



ZGS-11300-1

Electric Rescue Hoist Ground Support Equipment Operation and Maintenance Manual

Electrically and Manually Operated

United States Patent # 7,429,031 B1



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Before operation of the Ground Support Equipment, thoroughly review the entire manual in order to prevent damage to the wire rope, hoist, helicopter or operator.

1.0) Introduction

The purpose of this manual is to describe the operation and maintenance of the Zephyr International LLC part number ZGS-11300-1 Electric Rescue Hoist Ground Support Equipment (RHGSE). This RHGSE can be electrically or manually operated. **Cautions are noted in red where required.**

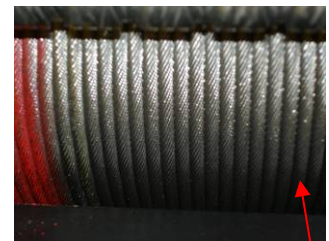
The Zephyr Electric RHGSE adapts the manual version of the RHGSE family to use available AC power to extend. The unit can apply the full rated load of the rescue hoist when it is retracting, and applies a 25 to 50 lb. load when extending. The RHGSE can be plugged into an available AC single phase power, 110 VAC or 220 VAC in the hanger.

2.0) Purpose of the Equipment

The RHGSE is designed to assist in inspecting and maintaining the rescue hoist and the wire rope on the ground.

Design Attributes:

- Man portable to and from the helicopter in order to perform pre and post flight checks, periodic inspection and maintenance of the wire rope and rescue hoist system.
- Allows one person to perform all inspections and maintenance operations in a minimum amount of time.
- Maintains positive tension on the wire rope as it extends and applies a heavy load over the length as it retracts, while protecting the wire rope in a rotating tub during hoist maintenance.
- Accommodates any rescue hook and bumper configuration.
- Cleans and dries the wire rope during post flight inspections after salt water use.
- Lubricates the wire rope if required by the hoist manufacturer.
- Specifically designed to season and tension the wire rope without having to fly the helicopter after a complete cable inspection.
- The RHGSE has been designed to provide approximately 610 lbs. maximum tension to the wire rope when retracting. It is balanced so that the center of mass is in line with the wire rope as it applies the tension.
- The system allows the operator to extend the wire rope from the rescue hoist electrically or manually. If the operator has AC power available, then the system is semiautomatic. Otherwise, if the system is used on the flight line it is necessary to manually crank the system to extend.
- The electrical drive system consists of a permanent magnet motor driven by an electronic controller and a 25-foot-long input power cord is provided.
- The AC power is turned on or off via a rocker switch on the RHGSE and also by two limit switches that are required to prevent retracting the cable with the motor drive engaged.



Maintains clean & tight wire rope storage on the rescue hoist drum.

Caution: Retracting with the motor drive engaged may damage the electronic control assembly.

The controller is set up to provide a constant tension while operating in a current limiting mode. Therefore, as soon as the extend switch is activated the system will pull on the cable with a constant tension and will extend at the speed the rescue hoist is operated at.

The potentiometer on the control limits the torque and is preset at the factory to 100 %. **There should be no reason to reduce the torque setting.**

Limitations

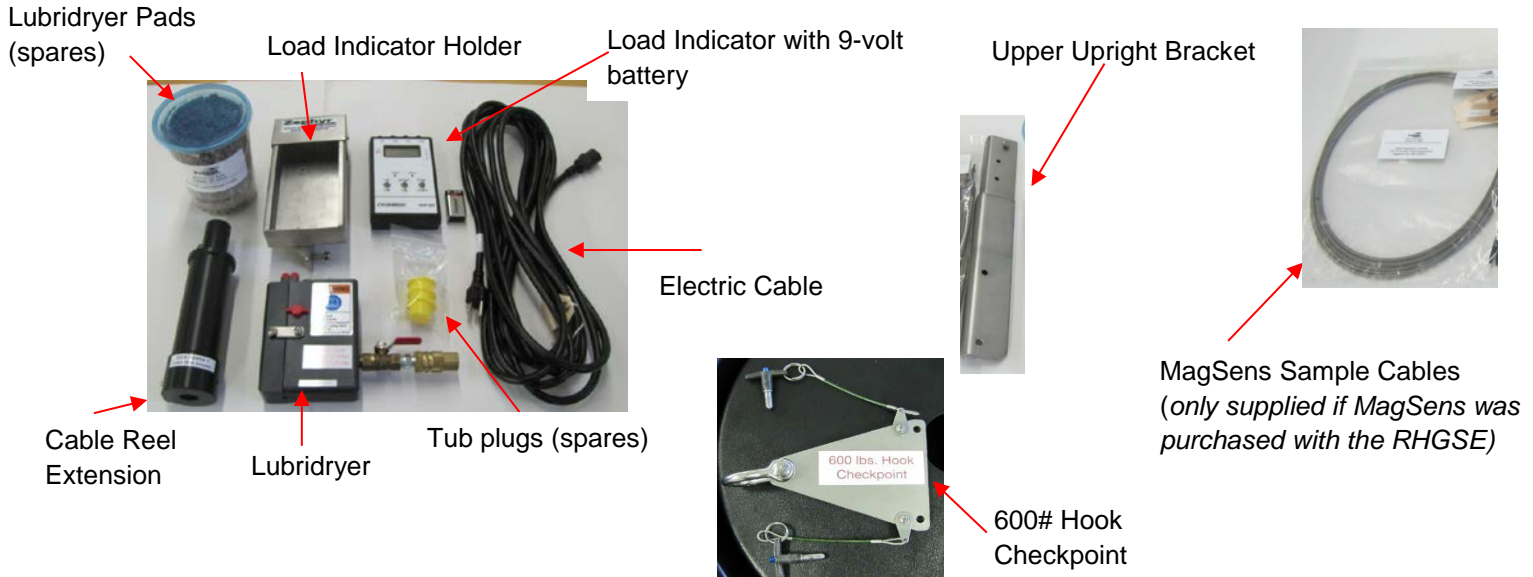
- The RHGSE uses a band clutch to generate the load in the cable in the retracting direction. The band clutch will get very hot. The GSE should not be used more than three times in a row without letting the band clutch cool down.
- The GSE is not to be used excessively at high loads without flying the rescue hoist and extending the cable as part of normal operations. Excessive use of the RHGSE without extending the cable in flight traps the twist in the cable.

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3.0) Unpacking the Equipment

The equipment is shipped in a sturdy plywood crate specifically designed to transport and store the RHGSE. The crate is designed to be opened by removing **ONLY** the screws that are marked “R” on the front and side panels and using the front cover as a ramp.

- Remove the screws that hold the wheel chock blocks.
- Cut the zip tie and pull the pin, then using the handle pull the RHGSE out of the crate and down the ramp. **Check to insure the wheel locks are unlocked as soon as the swiveling wheels clear the box.**
- Unlock the swivel locks in order to freely move the RHGSE around.
- Remove and unpack the parts stored in the Rotatub.



4.0) Setup the Equipment

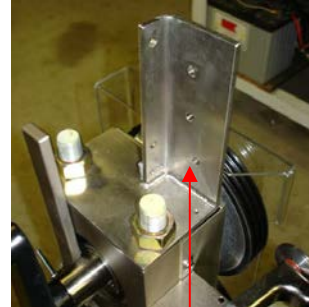
Remove the lubridryer, load indicator, load indicator holder, upper upright bracket, and 600 lbs. hook checkpoint from the Rotatub and unpack.



Lubridryer



Load indicator



Upright bracket



Upper Upright bracket

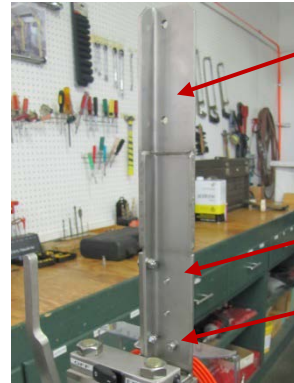
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600 lbs. Hook Checkpoint

Attach the Upper Upright Bracket to the inside of the Upright Bracket with the supplied (1) 1/4-20 x 3/4" long screw and locknut.

Note: Upper Upright Bracket may remain in place permanently



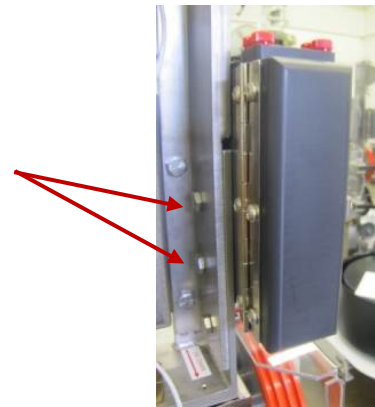
ZGS-10245-1 Upper Upright Bracket

Upright Bracket

Attach to this hole location



Attach Lubridryer and Load Indicator holder using the supplied hardware.



Thread the load cell wire through the cap of the load indicator holder and press the small grommet into the hole in the cap.

Install the supplied 9-volt battery, into the load indicator.



Grommet

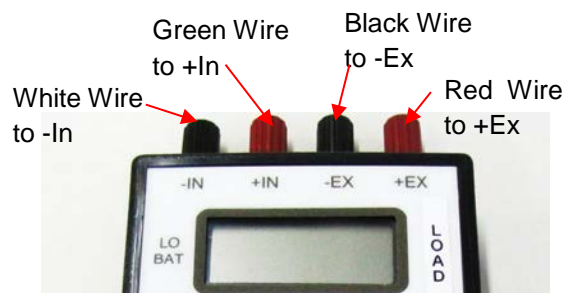
Load Indicator Holder Cap

Load Indicator

Load Cell Wire

Attach the wires to the load cell indicator as follows:

- Red wire = + Ex on meter
- Black wire = -Ex on meter
- Green wire = +In on meter
- White wire = -In on meter



Green Wire to +In

Black Wire to -Ex

White Wire to -In

Red Wire to +Ex

Insert the load indicator into the holder. Wrap the excess wires up and stow them under the cover and install the two screws.



Load Indicator

Load Indicator Holder



Attach into the two holes of the Upper Upright bracket using the Quick Release Pins.

Caution: ZGS-11443-1 Hook Check **MUST BE** removed from Upper Upright Bracket prior to wrapping the



5.0) Theory of Operation

The wire rope is paid off of the helicopter hoist and is wrapped three times around the capstans, and the rescue hook is positioned in a rotating tub. A spooler holds the rescue hook and establishes the starting position of the wire rope to achieve an even storage of the wire rope in the rotating tub. The wire rope is held firmly in the special grooving of the capstans by two tension roller assemblies. The tension roller assemblies are held open by pins when installing and removing the wire rope from the capstans. A transparent capstan cover is provided to enclose the capstans while in use. A limit switch on the capstan cover will disable the system operation unless the cover is closed.

Electrical Operation Extending

The RHGSE must be plugged into AC power, the operator then activates the extend switch, and then activates the pendant in the down direction.

