
PowerAssist ©
Counterweight Assisted Hoist System

Operation & Maintenance Manual



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Guarantee

We guarantee all equipment manufactured by us to be free from defects in material and workmanship for three years (one year for motorized equipment) from the date of shipment. At our option, we will repair or replace the equipment, at our factory. Any warranty on items manufactured by others will be assigned to you.

- No claims will be honored for equipment or in circumstances where, in our opinion, the equipment has become defective due to misuse, abuse, accident, act of God, alteration, vandalism, ordinary wear and tear, improper installation, improper maintenance, or used not in a manner intended.
- We make no implied warranties of any kind including no warranty of merchantability, or warranty of fitness for a particular purpose, all of which are expressly disclaimed.
- We will not be liable under this guarantee for consequential or incidental damages of any kind, including damages due to lost profits, loss of use, delays, personal injury or property damage.

Important notes

Anyone who enters a building with public access has reason to expect that he or she is safe from harm from the building itself or from the equipment and activities within the building. It is the legal responsibility of the owner and his designated manager to ensure that this expectation is met.

It is the responsibility of the owner to hire and train competent people. A competent person is defined as one who is capable of identifying existing and predictable hazards in the workplace, and who has the authority to take prompt corrective action to eliminate those hazards. It is the further responsibility of the owner and his designated manager to provide a safe working environment for all employees, including proper equipment, training on the use of equipment, and written procedures for its use and maintenance. It is also important to keep all unauthorized and/or untrained personnel from the working areas of the stage.

Before operating any stage equipment, operators must be given the necessary training and must then work only under the direction of qualified supervisors. Operators of the equipment must:

- Learn the feel, sound, and even the smell of your equipment so that you will immediately sense when something is not correct.
- Study the capacities and capabilities of each system and its components.
- Thoroughly learn and practice the proper operating procedures.
- Before operating any equipment, ask yourself questions about the current condition of equipment and about any existing conditions which may affect proper operation or which could be affected by its operation. For example, is anything fouling the equipment or in the path of its intended travel?

Any problem noticed during setup or operation of the stage equipment should be corrected **IMMEDIATELY**.

A routine maintenance schedule must be established and followed and appropriate records maintained. Perform an initial inspection, followed by inspections on a regular basis.

Routine maintenance prolongs the useful life of equipment and keeps it operating at peak efficiency. This insures the quietest possible operation and the least effort on the part of the operator.

In addition to routine maintenance, we strongly recommend that a qualified rigging firm be engaged to perform periodic inspections and to correct any deficiencies discovered. These firms have personnel who are trained to spot present hazards and many "potential" hazards.

WARNING!

Improper use of rigging equipment can result in serious injury. Do not operate without proper training and authorization. Not for lifting people.

DISCLAIMER

The information in this manual will not cover all possible situations, nor could such inclusive instructions be written by the equipment manufacturer, due to the various processes of mounting theatrical performances. This manual is intended to provide a guide to the safe and efficient operation of the furnished stage equipment and its routine maintenance. No manual can replace your duty to exercise constant vigilance and common sense. We are not responsible for any damage that results from your failure to comply with this manual.

Introduction: How the system works

The PowerAssist is designed to be installed with a dedicated counterweight arbor. In the most common application the arbor is loaded with one half of the capacity of the counterweight set, *not to exceed 1000 lbs*. In this case, when the batten is loaded with 2000 lbs of equipment, the load is counterweighted by 1000 lbs and the winch bears the remaining 1000 lbs. See figure 1 below.

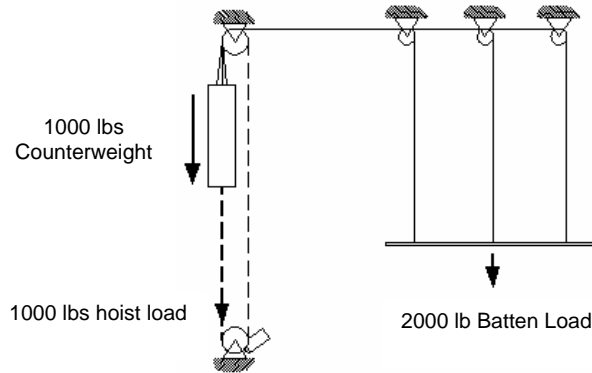


Figure 1: Counterweight assist hoist system with full load on batten

When the batten has no load on it, the 1000 lbs weight of the arbor is supported by the winch. See figure 2 below.

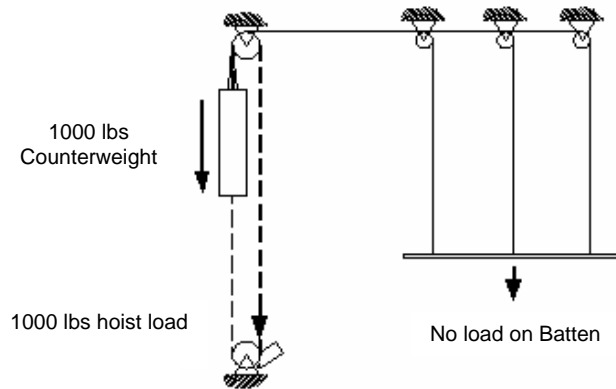


Figure 2: Counterweight assist hoist system with batten unloaded

Other arrangements are possible. However, in no case may the winch be subjected to loads of over 1000 lbs.

⚠ DANGER!

