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Installing and Conditioning Rescue Hoist Cable

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Serving Helicopter Rescue Hoist Users Worldwide

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Purpose	Information	
Recommendation is Mandatory or Optional	Highly Recommended	

Purpose: Discussing the topics of cable conditioning, cable loosening and rescue hoist cable handling

The cable used on all rescue hoists is of a 19 x 7 construction. The 19 x7 is a cable construction that requires care when handling to prevent damage to the cable when installing it and when using it. It is critical to not impart any twisting into the cable when installing it, to avoid shock loads and to limber it up properly before applying a heavy load to it. A properly made cable meets the requirement of Mil-W-83140 which among other things requires the cable strands stay tight over its installed life. Due to historical factors many terms that are in use by the hoist OEMs are misleading and incorrect. As an example the act of salvaging a cable that does not stay tight has been incorrectly labeled as conditioning a cable by one OEM.

One rescue hoist OEM requires repeated lifts applying a heavy load while in flight to condition a new cable. The other only requires one lift after installing it. Neither requires installing the wire rope in accordance with common recommendations in the wire rope industry. As a result, it has become a common practice to apply a 600 lbs. load to the cable in flight immediately after installing the cable, but according to all of the wire rope manufacturer's literature; using a heavy load to condition a cable is an incorrect practice. The majority of the references require using a light load of between 2 % to 10% of the working load limit of the cable. The working load limit for a rescue hoist cable is 600 lbs. To summarize; According to the wire rope experts, the initial loads used to install and condition the wire rope should be between 6 lbs. to 60 lbs.

Below are some examples and evidence of these recommendations from the wire rope manufacturers.

1) From CASAR's Handling, Installation and Maintenance of Steel Wire ropes by Roland Verreet

"After the rope has been installed and before it is going to do its proper job, several run throughs of the normal operational cycle should be carried out under light load. The new wire rope should be "broken in", so that the component parts can settle and adjust themselves to the actual operating conditions. It is most unfortunate that in practice only too often the exact opposite of this recommendation is performed: quite frequently after installing the rope overload tests are carried out with loads beyond the safe working load of the system"

From the Bridon manual:

'Run in' the new rope by operating the equipment slowly, preferably with a low load, for several cycles. This permits the new rope to adjust itself gradually to working conditions.
Note: *Unless otherwise required by a certifying authority, the rope should be in this condition before any proof test of the equipment or machinery is carried out.*

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2) From UniRope Slingmax

After installing the rope and with the boom fully extended run the rope through its operating cycle several times under light load and at reduced speed. Repeat this with increasing load and speed a couple of times.
This allows the rope to adjust itself to the working conditions and enable all strands and wires too become seated. Make sure you unspool the entire rope length down to the 3 safety wraps to pre-tension or pre-tightening the rope to 5-10% of the rope's WLL. This may also be required after the crane has been working using only a portion of the rope length.
Ideally, you should disconnect the rope end after the break-in-period to allow any possible torque and twists which may have developed during installation and the break-in-period to be released at the end connection.
Note 5-10% = 30 lbs.- 60 lbs.

3) From the US Navy Wire Rope Handbook Volume III AD-A955 310

Once the new rope has been installed, it should be subjected to a break-in
period prior to being used in service. Time for this period should be •_.
allocated so that break-in is accomplished before the system is needed.
The rope should be run through several cycles in the unloaded condition, then through several more cycles under a light load. The rope should be run at reduced speed, and the load applied smoothly.
A slack condition should be avoided, as it can result in damage to the rope or equipment.
The purposes of this break-in process are to uncover functional problems in the system, such as improper reeving or faulty controls, which might lead to rope damage under full load; and to get the longest possible service life from the rope. Reeving under light loads allows the rope lay, core, wires, and strands to set properly, resulting in a more efficient system. The rope lengthens somewhat (constructional stretch) and deforms slightly as it passes over the sheaves and drum.
2.10.

4) From PNNL

Pacific Northwest National Laboratory

Initial Cycle

After rope replacement and before returning the equipment to service, it is recommended that the hoist unit be cycled from maximum down position to maximum up position eight to ten times with 10% to 20% of rated load

5) From Wire Works (Bethlehem Steel)

Perform A Break-in Procedure

Perform a break-in procedure to achieve maximum service life. Run the new rope through its operating cycle several times under a light load at a reduced line speed. A light load is normally considered to be 10% of the working load limit. This allows the rope to adjust gradually to working conditions, enables the strands to become settled, and allows for slight stretching and diameter reduction to occur.

10%= 60 lbs.

Conclusion: Zephyr stands by its recommendation that the use of the Zephyr is an efficient and adequate way to install and condition a new wire rope on a rescue hoist, and safer and more cost effective than flying the helicopter and installing a heavy load in order to break it in, condition or season a wire rope used on the rescue hoist.

Use of the Zephyr may marginally improve the performance of a wire rope that does not stay tight as a result of incorrect manufacturing, but will not change the fact that the cable will continue to get loose as a result of the way it was made.

The Zephyr Operations Manual prior to this bulletin includes these statements'

Conditioning a new Wire Rope

RH cable conditioning is the process of acclimating the newly installed cable to the smaller diameter of the rescue hoist drum.

It is only required for new cables and is not effective at salvaging cables that do not meet the Mil-Spec and have loose outer strands. The loose strands may disappear temporarily but will soon return as soon as the cable is extended with no load on it.

Cable conditioning should be done with a low load and at slow speed, while gradually increasing the load up to the rated load.