Manual Operation Extending

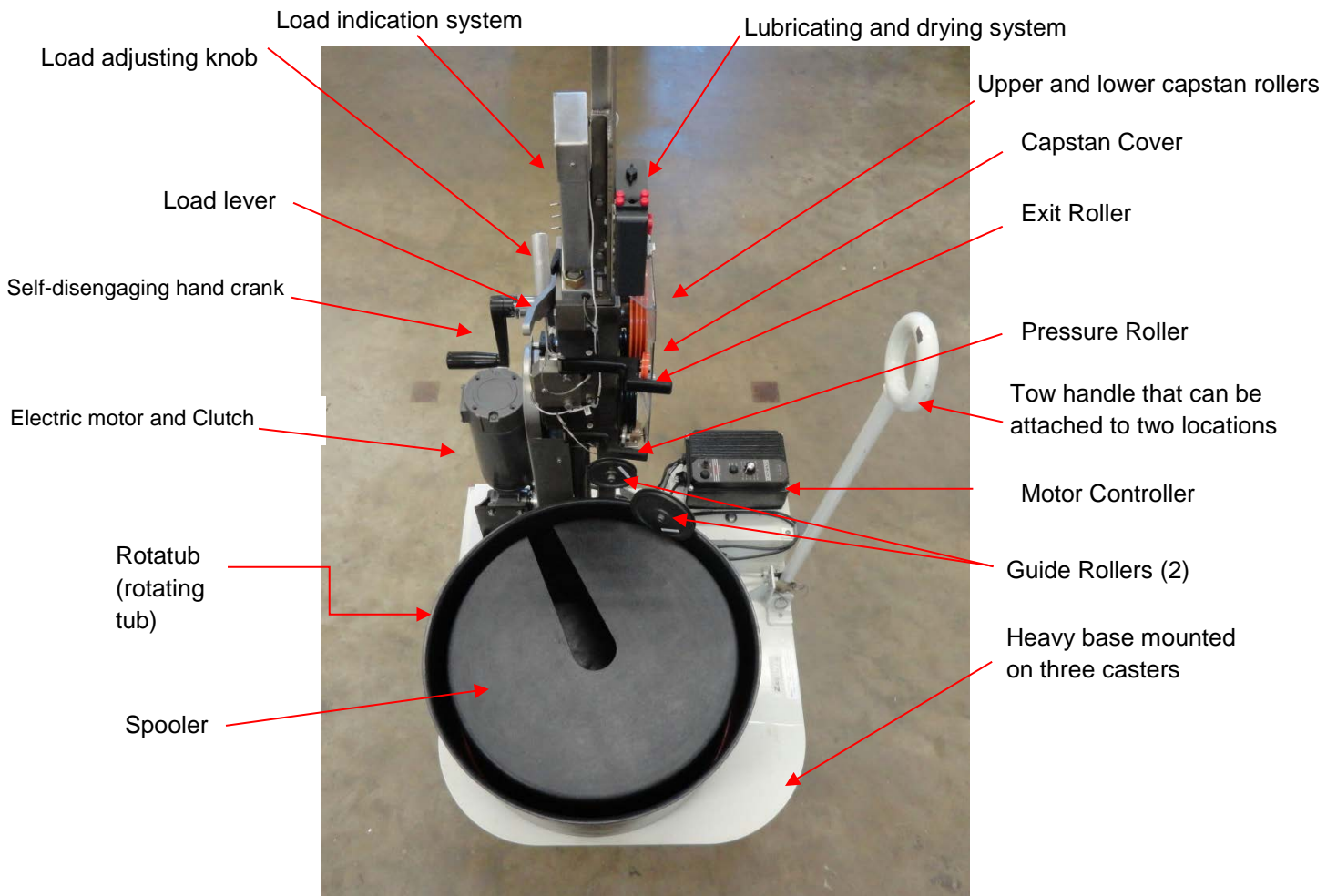
The RHGSE is manually operated by rotating the crank handle when the helicopter hoist is extending.

Retracting

When the operator is ready to retract they activate the reverse lever and adjust the load in the up direction using the load adjuster knob. A band clutch applies a back torque on the capstans to develop a heavy load in the wire rope when the helicopter hoist is retracting. The hand crank handle is self-disengaging so that when the RHGSE is used in the retracting direction the crank handle does not rotate. A load cell and display is used to measure the retracting load on the cable.

The rotating tub is mounted to a clutch that is adjustable to compensate for the taper in the spooler and tub. A set of pads installed in the Lubridryer clean the wire rope, and provides lubrication via an oil reservoir if required; the flow of oil from the reservoir can be started and stopped by a shut off valve. When the wire rope is to be cleaned using fresh water, the tub is filled with water and compressed air can be fed to a dryer located below the oiler to dry the wire rope as it is retracted from the rotating tub full of water. A ball valve has been added to allow the air supply to be shut off when not being used. Air pressure required is 30 psi minimum. After the cleaning is finished the tub is easily drained via a removable plug. The RHGSE can be used with different size wire ropes by changing the capstans. The RHGSE weighs 610 lbs. dry and is transported to the helicopter via a tow handle that is held in the upright position by a set of spring clips attached to the base. The tow handle can be attached to either side of the RHGSE as desired. A cable reel adapter is provided to facilitate installing a new cable into the rescue hoist.

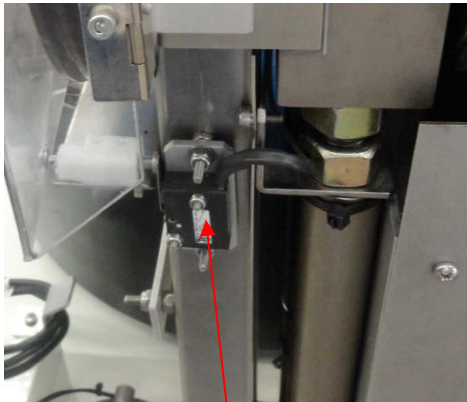
The RHGSE consists of:



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Safety Features

Safety Switches are provided to prevent electrical operation when the cover is opened or when the operator is retracting the cable.



Capstan cover limit switch



Extend Switch



Retract Switch

6.0) Operation of the Equipment

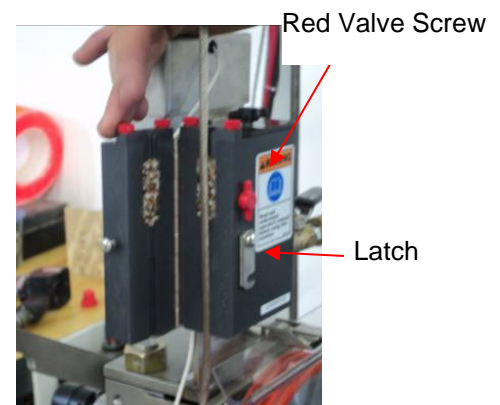
The operation of the RHGSE is straightforward, but rescue hoist maintenance requires strict attention to detail and situational awareness of the operation of the rescue hoist and the Electric RHGSE at all times during its use.

The Electric RHGSE operation involves:

- Attaching the wire rope to the system through the Lubridryer around the capstans and into the Rotatub.
- Setting the pressure roller and exit roller
- Adjusting the spooler position.
- Adjusting the Rotatub position fully clockwise to start.
- Energize the motor and operating the rescue hoist controls or cranking the handle to extend the wire rope in the down mode.
- De-energizing the electric motor drive when retracting.
- Actuating the load display, actuating the retract lever, and adjusting the clutch and operating the hoist in the up mode while observing the wire rope and the load on the wire rope.
- Using the Lubridryer to lubricate the cable, if recommended by the hoist OEM.
- Filling the Rotatub with water, if washing the cable is desired, and draining the rotating tub.
- Using the Lubridryer to dry the cable, after washing the cable.

6.1) Installing the wire rope in the Lubridryer.

Open the capstan cover and pay out approximately 16 feet of wire rope off of the helicopter hoist. Open the Lubridryer by flipping the latch up. Position the wire rope in the Lubridryer and close the Lubridryer by lowering the latch over the screw. After the cable is in position turn the Red Valve Screw counter clockwise 3 turns to allow oil to flow to the Lubridryer pads, if lubrication to the wire rope is desired.



6.2) Wrapping the wire rope around the capstans.

Position the hook down with wire rope going upwards in the Rotatub, as shown before wrapping the wire rope around the capstans. This is to allow the wire rope to twist in the hook assembly as it is wrapped around the capstans.

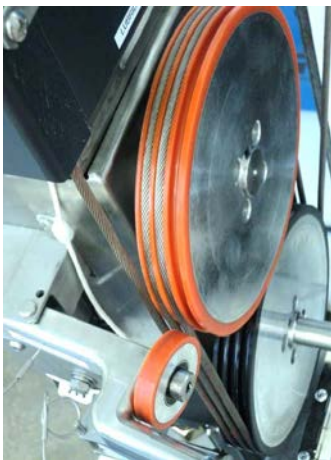
Wrap the wire rope around the capstans three times starting with the lower capstan innermost groove as shown, while insuring the rope is pulled tight into the capstan grooves.



Start wrapping the cable in the first groove of the lower capstan



Wrap around the first groove



Wrap around the second groove



Wrap around the third groove



Close the Lubridryer cover

6.3) Setting the tensioner arms

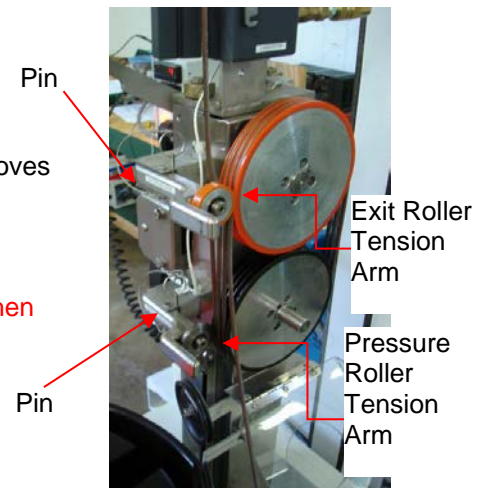
Remove the pins to apply the tension to the wire rope after it is wrapped on the capstans. Insert the pins into the pin storage hole in the tensioner base. Give a strong tug on the wire rope to insure it is imbedded in the grooves of the capstans.

Caution: If the wire rope is not wrapped tightly around the capstans it may loosen up and come off the capstans.

Caution: Insure that the exit and pressure tensioner rollers are engaged when extending the cable.

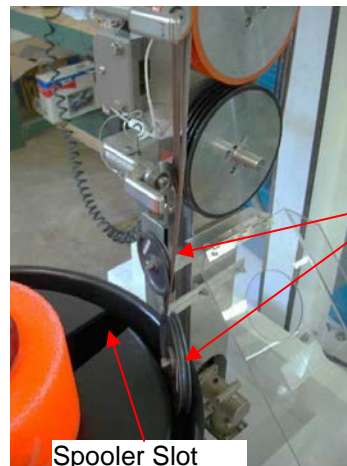
Guide the wire rope through the guide rollers and into the rotatub, then through the slot in the spooler.

Caution: Insure the cable enters the groove in the spooler at the base of the Rotatub





Set the hook on top of the spooler.



Spooler Slot

Guide Rollers

Turn the hook assembly upside down and position the cable in the slot of the spooler as shown.

6.4) Setting the Rotatub and Spooler orientation

With the wire rope wrapped on the capstans, in the rotatub, and through the guide rollers, rotate the Rotatub clockwise to remove any excess slack. The spooler can be relocated if required to adjust the relative position of the wire rope wrapped in the Rotatub to the capstans. This allows the user to adjust the relative wrapping of the Rotatub to the capstans if required for any reason at any time. If not enough wire rope is paid out from the rescue hoist to place the wire rope in the spooler correctly, run the hoist in the down direction while rotating the crank handle for a couple of feet to allow adjustment of the spooler in the correct orientation. Insure the cable is placed in the cable guide rollers as shown previously.

Once the spooler is in a good position push it down to firmly seat it in the Rotatub. Check to insure the wire rope is loosely sitting in the bottom of the slot in the spooler. Before operating the hoist, close and latch the capstan cover.

6.5) Actuating the load lever

When reeling out the load lever must be disengaged and when reeling in the crank handle should be disengaged and the load lever must be in the applied position to apply a heavy load to the wire rope. A limit switch on the load lever will disengage the motor drive in the retracting direction.



Shown is the load lever disengaged



Shown is the load lever engaged and crank handle disengaged

Load Lever

Hand Crank

Caution: Do not operate the rescue hoist in the up direction with the load lever disengaged and the extend switch actuated. Failure to disable the electric drive when retracting may damage the controller.

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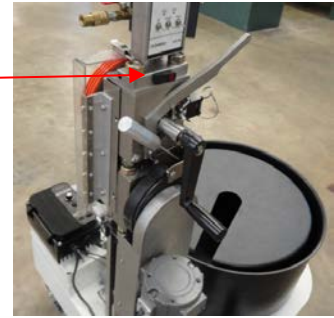
6.6) Running the rescue hoist in the down direction (extending)

Before extending, verify that the wire rope is properly installed on the RHGSE, the wire rope is wrapped tight on the capstans, and the cover is closed and latched.

Electrical Extending Mode

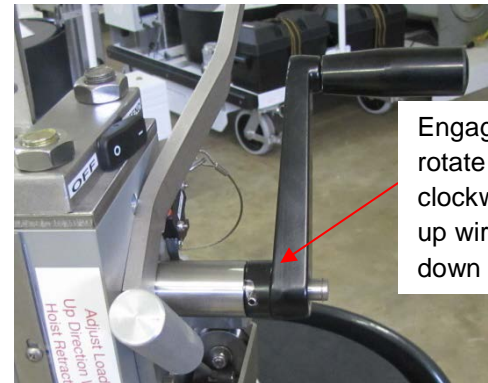
Activate the Extending Switch

Start running in the down direction, at a slow steady speed, while observing the wrapping of the cable on the capstans and the laying up of the cable in the Rotatub. The system will apply a constant torque via the current limiting circuit and the electrically activated clutch. The load has been preset to be approximately 30 lbs.