**TAMPERING WITH COUNTERWEIGHT IN ARBOR CAN CAUSE
INJURY OR DEATH**

**DO NOT ADD OR REMOVE COUNTERWEIGHT FROM THE SYSTEM.
SYSTEM IS PROPERLY COUNTERWEIGHTED AT TIME OF INSTALLATION.**

Operating the PowerAssist

1. Operating Precautions

Check these items every time before you operate the machine:

- Check the load and look for places where the load could foul during its travel.
- Ensure that the counterweight has not been tampered with and that the winch is not loaded beyond its capacity.
- Do not wear loose fitting clothes and jewelry. Secure long hair.
- The operator must constantly watch the progress of the load being raised or lowered. If the operator cannot see the load, a spotter should be stationed to watch and report its progress to the operator.
- There must always be a floor or "safety" person present on stage when sets are operated in order to:
 - Keep people out from under moving equipment.
 - Look for potential problems, such as lines or curtains which might foul a batten.
 - Make sure that proper operational and safety procedures are followed.
 - Identify any potential interference or other problems.

WARNING!

Improper use of this equipment can result in injury or death

**Do not operate without proper training and authorization
You are responsible for identifying & evaluating any hazards and determining the correct
operation method to be used.**

2. Operating Procedure

1. The first step in operating a motorized winch or other motorized device is to become familiar with its status and exact method of operation. Check the load and look for places where the load could foul during its travel. Check the limit switches and other travel limiting devices to be sure they are operating. Check to see that motor disconnects are turned on.
2. Become familiar with standard safety devices such as line contactors and Emergency Stop switches, plus any optional devices, such as phase loss or phase reversal relays, slack line relays, etc. Read and learn any specific instructions for control features which are unique to your system. Be sure that you understand all control functions on the main control panel and on any remote panels before actually operating the system.

NOTICE!

Standard J.R. Clancy control panels contain an EMERGENCY STOP button. This is a red, latching, mushroom head operator which is pushed to stop motion in an emergency. If the equipment is doing something you did not expect, press the E-stop button! The emergency stop circuit is normally wired separate from all other control functions and will affect all rigging equipment connected to that system. If you have to press an Emergency Stop button, carefully examine the system to understand why things did not work the way you expected before releasing the button. To release a latching E-Stop button, turn the mushroom head operator one-quarter turn clockwise and allow the button to pop out. Releasing the emergency stop switch will not re-start equipment. It will permit equipment to function again in the normal manner.

3. Turn on the panel key switch.
4. A standard control panel uses momentary pushbuttons in a “dead man” control scheme. To run a winch up, you must push and hold the UP button. The winch will move up until you release the button, or until the winch strikes the up limit switch. Use the DOWN button to initiate and maintain travel in the down direction. J.R. Clancy uses blue buttons for “UP” (sky), and green buttons for “DOWN” (grass) on standard control panels.
5. When the pushbutton controlling a fixed-speed winch is released, the winch will stop right away, but the load may travel a small additional distance. The distance traveled will depend upon the condition of the brake, the size of the load and whether the load is being raised or lowered. If you are attempting to stop at a certain point, find out the stopping distance by making trial runs and then plan ahead.

3. Emergency Stop Switches

EMERGENCY STOP SWITCHES have red, mushroom headed operators which are pushed to stop motion. These operate through a redundant circuit that operates independently of the normal control circuits, providing added security. See wiring diagrams for more detail. After corrective action has been taken and appropriate permission has been obtained, the emergency stop switch is reset by turning it clockwise. Resetting the emergency stop switch will not re-start equipment (unless there is very serious electrical fault, in which case the switch should be pressed again).

Maintaining the PowerAssist

 **DANGER!**

DISASSEMBLING DRIVE TRAIN COMPONENTS MAY CAUSE THE LOAD TO FALL AND CAUSE DEATH, INJURY, AND DAMAGE TO PROPERTY

LIFTING LOAD MUST BE REMOVED FROM THE HOIST PRIOR TO DISASSEMBLING DRIVE TRAIN COMPONENTS.

 **DANGER!**

MACHINERY MAY START BY REMOTE CONTROL. DEATH, INJURY, AND DAMAGE TO PROPERTY MAY RESULT IF WORKING ON MACHINE OR RIGGING WHEN IT STARTS.

LOCK OUT SOURCE OF ELECTRICAL POWER BEFORE REMOVING COVERS OR ENTERING MACHINERY SPACE

1. Maintenance Interval

The PowerAssist has been designed to provide many years of service. However, as with any rigging equipment, periodic inspection is the key to safe and reliable operation. J. R. Clancy recommends a complete annual inspection of the machine. Furthermore, if something does not look, sound, or smell right at any time the machine should be inspected prior to further operation.

2. General Operating Conditions

Inspection

- a. Verify that the counterweight has not been tampered with, and that the hoist is subjected to an imbalance no greater than the capacity indicated on the machine label.
- b. Verify that the counterweight is banded into place, and that the warning sign is in place on the arbor.
- c. Make sure that all warning signs are in place. These include the following:
 1. The warning label on the hoist machine showing the channel or set name and hoist capacity
 2. The warning label and the operation labels on the locking control box (if box is so provided)

3. The warning label on the arbor.
 4. If the system is lifting a dedicated load such that removal of the load over the stage can result in the capacity of the hoist being exceeded, warning signs must be attached to the dedicated load in a place that will be obvious to the user before the load can be removed.
- d. Inspect the conditions in the area where the machine operator must stand. Make sure that the area is free of obstructions and obvious hazards such as missing guards, damaged conduits, etc...

Maintenance

- a. If warning signs and labels are missing or damaged, contact JR Clancy for replacements.
- b. Keep the operators' area free of obstructions and hazards.

3. Frame and Anchors

Inspection

- a. Verify that all fasteners are fully tightened. Pay special attention to the fasteners securing the unit to the building.
- b. Verify that all guards and covers are in place.
- c. Visually inspect the frame of the machinery. Contact JR Clancy if it appears that the unit has been damaged or worn.

Maintenance

- a. Tighten bolts as required.

4. Gearmotor

Inspection

- a. Listen for smooth operation of the gear reducer.
- b. Look for leaking oil.
- c. Inspect mounting bolts of the gearmotor to make sure that they are tight.