Always extend with a low load of approximately 100 lbs. and at a max speed of 100 feet per minute in either direction

Perform 3 cycles

Extend at 100 lbs. then retract the cable at 100 lbs., then 300 lbs., then 600 lbs.

Then during the next flight extend the cable to full extension and retract under approximately 200 lbs. load. This procedure allows any twist that may have accumulated in the wire to be relieved and is considered the best practice by the hoist OEMs.

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Modified procedure

RH cable conditioning is the process of acclimating the newly installed cable to the smaller diameter of the rescue hoist drum.

It is only required for new cables and is not effective at salvaging cables that do not meet the Mil-Spec and have loose outer strands. The loose strands may disappear temporarily but will soon return as soon as the cable is extended with no load on it.

Cable conditioning should be done with a low load and at slow speed, while gradually increasing the load up to the rated load.

Always extend with a low load of approximately 20 -100 lbs. and at a max speed of 100 feet per minute in either direction

Perform 3 cycles

Extend at 20-100 lbs. then retract the cable at 100 lbs., then 200 lbs., then 300 lbs.

Then during the next flight extend the cable to full extension and retract under approximately 200 lbs. load. This procedure allows any twist that may have accumulated in the wire to be relieved and is considered the best practice by the hoist OEMs.

Handling a 19 x 7 cable when installing

The cable used on the rescue hoist has been selected because the application involves a single part line with the load attached to a swivel.

There are several reasons why a swivel is required in this application but the primary reason is to not impart twist into the cable if the load starts spinning. Imparting excessive twist into the cable has several severe consequences to the cable, such as loosening of the outer strands, or tightening of the outer strands, or the separation of the inner core wires from the outer strands. Any of these events will result in a permanently deformed cable that is not acceptable for use on the rescue hoist.

In order to obtain maximum life after installation the cable needs to be installed on the rescue hoist drum carefully and properly.

The cable should be rolled off of the storage drum or rolled out on the ground. The best practice is to unroll the entire roll of cable out on the ground, but this has the downside of the possibility of getting dirt into the cable or the possibility that the cable could be damaged by running over it or someone walking on it. Rolling the cable out in a straight line allows all of the twist to be relieved from the stored cable, and then as the cable is wound onto the rescue hoist drum the imparted twist that the rescue hoist drum creates is allowed to be relieved as the cable is rolled onto the hoist.

A more convenient method is to unreel the cable off of the storage drum and onto the rescue hoist directly. This should be done so the sense of rotation of the storage drum is the same as the sense of rotation as the rescue hoist drum. Afterwards the cable should be conditioned as stated above.

Proper Operation and Maintenance of the RHGSE

Speed

When using the Zephyr, it is important to understand the issue of twist in a 19 x 7 cable, and operate and maintain the Zephyr properly, so as not to impart twist into the cable with the machine. For a new cable one must start with low loads and then gradually increase the load. The speed of the extension, and the retraction should be limited. The reason for the limitation on speed is due to slippage between the capstans and the take up drum with a relatively stiff cable.

Torque

Check the torque of the take up clutch and keep an eye on the wear of the capstans. If the clutch is slipping at too high a value or the capstans are worn, then maintenance actions are required to adjust the clutch and or replace the capstans.

Repeated use with no hoisting in between use

It is not recommended to use the Zephyr repeatedly if the hoist has not been used in flight. The Zephyr is intended to help maintain the hoist in between flights, to reseat the cable, to clean, lubricate and inspect it, but repeated use without flying the helicopter and using the hoist is not considered good practice by Zephyr International LLC.

Hazards associated with using a 600 lbs. load rigidly attached to the cable

Shock Loads

As stated in all of the literature it is very important to avoid shock loading a 19 x 7 cable. But by attaching a rigid weight such as a concrete block directly to the hoist hook, the cable is likely to experience shock loads transmitted directly to the cable as a result of hoist accelerations, aircraft accelerations or as a result of sudden turbulence in flight. If a dead weight is used it should be attached to the hook with straps instead of directly to an eye bolt.

Swinging loads

If the load starts to swing the load transmits a large load at the end of each pendulum action of the cable. If the cable touches the airframe during the swinging, then severe abrasion damage to the cable and airframe may occur.

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Danger to ground personnel

If the load moves suddenly and while in the vicinity of personnel on the ground, they may be injured. If the load were to detach from the cable, then ground personnel may be in grave danger from falling debris.

Additional points regarding hoist and cable maintenance:

1) Salvaging a cable that repeatedly gets loose shortly after installation does not repair the cable.
2) The rescue hoist is designed to be used in flight and normal use should preclude additional periodic lifts of high loads as a maintenance action.
3) The cost to salvage a cable that repeatedly gets loose is more than the cost of a new cable.
4) Reseating a cable to insure the lower cable wraps are tight is a good practice that can be accomplished on the ground with the RHGSE.
5) Checking the full out limit switch functionality should be accomplished by use of the RHGSE on the ground.
6) Using the RHGSE also has the benefit of finding problems with the hoist system at the full out position before flight and eliminates the possible loss of the load in flight due to incorrect maintenance.

Dangers of loose strands

Loose strands do not take any load in a dynamic event, therefore the inner strands can be overloaded and break first, and then the loose strands break second.

Loose strands can catch on objects and be broken during a mission, thus effectively ending the hoist mission.

Broken strands require immediate termination of the lift or else risking fouling of the cable on the hoist drum and possible complete separation of the load as result of the cable being cut by jamming and crushing inside a hoist.

For any questions please call or email Mike Mitchell at mmitchell@zephyrintl.com phone 843-365-2675

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