Manual Extending Mode

The RHGSE can be operated in the manual mode if electrical power is not available. With one hand operating the hoist control pendant use the other hand to engage the slots in the handle with the pin on the shaft to rotate the crank handle in the clockwise direction to develop a small load in the wire rope. Actuate the pendant to start the hoist running in the down direction. Start cranking slowly and observe the wire rope to insure it is completely seated in the capstan grooves. If it begins to loosen on the third groove of the top capstan, stop and pull the wire rope down into the capstan groove and then continue. Run the hoist in the down direction at a speed that allows you to observe the hoist while cranking in the clockwise direction comfortably. Do not allow the wire rope to get loose while extending. Extend the wire rope completely; always paying careful attention to the helicopter hoist and to the condition of the wire rope. If the wire rope snags in the Lubridryer pads for any reason such as a kink or a broken wire or broken strand; the wire rope will loosen between the top of the Lubridryer and an increase in crank resistance will be felt. In this event, the wire rope needs to be replaced; run the wire rope out into the drum and follow the manufacturer's instructions for replacing the hoist wire rope. Absent any deficiencies noted during inspection, run the hoist in the down direction until the helicopter hoist is stopped by the full out limit switches.



6.7) Running the rescue hoist in the up direction (retracting)

The wheel brakes on the RHGSE should be unlocked to allow the equipment to center itself under the hoist.

Caution: Retracting with the motor drive engaged may damage the electronic control assembly.

Turn off the extending switch.



Starting the application of the load

Rotate the crank handle counterclockwise to disengage the pin, and start the hoist in the up (retracting) direction, then apply the load lever and begin to increase the load with the load adjuster. The clutch will start applying torque to the capstans in a dynamic condition. Apply the load lever and adjust the load if required (see section 6.8). With the hoist control pendant run the helicopter hoist in the up direction. Observe the wrapping of the wire rope on the hoist drum. Approximately 20 feet before the wire rope is completely retracted onto the hoist drum, slow down and observe the Rotatub. Stop the hoist operation when the spooler is in approximately the same position as starting and there are no more cable wraps in the Rotatub. Observe the wire rope at all times.

Caution: Do not operate the rescue hoist in the up direction with the load lever disengaged and the extend switch actuated. Failure to disable the electric drive when retracting may damage the controller.

Caution: Stop running immediately if the RHGSE lifts off the ground and adjust clutch as required.

Caution: When starting to reel in the load, the load lever must not be fully applied with the load adjusted to the maximum; this is because the coefficient of static friction is greater than the coefficient of dynamic friction. If the load lever is fully activated before starting, the RHGSE will be lifted off of the ground and may cause damage to the hoist, aircraft or to the operator. If the system does lift off the ground unexpectedly stop lifting with the rescue hoist and lower the system to the ground and release the load lever. Never try to lower the system by releasing the load lever when the system is off the ground.

Caution: Failure to stop the hoist before the hook comes out of the Rotatub may cause damage to the RHGSE and the wire rope. Pay close attention to the number of turns in the Rotatub as the hook approaches the up limit position.

6.8) Adjusting the load

Reeling in (retracting) under maximum load

If a maximum load is desired turn the load adjuster clockwise until the RHGSE just starts to lift off the ground and then back off the adjuster 1/16 of a turn. Do not operate the RHGSE with it lifted off the ground. Always place one foot on the RHGSE when adjusting to a high load.

Using Load Indication System

The load indication is for reference only. A load cell is included in the system to allow the operator to monitor and adjust the load applied to the rescue hoist cable.

Caution: The load cell attachment bolt should not be loosened or adjusted as this will disrupt the zero and span adjustments that were made at the factory. Should the load display require adjustment please see section 7.15 for detailed instructions.

The maximum load the RHGSE can apply to the wire rope is a function of its own weight and any additional ballast weight that may be added such as when the Rotatub is full of water. The RHGSE weighs 610 lbs (276 kg) when it is dry, it will start to lift off the ground at approximately 610 lbs (276 kg). To verify or adjust the load indication system place one foot on the RHGSE and retract the load at a moderate speed and increase the load with the load adjuster until the RHGSE just starts to lift off the ground. Adjust the display by turning the screw to adjust the span of the display to display 610lbs or 276kg as the cable is being retracted.

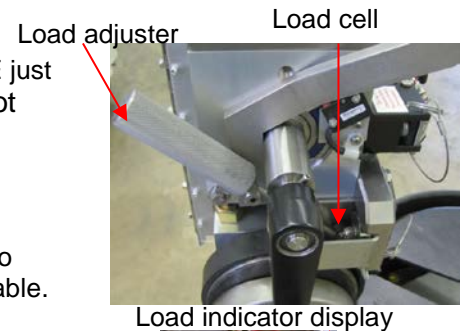
Normally the RHGSE will only be extended and retracted once during the course of a preflight, post flight, or a daily hoist inspection. However, in the case where a new wire rope has been installed it might be cycled repeatedly to condition the wire rope. In this situation the load should be set at approximately 100 lbs. (46 kg) and then increased to the maximum load in order to condition the wire rope properly. The brake drum should be allowed to cool after 2 or 3 consecutive cycles.

Important: When conditioning a new cable go slow to allow the cable to acclimate itself to the smaller diameter rescue hoist drum.

6.9) Setting Swivel Locks

The RHGSE is supplied with locks to prevent the front wheels from swiveling. The swivels should be allowed to rotate for moving the RHGSE around the hanger and aircraft, and then locked once the RHGSE has been positioned under the rescue hoist cable. To lock the swivels once the wheels have been positioned, rotate the ring to a horizontal orientation and engage the detent on the wheel with the pin. To unlock the swivels, pull the ring out of engagement and rotate the ring to a vertical orientation.

Note: If using the MagSens system the swivel locks should be in the unlocked position to allow the RHGSE to center itself under the hoist and thus prevent any fleet angle during the checking of the cable.



Load indicator display



Swivel locking mechanism



Locked position

Unlocked position

6.10) Replacement of the Lubridryer pads

Open the Lubridryer by unlatching and unscrew the (4) thumbscrews. Remove the two lubridryer bushings. Remove the used Lubridryer pad by sliding them up the channel. Discard of the used pads properly. Insert new pad by sliding the pads down the channel, install the bushing and thumbscrews. Replace the bushings when excessively worn.



Shown used pads



Shown one set of screws, bushing and pad

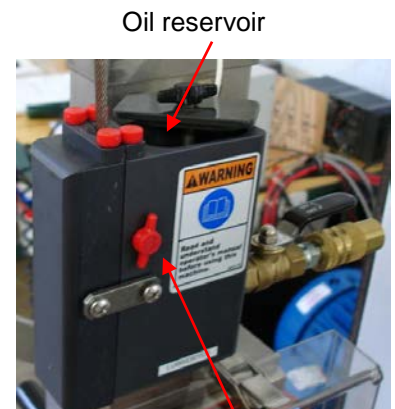


New pads installed

6.11) Lubrication of wire rope

The Lubridryer includes a reservoir that can be filled with oil. Use oil only as per the hoist manufacturer's recommendations. The reservoir can be used to store spare Lubridryer pads. The Lubridryer includes a valve that shuts off the flow of oil when not in use

When oil is added to the reservoir and the valve is open the oil seeps through a small hole to lubricate the rear pad. The front pad should be soaked in oil before installing it, open the oil reservoir and dip the pads into the oil filled reservoir. Therefore, it is recommended to always keep a spare set of pads in the reservoir of oil to use as the next set. Wipe excess oil off of the frame and use a clean cloth to keep the oil off of the capstans when the RHGSE is not in use.



Valve

6.12) Using fresh water wash

Caution: Do not allow the electrical cable or controller to come into contact with water.

Fill the rotating tub $\frac{3}{4}$ of the way with fresh water and extend the wire rope all the way down. Using a hose, rinse off the helicopter hoist and the wire rope between the helicopter hoist and the Rotatub.

If shop air is available, attach an airline to the Lubridryer via the

quick disconnect nipple supplied with the RHGSE.

(See section 6.13) Run the hoist in the up direction with the load brake applied.

Before operating with water rotate the load adjuster counter clock wise to reduce the load to approximately 100 lbs. Carefully observe the wire rope at all times on the capstans. Retract the entire wire rope out of the Rotatub, and position the drum so that the plug is above the hole in the frame then remove the plug at the bottom and drain into an approved drain.

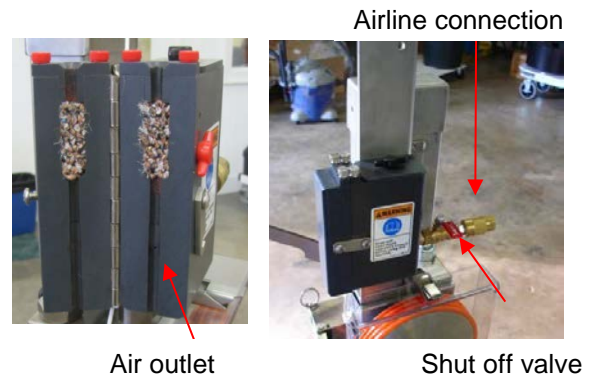
If shop air is unavailable drain the water and dry out the Rotatub, extend the cable into the empty tub and let dry. Retract the wire rope onto the helicopter hoist with the load lever applied using a gloved hand and a clean cloth to dry the wire rope.



Align the RHGSE cut out with the drainage hole in the tub as shown.

6.13) Using the Dryer

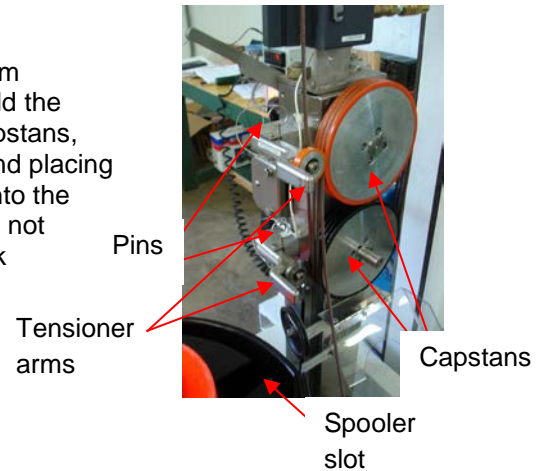
After extending the wire rope into the Rotatub, and filling the Rotatub with water, then applying the load lever, and just prior to running the wire rope up into the helicopter hoist, attach an airline to the airline connection located at the back of the Lubridryer. Then replace the Lubridryer pads with fresh pads. The air pressure required is 30 psi or 2 bar minimum. The air supply can be turned on or off via a ball valve. Replace the Lubridryer pads to clean off any excess salt and turn on the valve attached to the back of the Lubridryer. The compressed air will force the majority of the water off the cable prior to it being wiped clean and or lubricated by the pads.



6.14) Removing the wire rope from the RHGSE

Remove the hitch pins from their storage hole, rotate the tensioner arm assemblies away from the capstans, and reinstall the hitch pins to hold the tensioner wheels off the wire rope. Unwrap the wire rope from the capstans, carefully remove the twist by lifting the hook out of the spooler slot, and placing the hook facing down into the slot. Retract the remaining wire rope onto the helicopter hoist using a glove hand to apply tension and being careful not to catch the wire rope on the RHGSE or anything else. Store the hook fully as per the manufacturers' instructions.

Caution: Observe wire rope at all times to prevent damage.

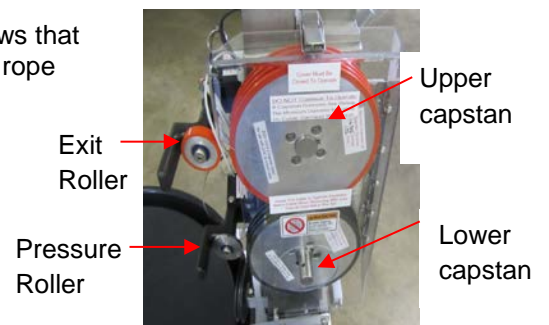


6.15) Changing the capstans to accommodate a different wire rope size.

(Optional if different capstans were purchased to accommodate a different size wire rope)

Remove the capstans and install the different capstans using the screws that were removed. Check the wrapping of the wire rope to insure the wire rope stays tight on the capstans.

Note: It is important not to reverse the upper and lower capstans.



6.16) Removing the wire rope from the hoist

The RHGSE can coil the wire rope for removal and disposal. Run the wire rope completely out into the Rotatub. Bypass the full out limit switch on the hoist as directed in the OEM manual, and run the hoist in the down direction until the wire rope can be removed from the hoist. Disconnect the wire rope from the hoist and run the remaining rope into the Rotatub.

Remove the hook assembly from the wire rope. Then reach down through the slot in the spooler and collect the wire rope spool in your hand and pull the spooler away from the tension rollers and lift the spooler and wire rope coil out of the Rotatub. Flip the spooler upside down and the wire rope will slide off in a neat coil. Discard or store the wire rope as appropriate.