Maintenance and Adjustment

- a. Keep cooling fins and grilles free of dust and debris.
- b. Addition or replacement of lubrication should be required only if the reducer has been disassembled or leaking. Contact JR Clancy for lubrication requirements in these circumstances.

5. Electric Brake

Inspection

- a. Remove the encoder (if required), the fan cover, and the brake shroud from the rear of the electric motor. See figure 1.

IMPORTANT!

To avoid corrupting position data, make sure that the control system is completely turned off prior to moving the encoder independently of the motor shaft.

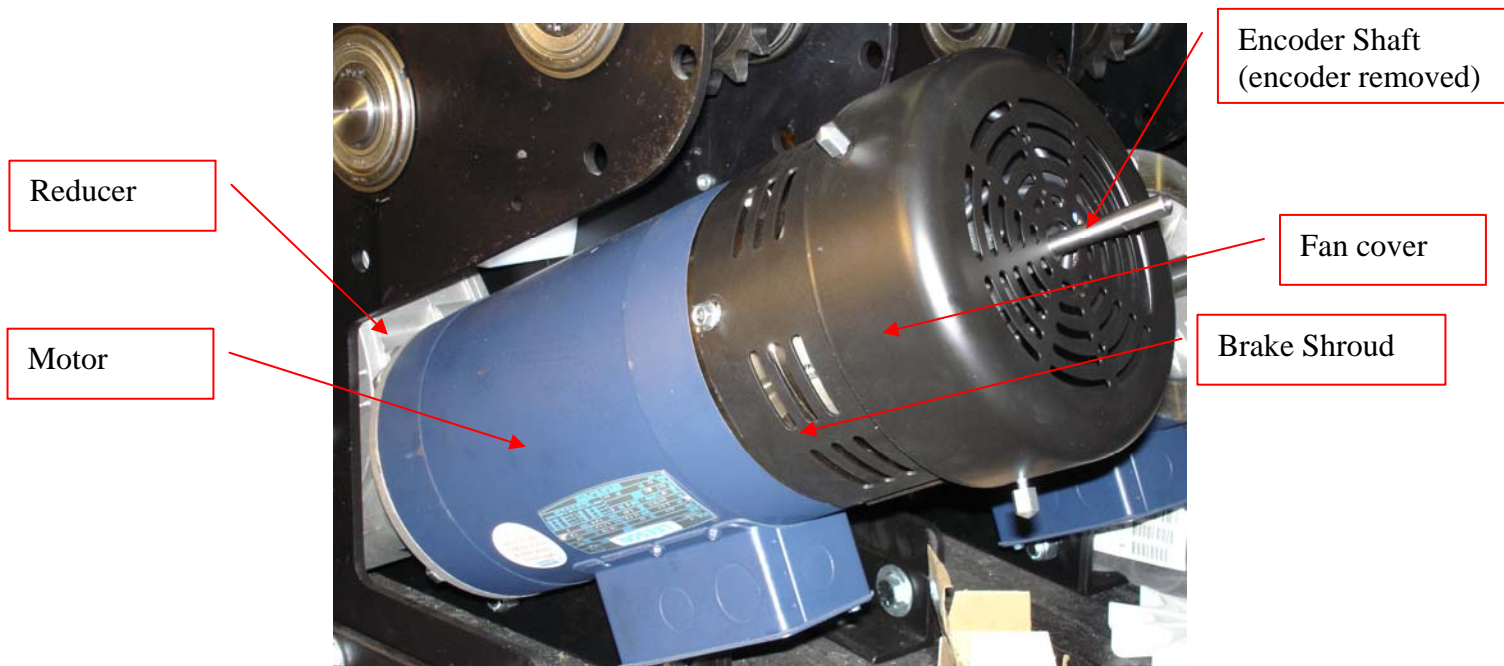


Figure 3: View of Electric Motor Assembly

- b. With the brake engaged (de-energized), use a feeler gage to check the gap between the armature plate and the magnet as seen in figure 2 below. Do this in three places around the brake. If the gap exceeds 0.016: (0.4mm) the brake should be re-gapped. See the manufacturers literature attached. The PowerAssist utilizes a size 4 KEB brake.
- c. Look for brake dust or other signs of wear. Contact JR Clancy for assistance if problems are suspected.
- d. Carefully re-assemble the shrouds to the machine and test the machine to make sure it runs smoothly and quietly.

