Rescue Hoist Ground Support Equipment

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Introduction:

Helicopter rescue hoists use tension rollers to keep their wire rope tight on the drum. The tension rollers are driven to keep the wire rope under tension on the drum with a scrub roller or positive contact roller. The tensioning device relies on physical contact with the wire rope. The tensioning devices tend to milk the wire rope’s inherent looseness to the lower end of the rope and then the wire rope starts to unwind resulting in loose outer strands. The process of reeling the wire rope out with no load accelerates outer strand loosening on many hoists.

Historically hoist failures occur when the hoist is run under no load and the wire rope gets loose on the drum and fouls the rescue hoist mechanism. Because the tensioning systems that are in use today only provide approximately 7 to 20 lbs of force on the wire rope, the cable tensioning system can easily be overcome and the wire rope loosens up on the drum. This normally will not happen in flight but happens with regularity when the hoist is operated on the ground during inspections, maintenance etc. When a hoist wire rope loosens and fouls the hoist. The damage that results can cost thousands of dollars to repair and significant time with the OEM. In addition if the wire rope miswraps on the lower layers when winding and the operator does not see the miswrap the wire rope can foul in flight putting the crew and the mission in jeopardy.

Zephyr International LLC provides Rescue Hoist Ground Support Equipment that solves these problems for hoist users. The RHGSE provides these benefits:

- Maintains positive tension on the wire rope at all times.
- Reduces or eliminates premature loosening of the wire rope.
- Applies load over the entire length of wire rope on the rescue hoist drum as it retracts the wire rope with the aircraft on the ground. The full load tension is easily adjustable.
- Allows the wire rope to relieve its inherent twist as it winds on and off the hoist drum.
- Keeps the wire rope off the ground and in a protective enclosure during hoist maintenance.
- Allows one person to perform all inspections and maintenance operations in a minimum amount of time.
- Allows the inspections to be performed with the hook and bearing attached to the wire rope.
- Measures and provides a record of the wire ropes physical condition over its installed life.
- Installs new wire ropes and conditions them.
Technical Description:

The Zephyr RHGSE utilizes a hydrostatic drive to power dual capstans; using three revolutions of wire rope on the system to provide enough traction to apply 600 lbs to the rescue hoist. The hydrostatic power system is fully integrated on the RHGSE frame.

![Image](image1.png)

Figure 1

The RHGSE consists of the frame, hydrostatic drive, battery power and charging system, capstan tensioning device, dryer / lubricator, wire rope take up device, wire rope inspection system, wire rope length and load indication.

The entire RHGSE unit is integrated onto a mobile platform and an onboard charging unit maintains the charge in the batteries.
Theory of Operation:
The Zephyr RHGSE uses a dual capstan tensioning system to maintain tension in the wire rope when extending and applies loads adjustable to 600 lbs on the wire rope as it is retracted back into the rescue hoist. The capstan drive is sized to be slightly larger than the drums of the helicopter hoists therefore not reducing the fatigue life of the wire rope less than the helicopter hoist does. The dual capstan drive is timed to match the rotation of a take up drum.

The drive operates in the extend mode, by spinning as fast as the hoist on the aircraft allows; extending under a light load of approximately 50 to 150 lbs depending on the low pressure relief valve setting. When the operator switches the mode to retract, the hydraulic motor provides reactive torque to the wire rope via the capstans and a high pressure relief valve controls the load in the wire rope. Therefore the load is adjustable via two simple adjustments; the wire rope is always under tension when it is extending or sitting idle, and can be subjected to full rated load when the rescue hoist retracts it on to the drum.

The 302 stainless steel wire rope is paramagnetic as a result of cold working to form it into wire rope. Using magnetic sensors the Zephyr GSE can detect flaws in the wire rope quickly and record their location. This information is stored on a laptop computer provided by Zephyr.

The wire rope can be inspected upon the first extension of the hoist. In this way if defects are found the wire rope can be replaced without lost time or effort. The software allows the setting of limits to determine if a wire rope is in a questionable state. The software will show the operator that a fault was detected, and the operator can reverse the direction of wire rope travel and make a closer visual inspection. Training in the art of wire rope inspection is provided via a video supplied with the GSE. Additional training can also be provided at the user’s locations if desired. In addition, the data can be sent in real time to Zephyr International for a real time interpretation and a decision can be returned.

Figure 2 trace shows a broken wire.
The wire rope is collected in a powered rotating drum. The rotating drum allows the wire rope to spool in a manner so that no twist is induced. This storage method does not put any external forces into the wire rope as it is stored in the drum. In the event the hoist has been used over the sea or a dusty environment, the drum is filled with water to clean off the salt deposits, dirt and dust. This eliminates the need for multiple personnel to hold the wire rope off the ground during inspections. The rotating drum also insures the wire rope is not kinked or otherwise damaged during rewind onto the hoist on the aircraft.

The RHGSE will accommodate any installed rescue hook, hand wheel, crushable bumper or all three if they are attached to the end of the wire rope. The picture above shows the EC-145 hook installed into the take up drum spooler.

The ground support equipment cleans, dries and lubricates the wire rope as it is reeled back onto the helicopter hoist drum. The Lubridryer is not filled with oil for Breeze hoists, but for the Goodrich hoists the Lubridryer applies oil as specified by the manufacturer. To desalinate the wire rope, the dryer blows air over the wire rope as it comes out of the rotating drum filled with water, thus drying the wire rope. This will help prevent corrosion on the Breeze style hoists. With their non lubricated wire rope and aluminum drums they have severe corrosion problems. By keeping the cable dry and clean these problems are controlled.

An onboard lap top computer records the results of the inspections. The software records the rescue hoist identification, the date of the test, the results of the test, the amount of wire rope that was run, and the magnetic signature of the wire rope for future references. The MagSens inspection system provides a baseline of the wire rope when it is installed and then can compare the wire rope condition during future inspections.

The data files are small so this information can be downloaded to a central location via the internet for users with remote bases.
Conclusion:

The RHGSE saves the users money and time and prevents costly damage during ground inspections and maintenance.

The RHGSE saves the users money on replacement wire ropes that may not need replacement, or alternatively identify wire rope defects quickly and efficiently and prevent failure of the wire rope in flight.

The RHGSE maintains the wire rope and hoist mechanism in good working order by drying and lubricating the wire rope; Thus preventing corrosion problems much better than current practices.

The RHGSE allows data to be collected that will lead to improved safety during operations and improved logistics support.

The RHGSE provides a cost efficient Quality Control tool that documents the condition of the wire rope before the rescue hoist leaves the factory, leaves the hanger, or leaves the ground.

Depending on usage the RHGSE pays for itself in between 1-3 years in savings from technician time, helicopter flight time and wire rope replacement costs.