6.17) Installing a new wire rope with the optional cable reel extension

The RHGSE has the ability to attach the wire rope shipping reel in order to facilitate installation of a new wire rope.

Attach the ZGS-10454-1 Cable Reel Extension with its pin as shown. Slide the shipping reel on the extension and attach the wire rope following the OEMs instructions. Use a gloved hand to exert an even tension to the wire as it is retracted on the hoist. Pay close attention to the wrapping on the hoist.

Once the wire rope is completely on the rescue hoist, remove the cable reel and cable reel extension and run the wire rope on and off the hoist onto the RHGSE three or four times while increasing the load incrementally on each cycle in order to condition the wire rope.



Goodrich Cable Reel



Breeze Cable Reel

6.18) Conditioning a new Wire Rope

Rescue hoist 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 25lbs and at a max speed of 100 feet per minute in either direction. Perform 3 cycles: Retracting at 100 lbs., then 200 lbs., then 300 lbs.

6.19) Hook Attachment Check

A hook check is available to attach the rescue hook to in order to perform the hook load test. When the wheels of the RHGSE come off the ground there will be a 600 lb. load on the hook and cable end.

Connect the rescue hoist hook to the Manual GSE Lifting Assembly.

Retract cable, lifting Manual RHGSE off the ground.

Extend cable, lowering the Manual RHGSE to the ground.

Caution: ZGS-11443-1 Manual GSE Lifting Assembly MUST BE removed from Upper Upright Bracket prior to wrapping the cable around the capstans.



7.0) Maintenance of the RHGSE

7.1) Storage of the RHGSE

After using the RHGSE it should be stored indoors in a dry location. Use compressed air to blow off any water remaining on the RHGSE or towel dry.

7.2) General preventive maintenance

- Keep the RHGSE relatively dry.
- Rinse of the RHGSE after a wire rope cleaning.
- Do not impact the Rotatub, especially in cold operating conditions.
- Do not leave water in the tub in conditions likely to freeze.
- Clean any excess oil from exposed portions of upright assembly as required.
- Wash the RHGSE capstans with water when required to clean and then set out to dry or blow off excess water with compressed air.
- Keep all loose components in their respective storage locations.
 - Tub plug in the Rotatub
 - Tension release hitch pin in the tensioner base storage holes
 - Spare Lubridryer pads in the Lubridryer reservoir

7.3) Retracting clutch adjustment

The clutch has been preset at Zephyr to approximately 100 lbs. If a high load is desired, then make small clockwise adjustments until the empty RHGSE starts to lift. When the RHGSE starts to lift, the load in the wire rope is approximately 610 lbs. To reduce the load, turn the load adjuster counter clockwise. Check operation in the retract mode.

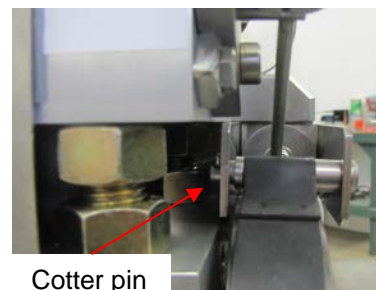
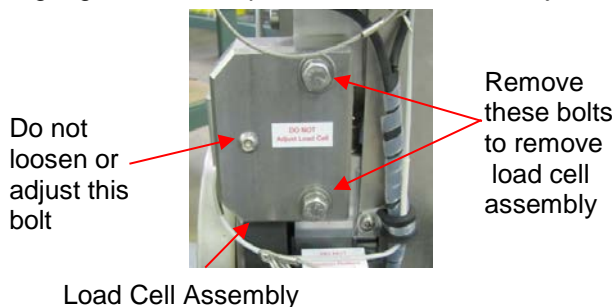
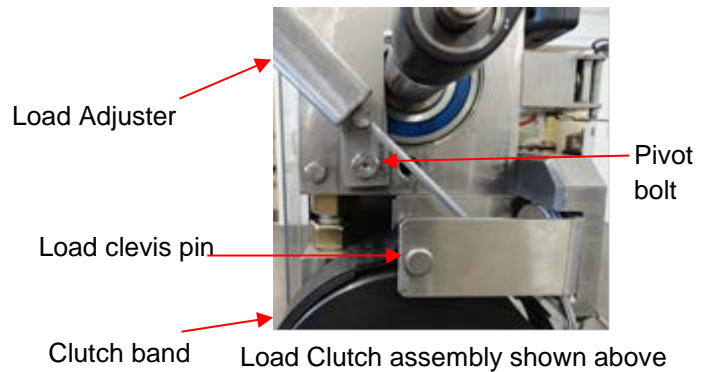
7.4) Retracting clutch removal and replacement

It is only required to remove the clutch assembly when adjusting the head to tighten the capstan drive chain. Any adjustment between the upper and lower heads requires removing the load cell assembly. Remove the (2) hex head bolts and unscrew the load adjuster completely. Then remove the cotter pin from the load cell clevis pin and remove the entire load cell assembly.

If it is required to remove the clutch band then, unscrew the load adjuster completely. Remove the cotter pin from the load cell clevis pin. Then carefully work the clutch band and load adjuster pin out from under the load cell mounting plate.

If the clevis and through hole load cell are disassembled the load display will need to be readjusted. It is not required to remove the load cell or the attachment bolt.

Use light grease on the pivot bolt and the load adjuster shaft.



7.5) Lubridryer cleaning

Occasionally clean the Lubridryer oil reservoir out, as dirt and dust will accumulate over time.



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7.6) Capstan drive chain oiling

Once a week, or less frequently depending on usage drip a few drops of turbine oil on the upper capstan chain through the small hole in the upright bracket base

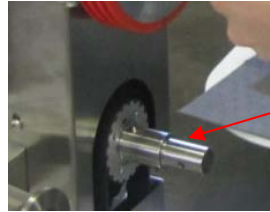


7.7) Chain and belt adjustments

Before making any adjustments remove the cover for the vertical belt and chain
First remove the lower capstan



Remove (4) 10-32 x 1-1/4 screws from the Lower Capstan (Black)



Verify the .8 Key has remained in its location

Next remove the limit switch assembly and the (4) screws for the cover



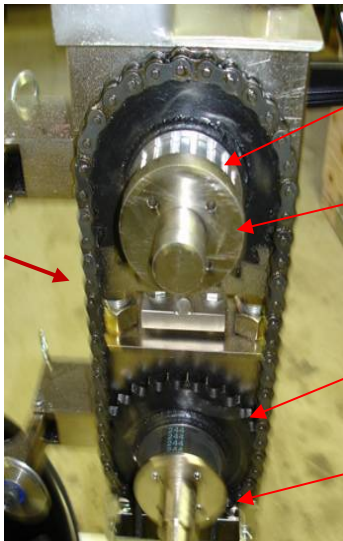
Limit switch assembly

Remove the load clutch assembly. (see section 7.4)



Remove the load cell and clevis assembly by removing the two bolts holding the load brake reaction plate to the heads. The capstan heads are coupled by a capstan chain. The heads are adjustable on two threaded rods.

To make any adjustments to the chain or vertical drive belt, it requires the loosening and adjusting all of the ten (10) nuts from the top of the upright assembly down. When making adjustments always loosen the large nuts on the threaded rod from the top down and then tighten from the bottom up while checking the belt or chain for proper tension. Insure the upright components are square to each other and the base when completely tight.



Chain

Setscrews

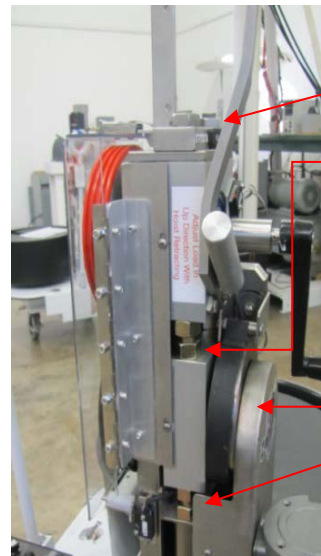
Capstan drive pulley upper

Chain sprocket

Capstan drive pulley lower

Vertical Drive Belt

Large nuts for threaded rod



(2) nuts to be adjusted

(4) nuts to be adjusted

Load clutch assembly

(2) nuts to be adjusted (only the 2 top nuts)

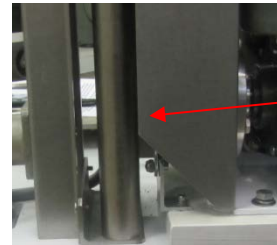
7.8) Electric Drive Belt Adjustment

The electric drive belt couples the drive motor and clutch assembly to the lower capstan shaft through pulleys mounted on the brake drum and lower drive shaft. If the belt gets too loose the pulleys may slip and the belt needs to be tightened. Adjustment is via two ¼ -20 screws mounted to the motor mounting plate. Use care when making this adjustment to move the motor equally with each screw.

Tension the belt such that when the motor is trying to extend with maximum torque the belt does not jump teeth. This can be checked by setting the load actuating lever and by overriding the retract switch by activating it with your fingers. The motor should stall and the current limiting circuit will limit the torque of the motor. Check to insure the belt does not slip under this condition.



Remove the (4) cover attachment screws (2 on each side of the cover)

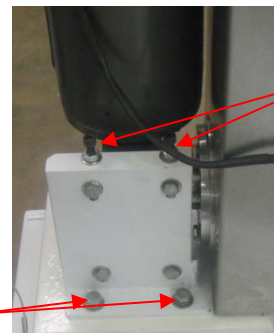


To remove the cover, the easiest method is to remove the clutch bracket 10-32 screw & nut.

Remove the four 5/16-18 screws that hold the motor mount to the base, without loosening the belt adjustment screws.



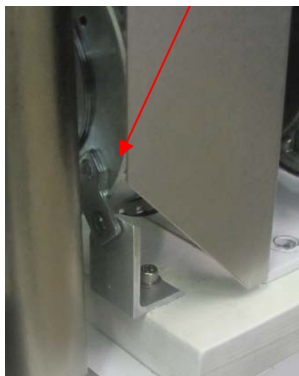
Motor mount screws (4)



Belt adjusting screws (2)
(Do not loosen)

Rotate the clutch bracket upward and move the motor back slightly from the cover.

Carefully slide the cover off of the assembly.



In order to pretension the belt, leave the cover off, install the 5/16 bolts and bolt the motor base down, and make the initial adjustment. Then remove the attachment screws, reinstall the cover and replace the motor mount bolts and then perform the final adjustment. Reattach the clutch bracket.

Tension the belt such that when the motor is trying to extend with maximum torque the belt does not jump teeth. This can be checked by setting the load actuating lever and by overriding the retract switch by activating it with your fingers. The motor should stall and the current limiting circuit will limit the torque of the motor. Check to insure the belt does not slip under this condition.

7.9) Capstan drive chain adjustment

The upper capstan chain should be adjusted every 6 months to a year depending on usage. Check for excessive chain looseness by removing the capstans, removing the chain cover to expose the chain. Check the chain by pressing on the chain. The chain should be tight with a small deflection of 1/32 of an inch with moderate hand force. While the chain cover is off check the torque on the setscrews of the chain sprockets and capstan drive pulleys.

7.10) Vertical drive belt adjustment

Remove the lower vertical belt cover. Adjust the lower capstan head upwards to obtain approximately 1/8 inch deflection with a light hand force.

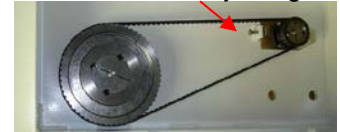
7.11) Vertical drive belt replacement

Lower the lower capstan head enough that the vertical drive belt can be removed and replaced.

7.12) Drum drive belt adjustment

Loosen the two screws, located underneath the base, which hold the Anglegear assembly to the base. Turn the drum belt adjusting screw so as to tighten the drum drive belt, such that a small deflection of approximately 1/16 an inch is obtained with moderate hand force.

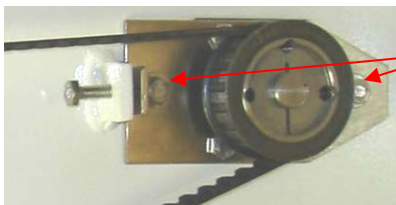
Drum drive belt adjusting screw



Shown is the bottom of the RHGSE

7.13) Drum drive belt replacement

Loosen the two screws that hold the Anglegear assembly to the base. Turn the drum belt adjusting screw so as to loosen up the drum drive belt to remove and replace.