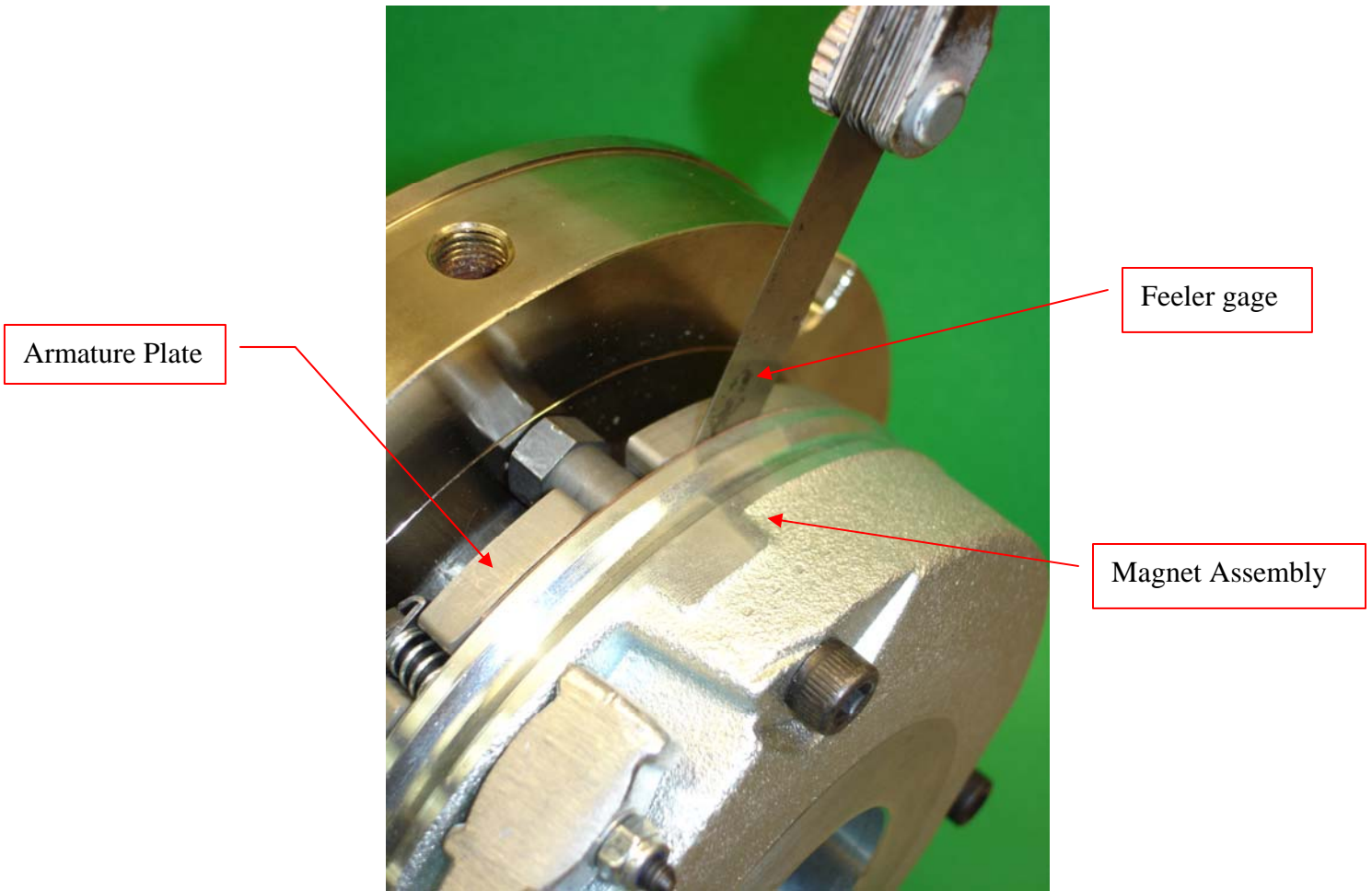


Figure 4: Checking the motor brake air gap with a feeler gage

Maintenance and Adjustment

- a. Avoid getting grease or oil on the brake.
- b. See the manufacturers literature attached for other maintenance procedures.

