point of failure.
Requirement Addition	N/A	Facilities utilizing a zipSTOP must have and follow a documented operational and training procedure which addresses all necessary tasks for proper operation, maintenance, inspection, safety, rescue etc. This document must take into account all items within this manual as well as any item pertaining to site specific requirements, safety and rescue.	Proper operation of the zipSTOP requires several steps be followed by operators. The presence of a documented procedure and ensuring that procedure is adequate and followed is a critical mitigation method to preventing improper operation and missed inspection steps.
Information Addition	N/A	Qualification of the entire zip line ride including establishing operational limits	It's the customers responsibility to ensure the zipSTOP is being operated within its limits
Requirement Addition	N/A	Riders must descend one at a time	the zipSTOP is designed to brake 1 participant at a time

Requirement Modification	"ALWAYS OPERATE WITH RIDER FACING FORWARD UPON ARRIVAL INTO THE ARREST ZONE. Serious injury due to upswing may result if rider is not in the forward-facing position. Arrivals without orientation control should be verified such that minimum and maximum rider weight patrons cannot come into contact with the line, brake trolley, or other equipment during deceleration when arriving backwards uncontrolled."	"Non-forward facing arrival may result in riders' heads being in closer proximity to the zip line. Serious injury due to upswing may result if rider is not in the forward-facing position. When the possibility of non-forward-facing arrival exists, ensure riders cannot come into contact with the zip line, brake trolley or other equipment during deceleration."	Slight modification of language - removal of "always" statement. Intention remains the same - ensure riders cannot contact components due to swing up during braking.
Requirement Addition	N/A	Operating Procedure added with minimum step by step procedural requirements	Consolidate and summarize procedure that was not explicitly enumerated.
Requirement Addition	N/A	Records of daily inspection, service and component replacement must be kept	ACCT and ASTM require records to be kept for a certain amount of time - HRT now does too.
Requirement Addition	Not addressed	Devices subjected to overspeed require service by an authorized servicing agent. Cease operations immediately.	Not specified in past manual but communicated via other means (email, letter, etc.). Oversped devices may be damaged internally, not field inspectable; continued use may result in dangerous situations.
Information Addition	Environmental conditions mentioned as being factors but effects are not explicitly discussed.	Section Factors Affecting Braking System Performance added to discuss affects of environmental conditions, wind, temperature, wet/humid conditions, harsh environments, pivot height, etc.	Factors not previously discussed in depth. Further clarification and discussion added for further understanding.
Requirement Addition	Commissioning testing referenced, testing of primary and EAD required, procedure not specified. "Always carry out unmanned testing to determine actual braking distance. A number of other variables will affect the final performance of zipSTOP and must be taken into consideration when designing the complete zip line braking system... Line slope, EAD design, Friction, Weather conditions, Environmental Factors."	Minimum requirements for commissioning testing specified for primary braking system and EAD. Test data/results must be added to the commissioning report and retained by the owner/operator.	Test procedure specified to establish performance, including baseline, correlation, etc. This is a new section to the Installation Manual.