Loosen these screws to adjust or replace the drum drive belt

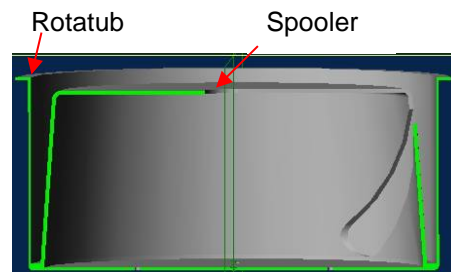
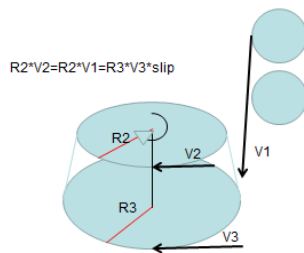


Anglegear Assembly

7.14) Adjustable platen adjustment

In order to accommodate the variation in speed of the cable as it wraps in the Rotatub and around the Spooler a simple clutch is used. The clutch is lubricated with Mil-G-81322 grease. If the clutch is too tight the cable will ride up the spooler too quickly and may come out of the Rotatub. If it is adjusted too loose then the cable will back up in the Rotatub and not wrap up on the spooler properly. In addition if the cable is wrapped too tightly around the spooler it cannot relax in the Rotatub thus trapping the twist between the RHGSE and the rescue hoist.

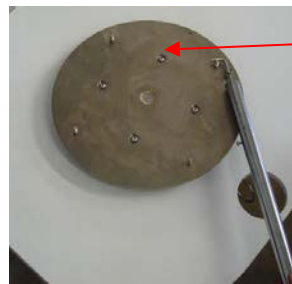
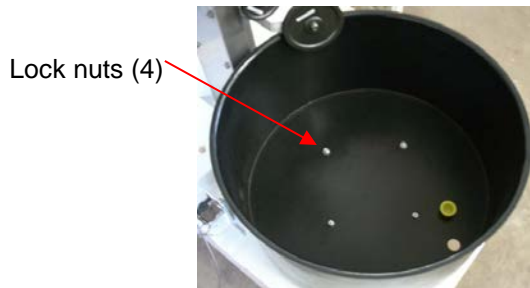
Rotatub Clutch Slip



The above pictures show that as the cable is wrapping at the bottom of the spooler it is going at maximum speed which is above the speed as it is coming off the capstans. As the cable starts to climb up on the spooler it starts to slow down due to the reduced diameter. But the cable speed must be faster in order to collect the cable and not allow it to back up in the Rotatub. Therefore, the clutch is slipping the most when the cable is at the bottom of the spooler. If the clutch does not slip properly the cable is forced up the spooler and there is less room on the spooler to collect all the cable.

Caution: Never continue operating with the cable wrapping tightly on the upper edge of the Spooler, as the cable can come out of the Rotatub and twist and kink.

To adjust the platen torque, remove the Rotatub and the Spooler, remove the (4) lock nuts and washers and lift the Rotatub off of the platen. Check the adjustment by using a spring scale to rotate the platen clock wise while pulling tangentially to the bolt circle. The clutch is set properly when the torque required is such that with a spring scale attached (*shown below*) to the attachment screws as shown, the platen slips with a force of 2.2-2.7 kg or 5-6lbs of load applied. Note the brake must be applied in order to check the clutch slippage.



Technical notes

Effect of overall cable diameter

When a cable is new its diameter is at its maximum and is approximately .194 inches. As it is accumulating time in service it wears and stretches and its diameter becomes smaller overtime. As the diameter is reduced the slippage on the capstans increases. As the slippage increases the tension in the cable as it wraps on the Spooler increases. When this happens the cable may start to ride to the top of the spooler. If this is noted during extending, the operator can slow down the Rotatub with a hand or foot contact to allow the cable to fall to the bottom of the Rotatub in order to complete the evolution. Afterwards the Rotatub clutch should be adjusted as per paragraph 7.14 above.

Effect of cable manufacturing process

When a cable is manufactured it is critical that the producer properly setup and engineer the manufacturing process. During the manufacturing process the producer must strive to properly balance the inner and the outer strands to create a spin resistant cable that will wrap on a modern rescue hoist drum. In order to do this the wires and the strands are performed so that they do not abrade on each other under load and they do not tend to unwrap under load. If the preforming and balancing is incorrect the cable will loosen up prematurely.

Effect of cable lubrication

When a cable is new the internal spaces between the wires are full of the lubricant that is used to draw them down to size. One rescue hoist manufacturer removes the external lubrication and the other does not. Therefore, it is the operator' responsibility to determine if adding additional lubricant is required. If additional external lubricant is applied then the coefficient of friction is reduced and slippage on the capstans increases.

Effect of worn capstans

The capstans will wear as a result of slipping and heavy loading. The first groove on the lower capstan will wear out first because it has the heaviest load applied to it. The lower capstan is of a harder material than the upper capstan. When the wear of the capstans becomes significant the cable will slip excessively on the capstans. The results may be seen as the cable starting to ride to the top of the spooler or twisting of the cable between the top of the RHGSE and the rescue hoist.

Zephyr International maintains inventory of spare capstans and has a refurbishment program. Email Zephyr for details.

In general, in order to reduce cable slippage, reduce the cable load and or the speed of operation.



Worn Capstans shown



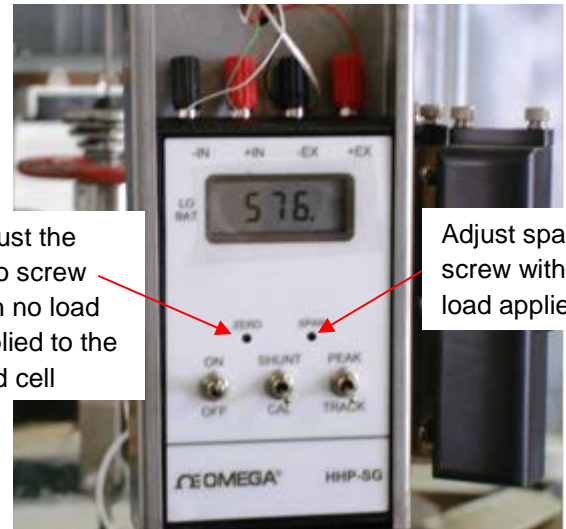
New Capstans shown

7.15) Adjusting the load display

The load display is for reference only. It is adjusted when new and should not require precise calibration. The load cell display can be checked as required by adjusting the load adjuster until the RHGSE just starts to lift off of the ground.

If the display is not close to the weight marked on the base the display can be adjusted by turning the span screw on the display face. Turning the span screw clockwise increases the displayed reading and counter clockwise decreases the displayed reading.

Once the maximum load (span) is adjusted then the zero displayed reading should be rechecked. This is accomplished by moving the load lever to the unlocked position and with no load being applied to the cable, adjust the zero screw to achieve 0000 on the display.



7.16) Checking the Capstans

It is essential to replace the capstans when the pitch diameter of the first groove, of the lower roller becomes too small. To check the pitch diameter a 6-7-inch micrometer is required and a set of pins of the correct diameter is required.

There are several capstans available for the different size cables in use. It is important to use the correct style capstans for the type of cable being serviced. The following table lists the relevant dimensions for each capstan style. **Note: 4.5 mm capstans will work with a 3/16 diameter cable.**

Lower Capstans

Cable Diameter	Lower Capstan Part number	Measurement Pin diameter	Minimum dimension over pin
3/16 inch	ZGS-10113-20-1	.185	6.745 in
4.5 mm	ZGS-12474-1	.175	6.725 in
5/32 inch	ZGS-10113-30	.156	6.715 in
3.5 mm	ZGS-10340-1	.132	6.695 in
1/8 inch	ZGS-10113-40	.120	6.685 in



Upper Capstan

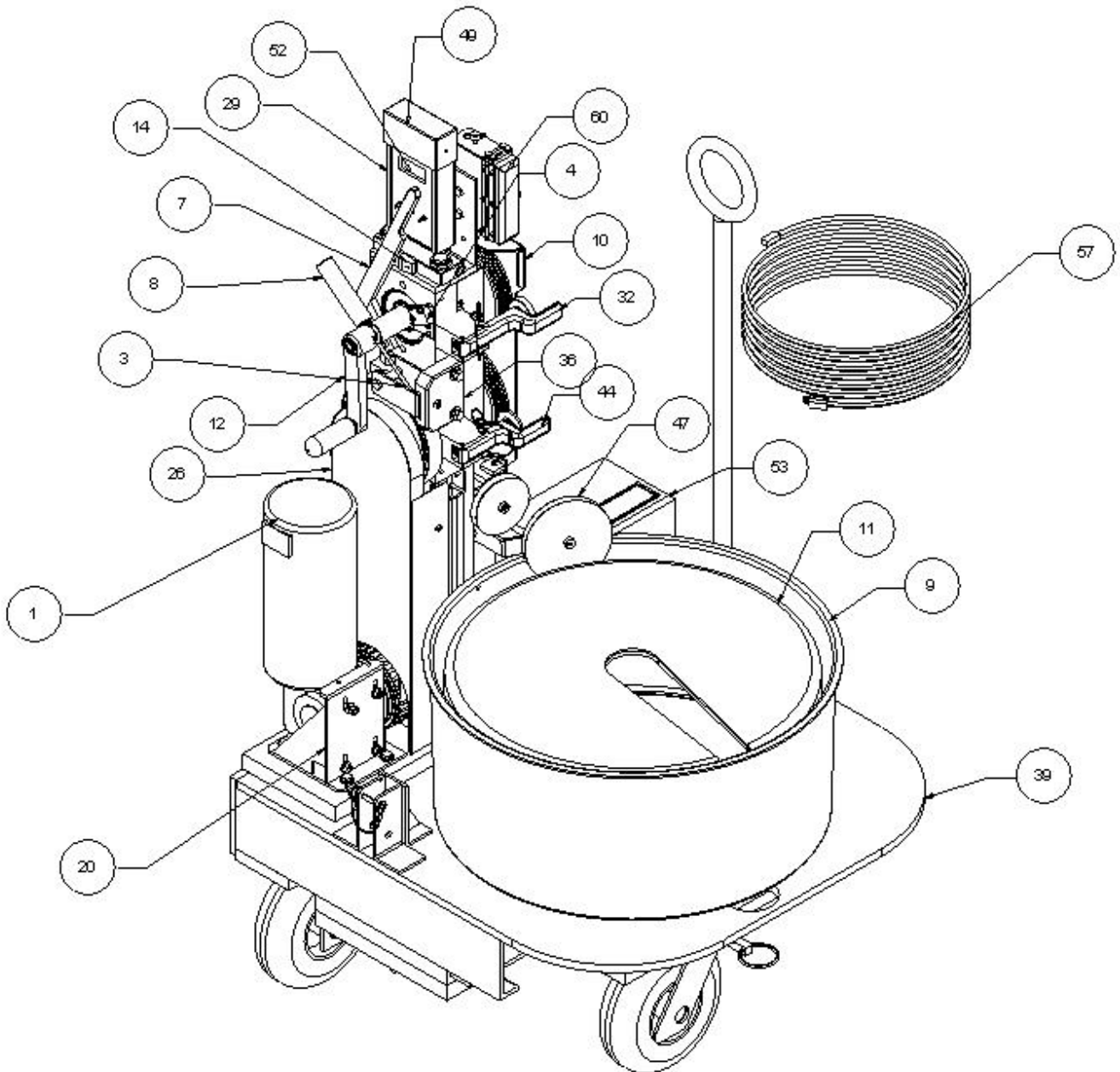
Cable Diameter	Upper Capstan Part number	Measurement Pin diameter	Minimum dimension over pin
3/16 inch	ZGS-10113-20	.185	6.745 in
4.5 mm	ZGS-12474-2	.175	6.725 in
5/32 inch	ZGS-10113-30	.156	6.715 in
3.5 mm	ZGS-10340-1	.132	6.695 in
1/8 inch	ZGS-10113-40	.120	6.685 in