6. Shaft Bearings

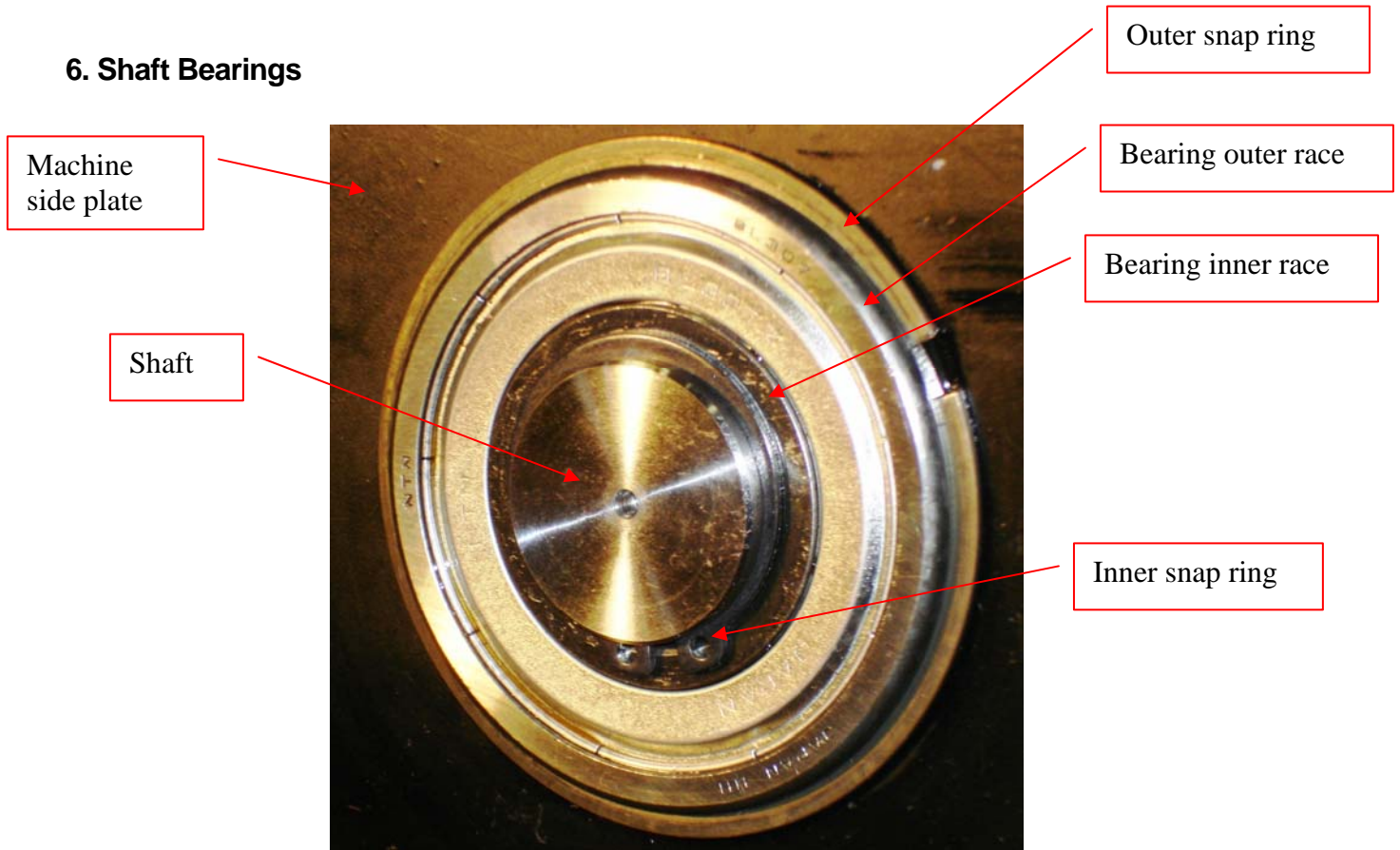


Figure 5: Shaft bearing assembly

Inspection

- Listen to the unit in operation to make sure the bearings are running smoothly and quietly.
- Make sure that the outer race of the bearing is not rotating.
- Make sure that inner and outer snap rings are fully seated.

Maintenance

- Bearings are shielded and lubricated for the life of the machine.

7. Offset Chain and Sprockets

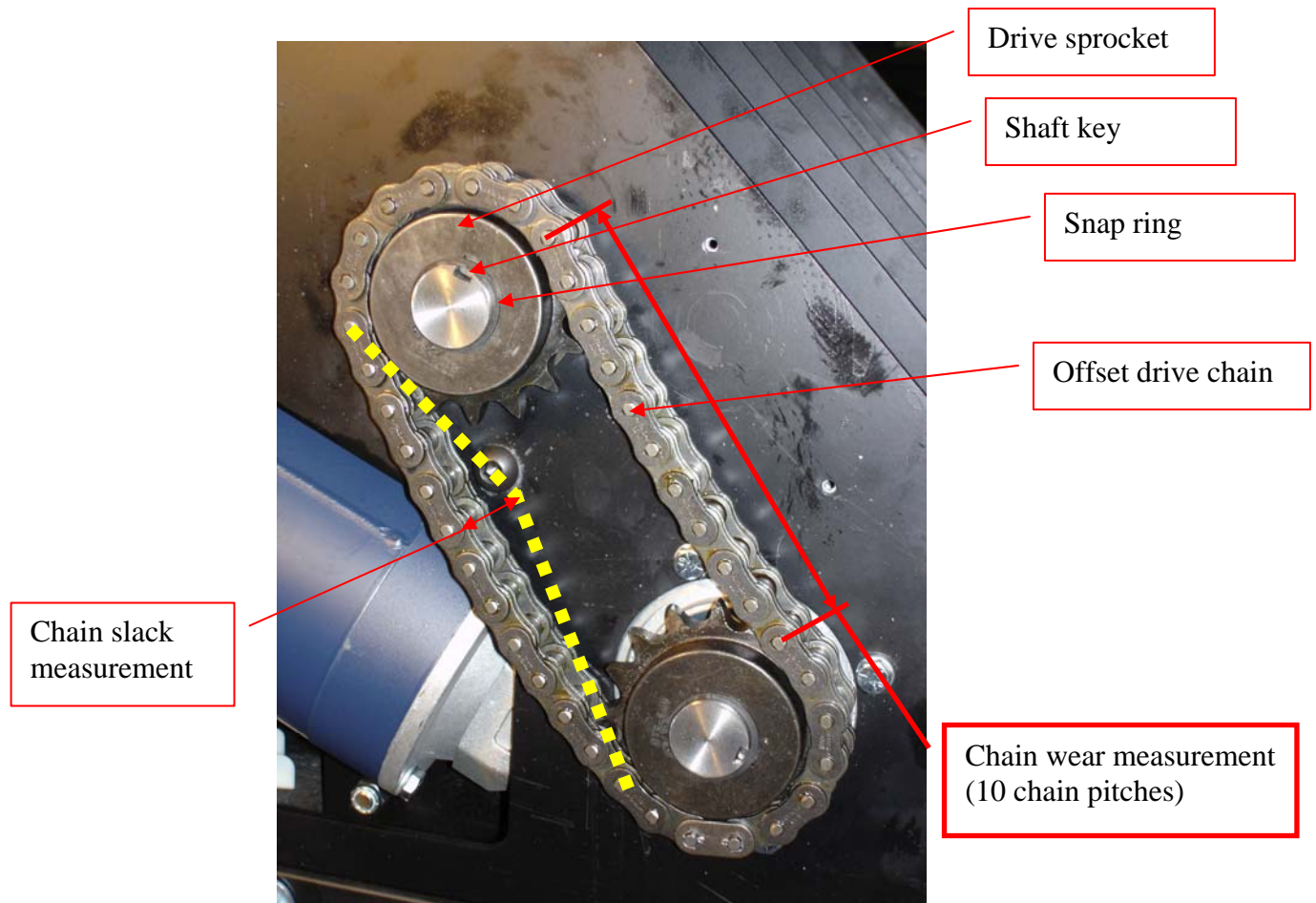


Figure 6: Offset drive assembly

Inspection

- Remove the chain cover from the machine.
- Make sure that keys and snap rings are in place and seated properly.
- Check the chain wear by measuring chain length over ten pitches. If this distance is greater than $7 \frac{3}{4}$ ", the chain length has increased by over 3% and it should be replaced.
- Measure the chain slack as seen in Figure 4. This should be no greater than $\frac{5}{8}$ "
- The chain should be oily to the touch and free of any reddish-brown or rusty discoloration of oil in the chain joints. The rusty discoloration indicates that joints are becoming dry.
- Make sure that the chain or sprockets show no signs of sprocket misalignment.

Maintenance

- a. Use a brush to apply good quality, non-detergent, petroleum-based oil that flows freely into chain joints at the normal operating temperature. Use SAE 30 weight oil for operating conditions between 40 and 100°F. Do not allow roller chain to operate in an un-lubricated condition.
- b. Replace the offset drive chain if the chain wear or slack exceeds the values given above.

8. Drive and idler sprockets

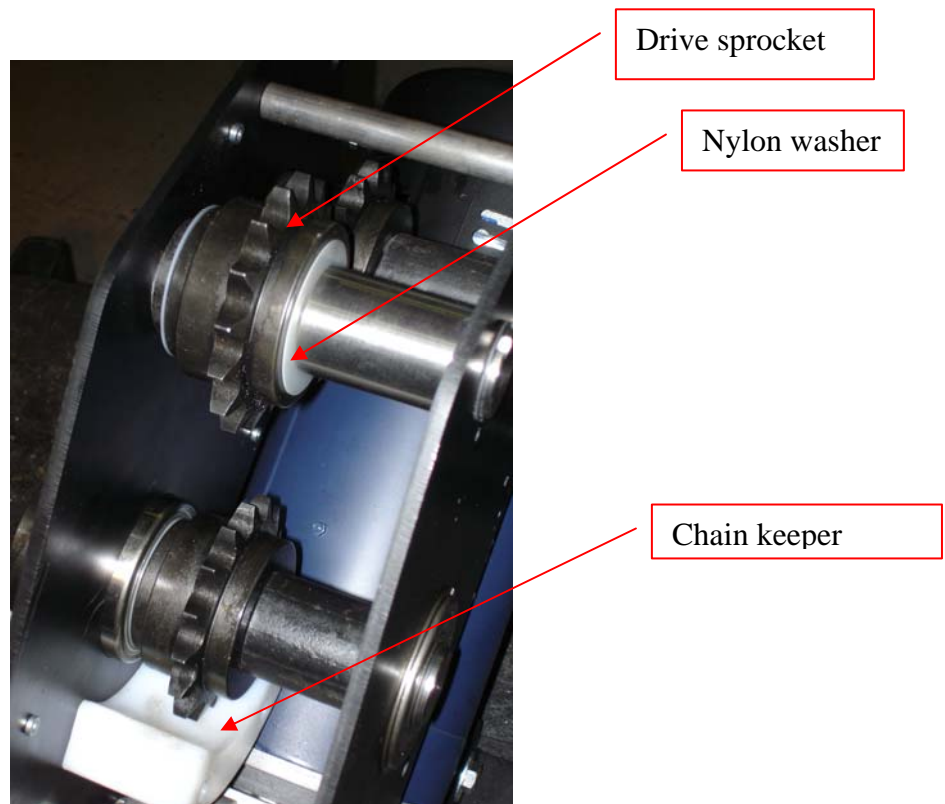


Figure 7: Drive and idler sprockets

Inspection

- a. Remove the top chain guard from the machine.
- b. Look for wear marks or debris that might indicate parts rubbing against each other improperly.
- c. Make sure all nylon washers are in place and undamaged.
- d. Look for wear marks on the chain keeper blocks. Excessive wear marks indicate improper drive chain tension.

Maintenance

- If the chain keeper or any drive train components are damaged they must be replaced. Contact the factory in this event.
- Clean out excess grease or debris from inside the chain cover.
- Keep the drive chain tensioned properly. See the drive chain section of this manual.