8.0) Replacement Parts List

Part Number	Part Name	Qty
	Belts	
ZGS-10025-1	Drum Drive Belt	1
ZGS-10040-1	Vertical Drive Belt	1
ZGS-11304-3	Motor Drive Belt	
	Capstans and Cover	
ZGS-12474-2	Upper Capstan (orange) for 3/16" or 4.5 mm wire rope)	1
ZGS-12474-1	Lower Capstan (black) for 3/16" or 4.5 mm wire rope)	1
ZGS-10328-1	Capstan Cover Assembly	1
	Clutch (Retracting)	
ZGS-10369-1	Clutch Band	1
ZGS-11385-1	Clutch	1
	Drum & Spoolers	
ZGS-10022-1	Rotatub	1
ZGS-11134-1	Cable Spooler EC Hook	1
ZGS-10357-1	Cable Spooler Basic	1
ZGS-10149-1	Rotatub Plug	Set of 5
	Electrical	
ZGS-11396-1	Brake Handle Limit Switch assembly	1
ZGS-11392-1	Controller	1
ZGS-11386-1	Motor	1
ZGS-11389-1	90 VDC power Supply	1
	Handles	
ZGS-11240-1	Manual Handcrank Bearing Assembly	1
ZGS-10111-1	Tow Handle	1
ZGS-11242-1	Tow Handle Quick Release Pin	1
	Load Indicators and Adjuster	
ZGS-11099-2	Load Cell	1
ZGS-11100-2	Load Cell Indicator Display	1
ZGS-11109-1	Load Adjuster	1
	Lubridryer	
ZGS-10126-1	Lubridryer Bushings	2
ZGS-10104-10	Lubridryer Pads	100 in pkg
	Tensioning Wheels/Rollers	
ZGS-10127-1	Pressure Roller Assembly	1
ZGS-10258-1	Tension Wheel	1
ZGS-10259-1	Tension Wheel Large	1
ZGS-10294-1	Exit Roller Assembly	1
ZGS-10047-2	Tension Release Hitch Pins	Set of 2

9.0) Illustrated Parts Breakdown

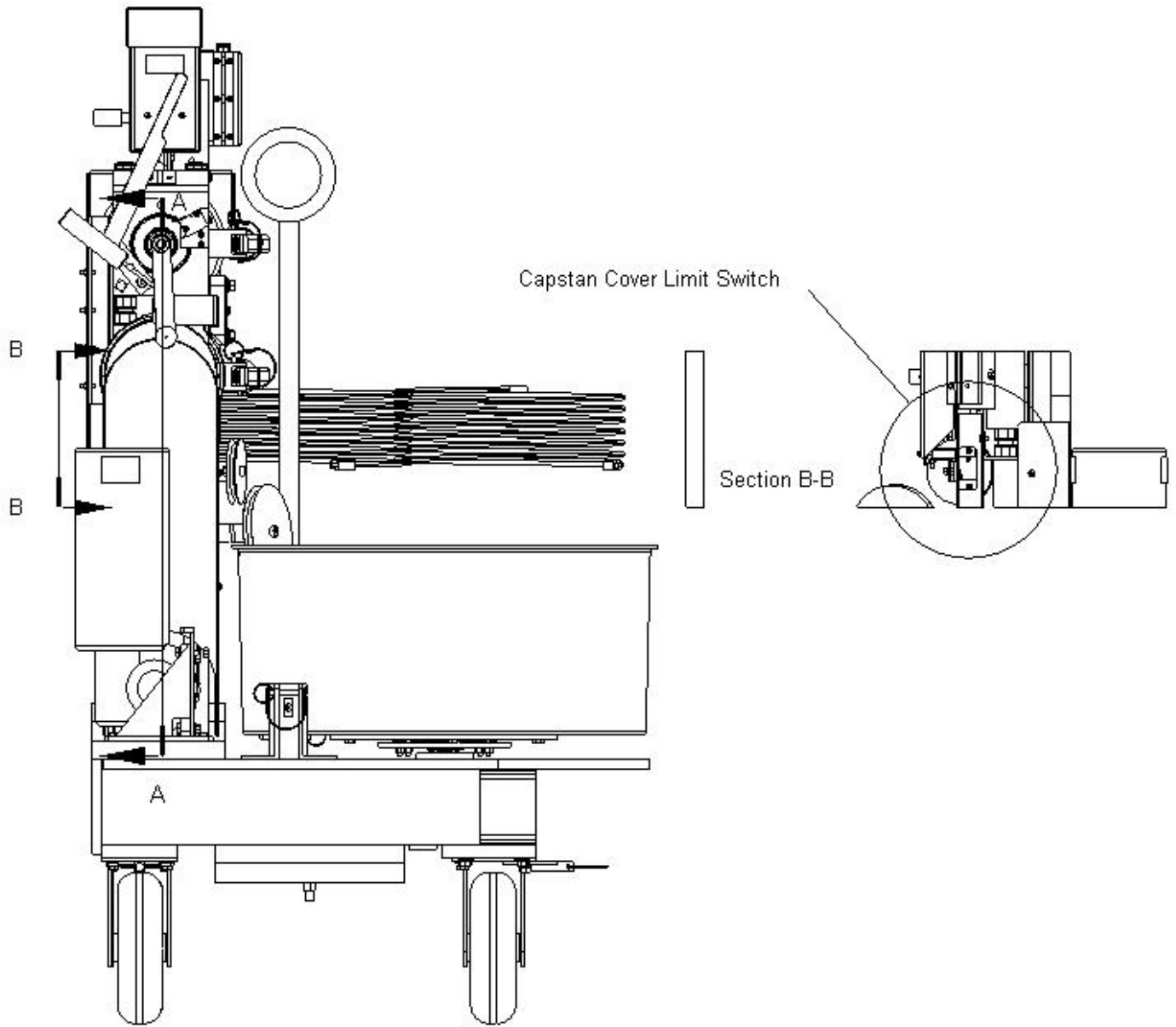
ZGS-11300-1



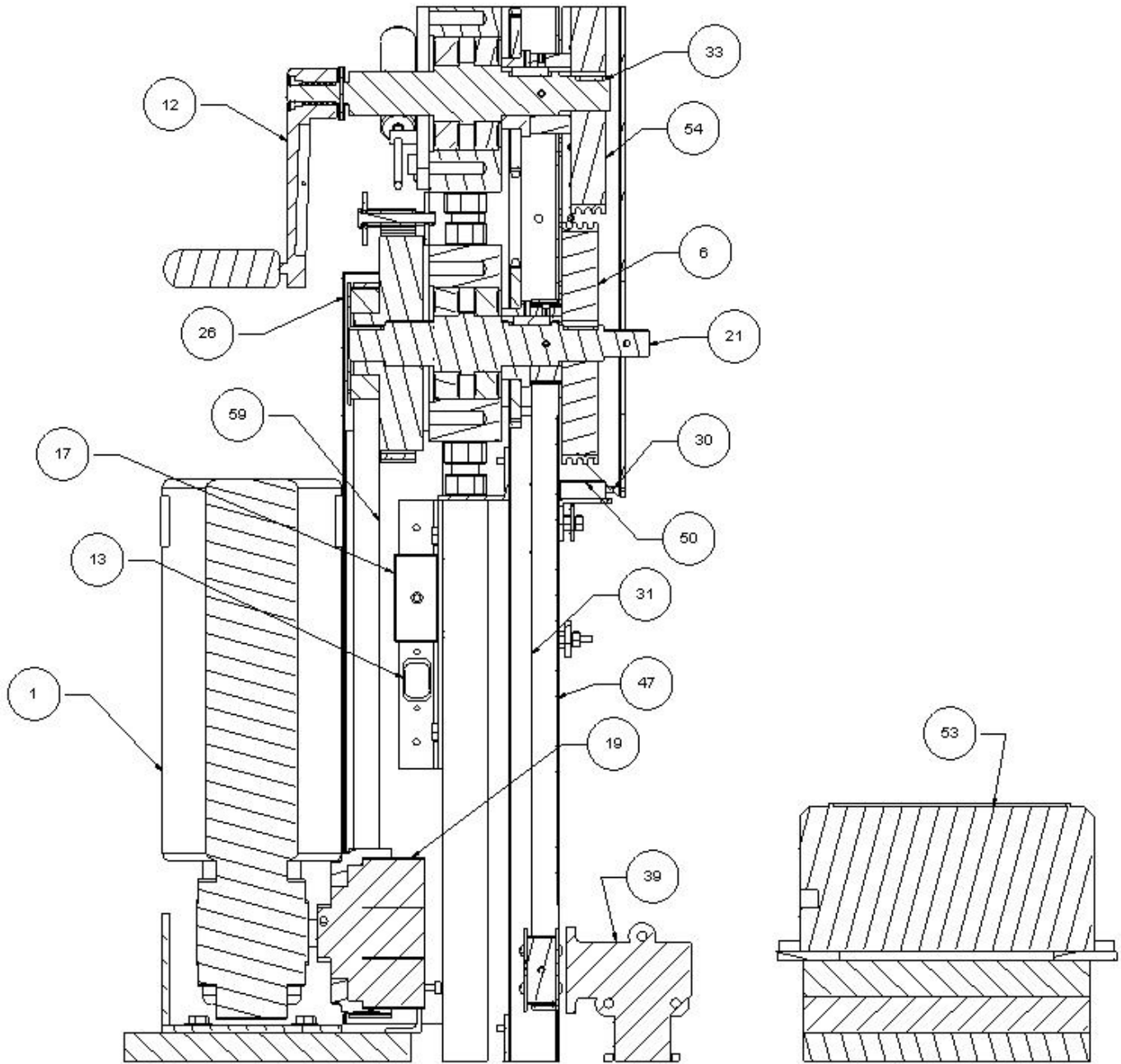
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Item Number	Quantity	Part Number	Part Name	Revision	Comment
1	1	ZGS-11386-1	GearMotor Right Angle .5 Hp		
2	2	ZGS-11096-2	Ballast Bar 2A		
3	1	ZGS-11113-1	Load reaction clevis		
4	1	ZGS-11396-1	Brake Handle Limit Switch Asserr		
5	1	ZGS-11056-1	Brake Pin		
6	1	ZGS-12474-1	Capstan 4.5 mm cable		
7	1	ZGS-11119-1	Brake Handle		
8	1	ZGS-11109-1	Load Adjuster Assy		
9	1	ZGS-10022-1	Tub , GSE		
10	1	ZGS-10328-4	Capstan Cover Assy Magnetic Lat		
11	1	ZGS-10357-1	Spooler Basic		
12	1	ZGS-11240-1	Manual Hand Crank Bearing Asse		
13	1	ZGS-11391-1	Receptacle Power Cord		
14	1	ZGS-11397-1	On -Off Rocker Switch Assembly		
15	2	ZGS-10502-1	Electrical controller mount		
16	1	ZGS-11302-2	Electric Drive lower pulley 2		
17	1	ZGS-11389-1	90 VDC Power Supply		
18	1	ZGS-10375-1	Capstan Cover Switch Assembly		
19	1	ZGS-11385-1	Clutch SC-425-14		
20	1	ZGS-11333-2	Right Angle Motor Mount Weldme		
21	1	ZGS-11031-1	Lower head Assembly Manual Dr		
22	1	ZGS-11312-2	Electric Belt Guard Bracket A		
23	1	ZGS-11344-1	Electrical Upper Pulley Assembly		
24	1	ZGS-10085-1	Upright Bracket		
25	1	ZGS-11099-2	Thru Hole Load Cell		
26	1	ZGS-11346-1	Electric Belt Guard Assembly		
27	1	ZGS-10107-1	Roller Chain		
28	1	ZGS-11034-2	Solid Prony Brake Drum		
29	1	ZGS-11118-1	Load Indicator Holder Assy		
30	1	CLP-168	LS Actuator Clevis Pin		
31	1	ZGS-10040-1	Drive Belt, Vertical		

Item Number	Quantity	Part Number	Part Name	Revision	Comment
32	1	ZGS-10129-1	Tensioner assy upper		
33	1	ZGS-11130-1	Upper Head assy manual drive irr		
34	1	MSC 06812382	Clutch Spring		
35	1	CLP-126S	3-8 Pin 2 inch long		
36	1	ZGS-11112-2	Load Brake Support ManGSE		
37	1	ZGS-11097-3	Ballast 1B tapped		
38	1	ZGS-10369-1	Brake Band		
39	1	ZGS-11127-1	Base Tripod		
40	2	ZGS-11097-2	Ballast 1B		
41	1	A7X8-C12125	3-8 shaft spacer .12 long		
42	1	ZGS-11097-4	Ballast 1B Controller Mount		
43	1	EH-12-S02	es_12		
44	1	ZGS-10128-1	Tensioner Assy Lower		
45	1	ZGS-10119-1	Tensioner Roller Shaft		
46	1	ZGS-10046-1	Latch Catch		
47	1	ZGS-10045-1	Belt Guard and Cover Assembly		
48	2	ZGS-10082-1	Belt Guard Bracket		
49	1	ZGS-11117-1	Load Indicator Holder Lid		
50	1	ZGS-10372-1	LS Plunger Body		
51	1	ZGS-11393-1	Clutch Reaction Clip		
52	1	ZGS-11100-2	Load Cell Indicator Omega		
53	1	ZGS-11392-1	DC Motor Drive		
54	1	ZGS-12474-2	Capstan Upper 4.5 mm cable		
55	2	ZGS-10030-1	Upright Tube Upper		
56	1	ZGS-11049-1	Overcenter Lock Stop		
57	1	ZGS-11390-1	Power Cord Electrical GSE		
58	1	ZGS-11312-1	Electric Belt Guard Bracket		
59	1	ZGS-11304-3	Electric Drive Belt .5 hp		
60	1	ZGS-10048-2	LubriDryer Assembly Manual GSE		
61	1	ZGS-11053-1	Brake Handle Stud		
62	1	ZGS-11064-1	Chain Guard Cover Assy		