9. Drive chain and rope

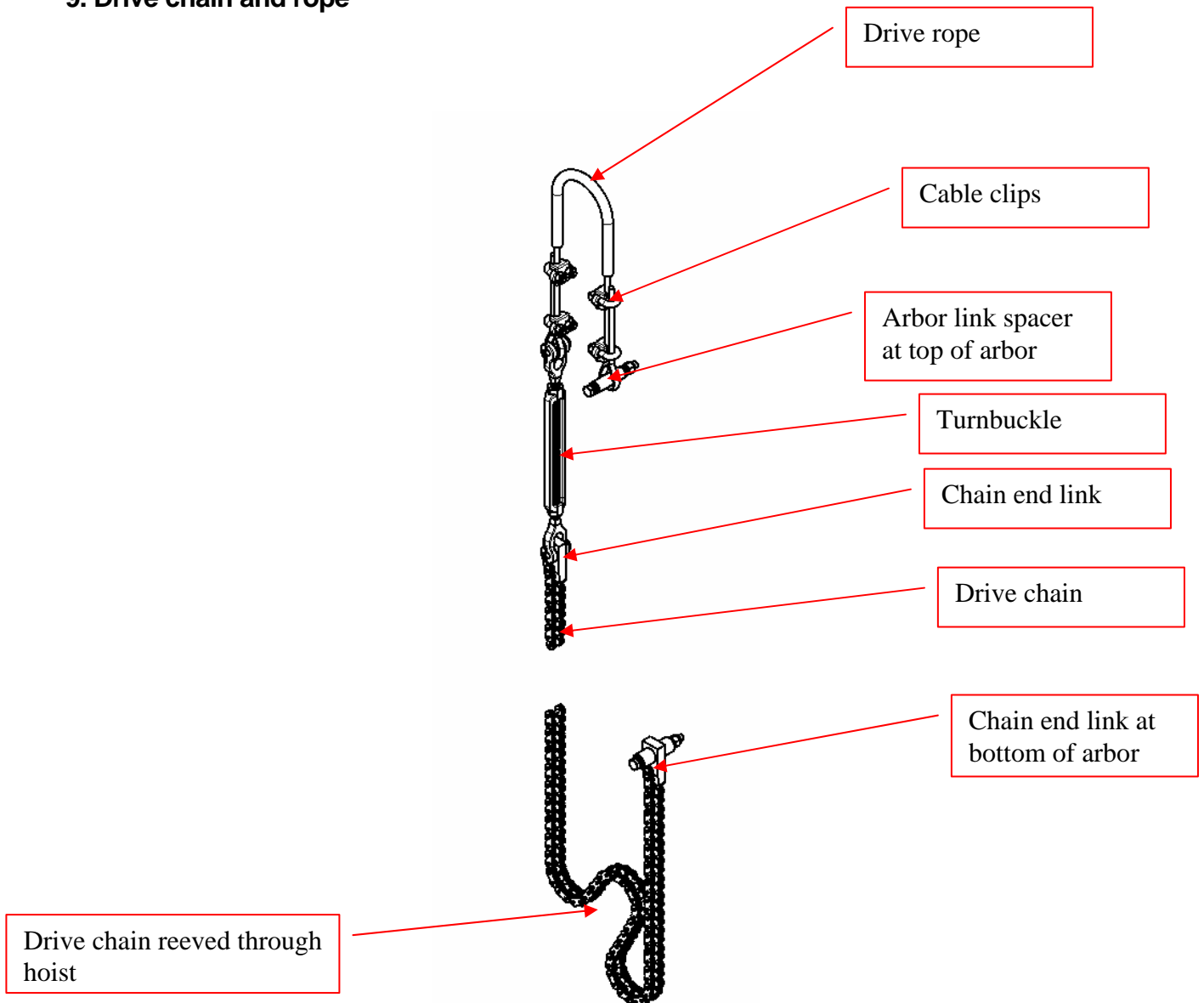


Figure 8: Drive and idler sprockets

Inspection

- Inspect the entire length of the drive rope to look for cuts or abrasions to the jacket. Visually inspect the wire rope through the jacket to look for bulges or broken strands on

the wire rope. If the jacket is worn to where the rope cannot be inspected the drive rope should be replaced.

- b. Inspect and tighten the wire rope clips per the maintenance instructions below.
- c. Inspect the attachment to the top and the bottom of the arbor to look for any signs of wear or damage. The turnbuckle should be “moused” to prevent unwanted movement.
- d. Inspect the turnbuckle and chain end link for signs of wear or damage.
- e. The chain should be oily to the touch and free of any reddish-brown or rusty discoloration of oil in the chain joints. The rusty discoloration indicates that joints are becoming dry.
- f. Unload the pipe batten so that all of the weight of the arbor is supported by the drive chain running up from the hoist, to the drive rope, over the head block, and down to the top of the arbor. Run the pipe to its out limit, bringing the arbor as close the hoist as possible. Now examine the chain running from the bottom of the arbor back to the hoist. The chain should be slightly loose.

Maintenance

- a. Use a torque wrench to re-tighten the cable clips. The tightening torque specification for 3/8 wire rope clips is 45 Ft-lbs.
- b. To lubricate the chain, use a brush to apply good quality, non-detergent, petroleum-based oil that flows freely into chain joints at the normal operating temperature. Use SAE 30 weight oil for operating conditions between 40 and 100°F. Spray applied chain lubricants are also available and may ease the application. Do not allow roller chain to operate in an un-lubricated condition.

10. Limit switches

PowerAssist winches are equipped with a Ravasi 4-element rotary limit switch. The four elements correspond to the four limit positions: Up Overtravel, Up Normal, Down Normal, and Down Overtravel limit. The normally-closed contacts of the four switches are wired in accordance with the winch electrical drawings. The positions of the four limits must be set by the installer once the winch is installed. A later section of this manual describes the procedure used to set the limits.



Figure 9: Ravasi rotary limit switch

11. Head Blocks and Loft Blocks

Inspection

- a. Check housings for signs of bending, wear, loose or bent connections, and movement on the supporting structure. Check the supporting structure.
- b. Sheaves should be checked for proper fleet angles, wear and checking in the grooves, and wear and tightness in the bearings and shafts. Castings should be checked for chips or cracks that would indicate that the block has been shock loaded or abused in some other manner.
- c. After a sheave has been subjected to any shock load it should be closely inspected for damage.

Maintenance

- a. Tighten and adjust loose fittings as necessary.
- b. Maintenance of sheaves consists of maintaining the bearings, keeping the grooves clean, and keeping the mounting tight. Bearings need to be kept clean, dry, lubricated and properly torqued. The bearings are factory lubricated and should not be greased unless they become contaminated. If they do require lubrication, the sheave should be removed from its housing and the bearings cleaned. Only then should the bearing be pressure lubricated with lithium-based bearing grease. Be sure to properly re-torque the bearings when putting the block back together. Tapered roller bearings should be tightened carefully until tight; then back off the nut on the shaft until the sheave rotates freely without any end play. Standard J.R. Clancy head blocks use tapered roller bearings. If ball bearings have been used in a special head block, lubricate them only if they are not sealed. Ball bearings can be crushed if the shaft is over tightened, so only tighten the shaft nut until end play is removed.
- c. Safety all turnbuckles after adjustment.

- d. DO NOT OVER TIGHTEN the turnbuckles on guide wires.
- e. High strength strands in aircraft cable wear the grooves in cast iron sheaves over time. Even steel or Nylatron sheaves will be affected. For this reason grooves are manufactured slightly oversized so cables will fit in the grooves without pinching. As cables wear the grooves they get smaller so wire rope check gauges are almost always made to the minimum groove size. If the gauge will not bottom out in the groove the sheave should be replaced. Figure 10 lists groove dimensions for new and worn sheaves.