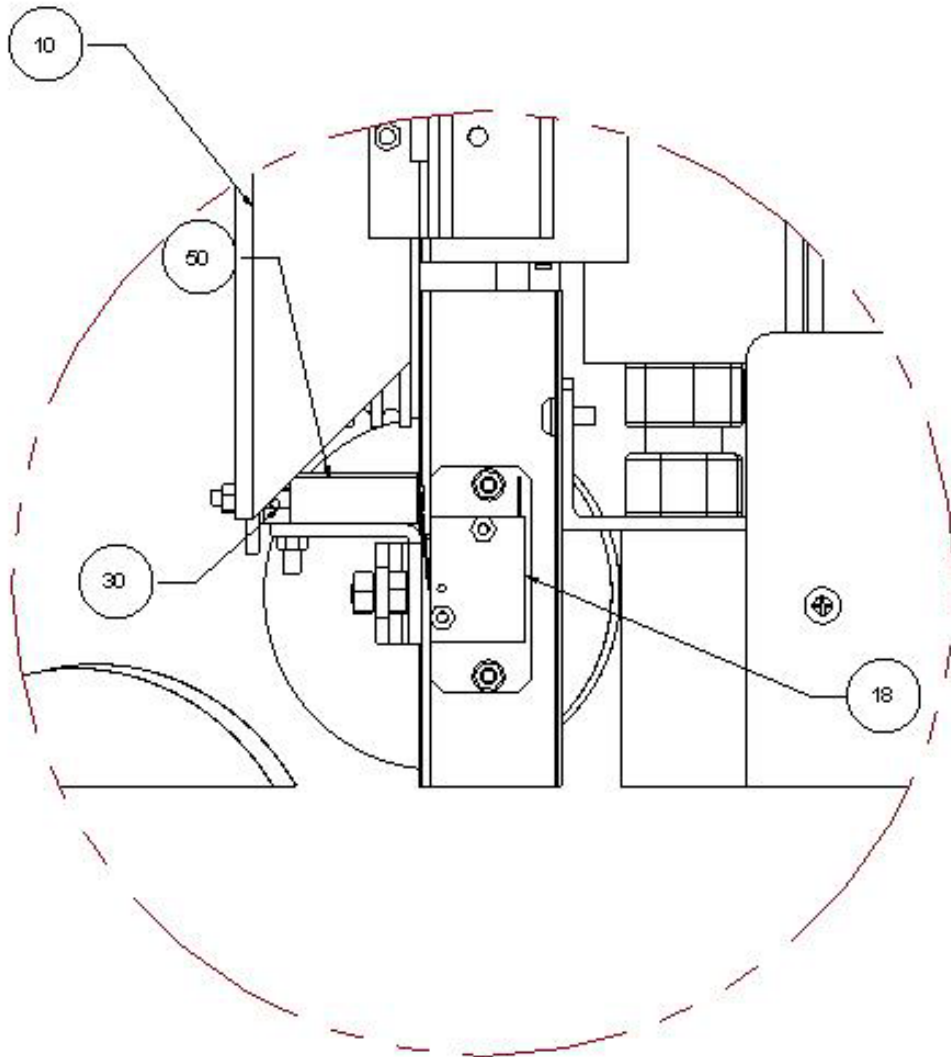


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Section A-A

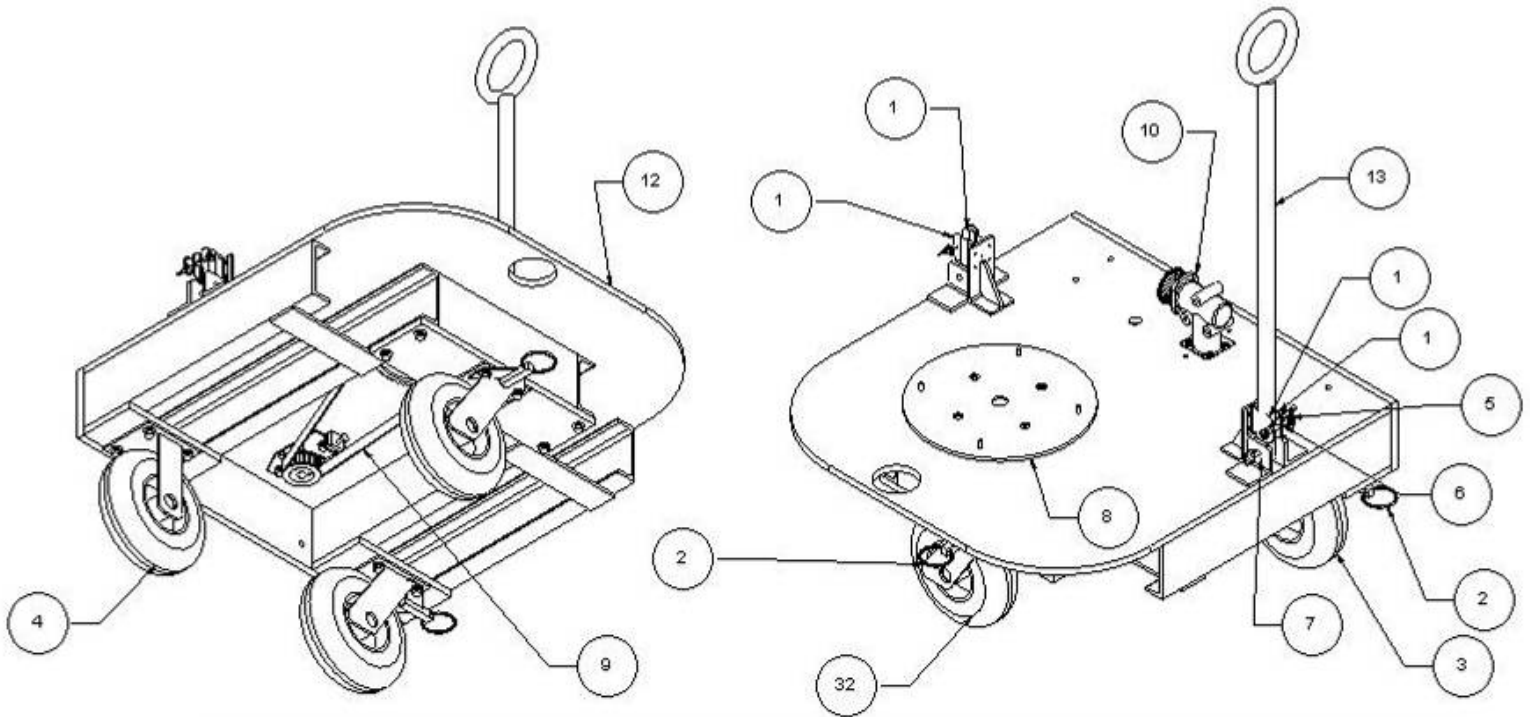
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Detail Capstan Cover Limit Switch

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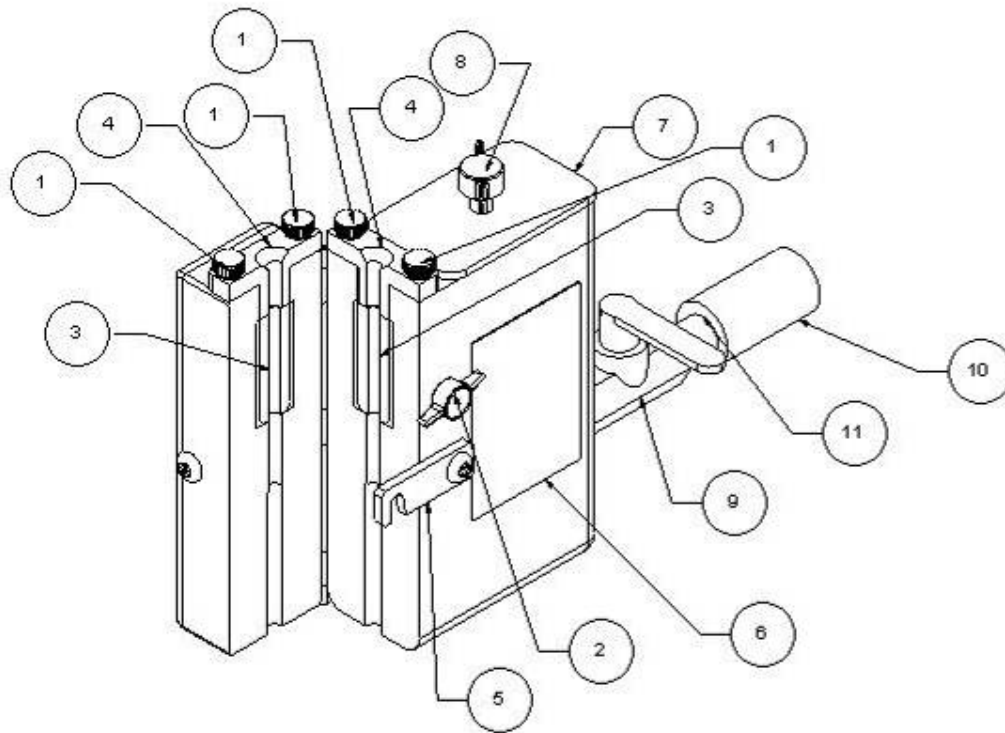
ZGS-11127-1



Item Number	Quantity	Part Number	Part Name	Revision	Comment
1	4	ZL-1031-1	Leg, Mounting Standoff		
2	2	ZGS-10314-1	Swivel Caster Lock		
3	2	ZGS-10144-2	Swiveling Tornado Caster		
4	1	ZGS-10143-2	Rigid Tornado Caster		
5	2	ZL-1037-1	Lanyard		
6	2	ZL-1036-1	QRP		
7	1	ZGS-11242-1	.38 Detent Pin 2 in long		
8	1	ZGS-10248-1	Infinitely adjustable platen assy		
9	1	ZGS-10025-1	Drive Belt, Drum		
10	1	ZGS-10013-1	AnglGear		
11	2	ZGS-10327-1	Tow Handle Stop		
12	1	ZGS-11126-1	Base Weldment 4 Tripod		
13	1	ZGS-10111-1	Tow Handle		

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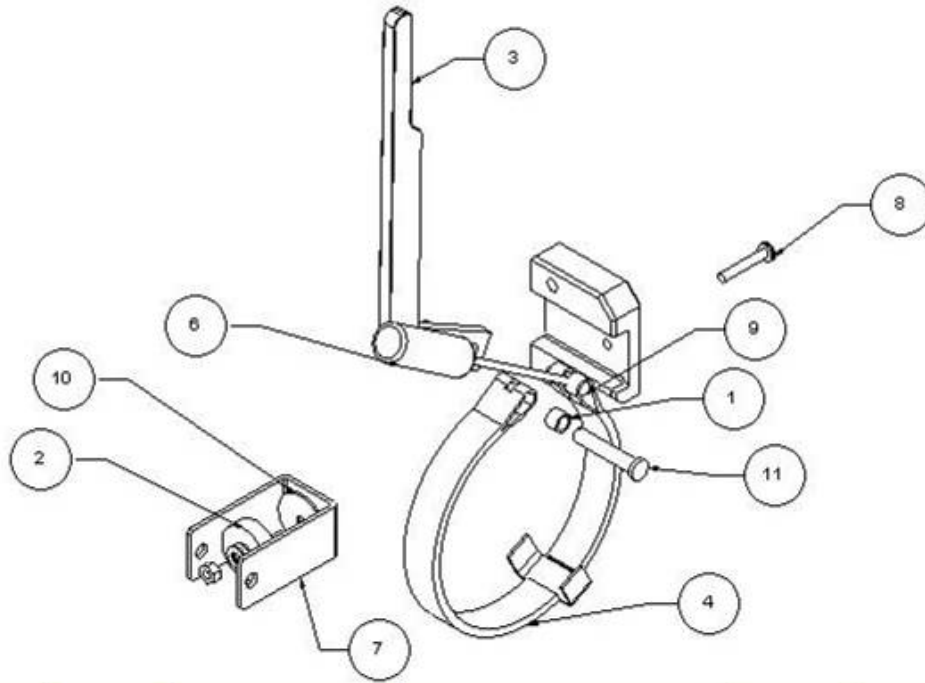
ZGS-10048-2



Item Number	Quantity	Part Number	Part Name	Revision	Comment
1	4	ZGS-10147-1	#6 Thumbscrew 1/2 in long		
2	1	ZGS-10361-1	#10 Thumbscrew		
3	2	ZGS-10104-1	Lubridyer Pad		
4	2	ZGS-10126-1	Lubridyer Bushing		
5	1	ZGS-10051-1	Oiler Latch		
6	1	MS01:J6411-FF	Label, Safety Instructions		
7	1	ZGS-10124-1	Lubridyer Cover		
8	1	ZGS-10137-1	Lubridyer Screw Assembly		
9	1	ZGS-10252-1	Shut Off Valve		
10	1	QD Female	QD Female Coupler		1/4 NPT Thread
11	1	1/4 QD Coupler	QD Male Coupler		

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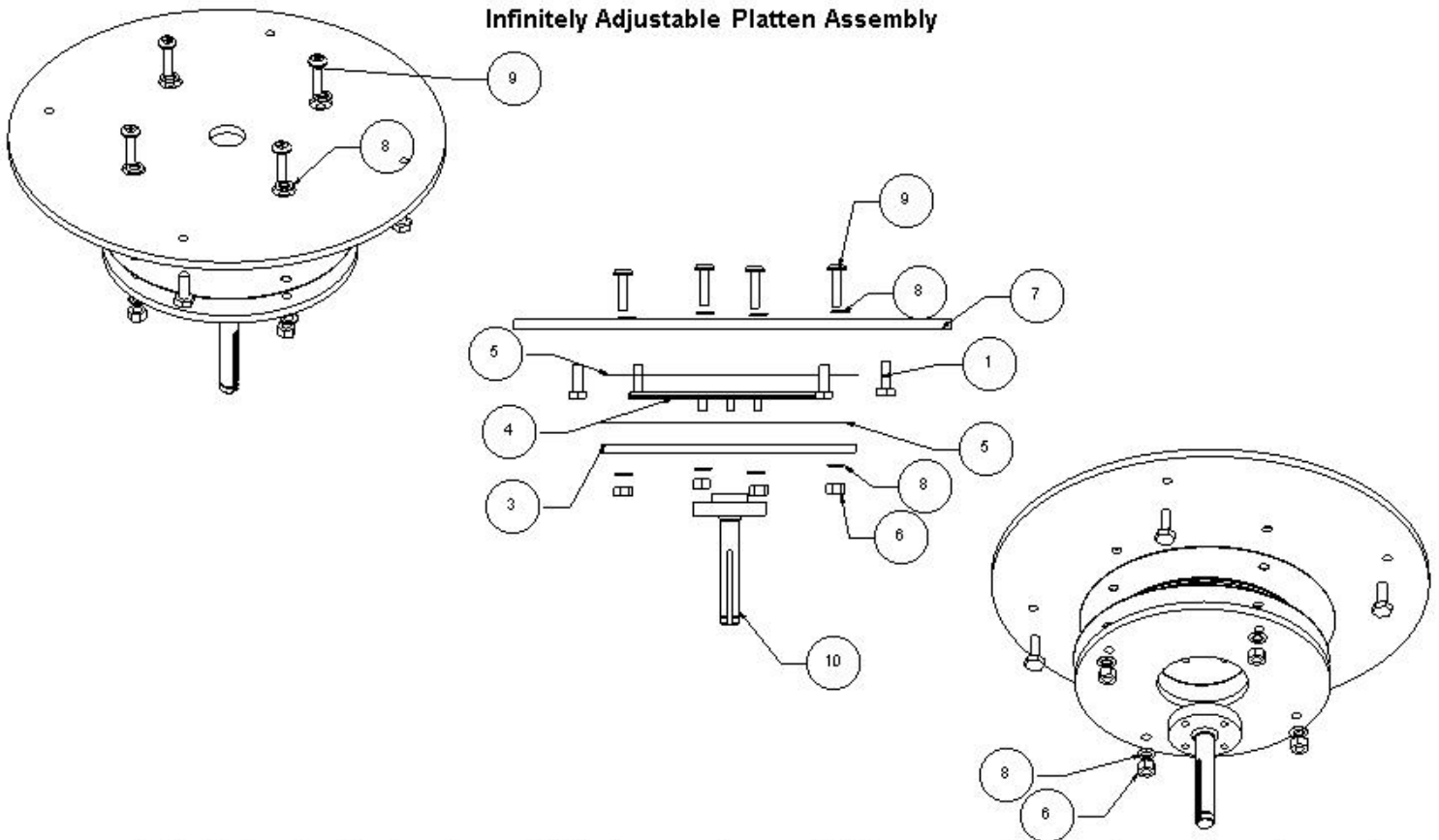
Load Cell and Clutch Assembly



Item Number	Quantity	Part Number	Part Name	Revision	Comment
1	1	A7X8-C12375 SDP#	3-8 shaft spacer .38 long		
2	1	ZGS-11099-2	Thru Hole Load Cell		
3	1	ZGS-11119-1	Brake Handle		
4	1	ZGS-11055-1	Brake Band		
5	1	ZGS-11112-2	Load Brake Support ManGSE		
6	1	ZGS-11109-1	Load Adjuster Assy		
7	1	ZGS-11113-1	Load reaction clevis		
8	1	ANSI B18.6.3	1-4 x 28 x 1.5 machine screw		
9	1	ZGS-11056-1	Brake Pin		
10	1	1/4- 1 1/4	Fender Washer		
11	1	3/8 x 2 1/2 inch Hex Bc	3-8 Pin 2 inch long		
12	1	ZGS-11053-1	Brake Handle Stud		
13	1		3-8 shaft spacer .12 long		

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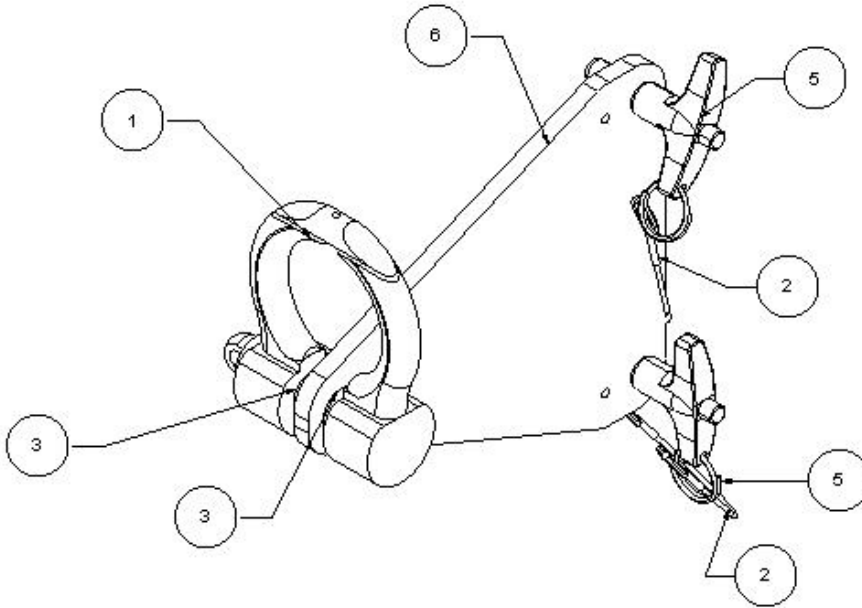
Infinitely Adjustable Platten Assembly



Item Number	Quantity	Part Number	Part Name	Revision	Comment
1	4	129	.25 x .75 cap screw		
2	4	10-32 x 1/2	10-32 Flat Head .5 long		
3	1	ZGS-10176-2	Infinitely adjustable Lower plate		
4	1	ZGS-10175-2	Infinitely Adjustable Platten Plate		
5	2	ZGS-10737-1	Infinitely adjustable Slip Pad		
6	4	2554	.25 Lock nut		
7	1	ZGS-10180-2	Infinitely Adjustable Platten Top Plate		
8	8	87779237	Belleville Washer		
9	4	ANSI B18.6.3	1-4 x 28 x 1 machine screw		
10	1	ZGS-10020-1	Axel		

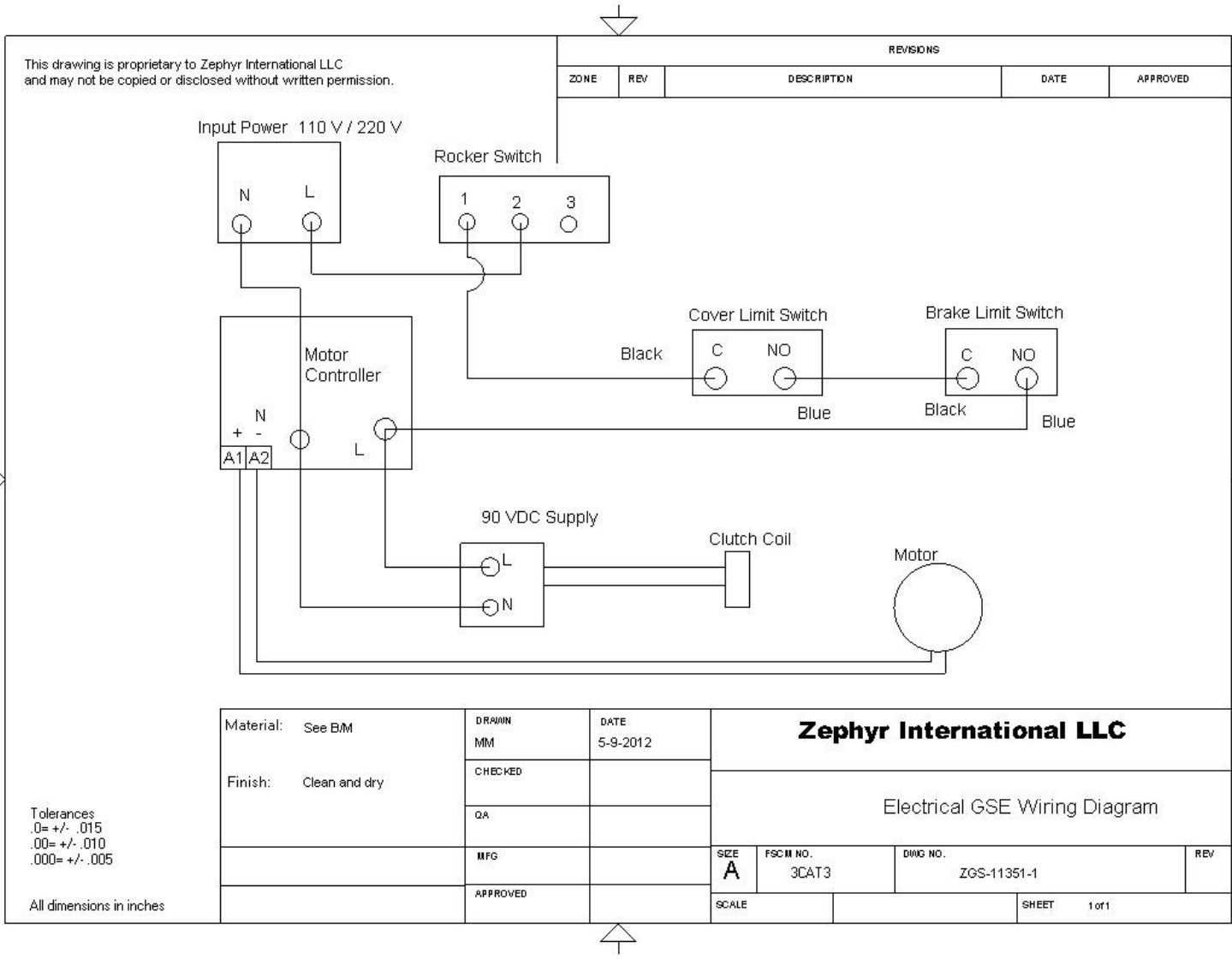
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600 lbs Hook Checkpoint



Item Number	Quantity	Part Number	Part Name	Revision	Comment
1	1	ZGS-11421-1	Shackle_SUN-85		
2	2	ZGS-11437-1	SB Lanyard Assy		
3	2	A7X8 -C16250	Axel Sleeve .25 inch		
4	2	5317	8 32 x . 25 Screw		
5	2	90293A122	Pin 90293A122		
6	1	ZGS-11442-1	Manual GSE Lifting Plate		

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10.0) Technical Assistance

Please contact Zephyr International LLC with any questions 1-843-365-2675.
 Send comments or suggestions to: mmitchell@zephyrintl.com