Cable Diameter (inches)	New Groove		Worn Groove	
	inches	mm	inches	mm
1/8	0.156	3.97	0.141	3.57
3/16	0.219	5.56	0.203	4.76
1/4	0.281	7.14	0.266	6.75
5/16	0.344	10.3	0.328	8.33
3/8	0.438	11.1	0.406	10.3

Figure 10: Sheave groove inspection criteria

- f. Damaged or worn blocks should be replaced

12. Cables and other rigging

Inspection:

- a. Look for rust, damage, wear, and general wear. Look for the following and replace the cables as necessary.
- b. Measure the diameter: A significant change in the cable diameter means wear or breakdown of the core. Investigate further and replace if needed.
- c. Wear on outer wires: A reduction of 1/3 of the outer wire diameter means the cable needs replacement.
- d. Look for broken strands, especially at the end fittings. If more than one or two broken strands are found, replace the cable.
- e. Serious kinking or other deformation of cables is cause for replacement.

Maintenance

- a. Clean cables occasionally and lubricate with wire rope lubricant to prevent abrasion damage due to dirt and prevent rust.

13. Power and controls

The PowerAssist winch requires a three-phase 60Hz main supply, either 208-230VAC or 480VAC. Each winch required 5 Amps (at 230VAC) or 2.5 Amps (at 480VAC). The supply voltage must be specified at the time of order, to assure that the system is wired correctly.

Control power for the winch is derived from the main supply through a control transformer (24VAC systems) or a power supply (24VDC systems). The winch starter enclosure houses the control supply and fusing, a self-protected reversing starter, brake rectifier, and control panel with key switch and Emergency Stop button.

NOTE: The controls on a standard PowerAssist winch (including Emergency Stop button) pertain only to that one winch.

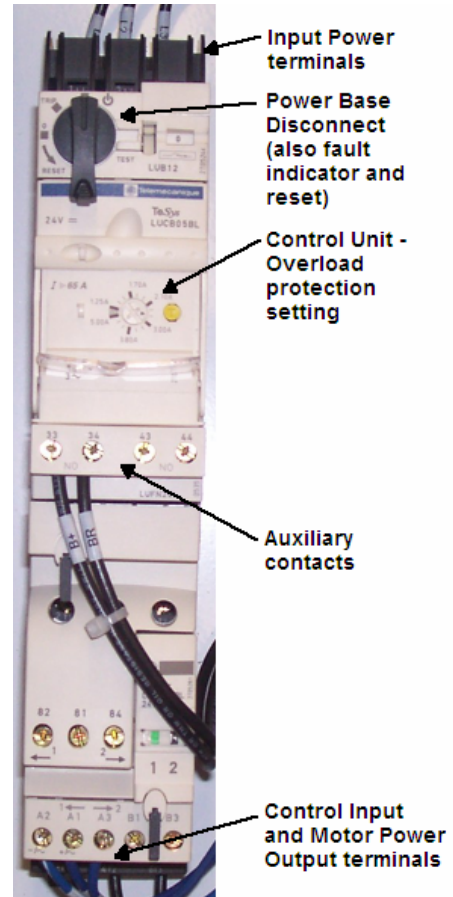
PowerAssist winches are controlled through the use of a self-protected motor starter. This unit includes a disconnect switch to shut off motor power. The disconnect handle is turned to the “twelve o’clock” position when the power is on, and to the “nine o’clock” position when the power is off. This handle also functions as a fault indicator; when the handle is in the “ten-thirty” position, it indicates that a power fault has occurred. The handle must be turned to the reset position (seven o’clock), to reset a fault.

The starter contains a control unit with an adjustable overload setting. This dial is set at startup to match the motor’s Full Load Amperage (FLA), so that the starter will register an Overload Fault if the current is exceeded.

The self-protected starter is modular in construction. Modules containing auxiliary contacts are added to the starter for various purposes, including fast actuation of motor brakes and external fault annunciation.

Terminals at the top of the starter accept the starter’s input power. Terminals at the bottom of the starter are used to connect the starter output power to the motor. Control terminals on the reversing module at the bottom of the starter accept control signals to actuate the contactors within the starter.

The starter components are selected for the motor size and current requirements, and for the required control system voltage.



Appendix A: Rotary Limit Switches

The following section describes the procedure used in setting Ravasi rotary limit switches.



Establish Rotation

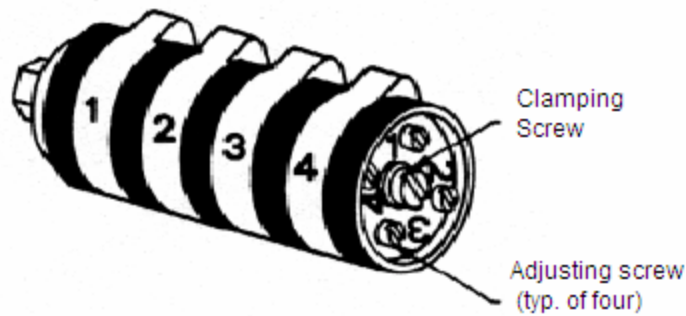
- Remove limit switch cover.
- Drive winch in UP direction – note direction of cam stack rotation.
- Mark switch cover or label inside switch to record cam stack rotation.
- Avoid contacting screw terminals on operating switches while winch system is on.

Determine Travel

- Determine where load must stop to avoid damage/misalignment – set overtravel to stop short of this point.
- Determine what range of normal travel of load must be – set normal limits to stop load at these points.
- For each end of travel, set overtravel limit first, then set end-of-travel limit.
- Make sure that the operator can clearly see the entire load for its entire travel, or that spotters are in place to observe and clearly communicate with the operator.

Adjust Limit

- Drive the winch to the desired end of travel
- Re-verify cam stack rotation (when the winch travels up, does the cam stack rotate clockwise or counterclockwise). Determine which side of the desired switch the limit cam must strike (i.e. if the cam stack rotates clockwise when the winch travels down, and you are setting a down limit, the cam must actuate the down limit while moving in a clockwise direction)



- Loosen the central cam stack clamping screw (1/2 turn).
- Locate the adjusting screw for the desired limit by referring to the numbers adjacent to the adjusting screws. Note that the lowest switch in the cam stack (down overtravel) is switch 1, the next switch (down limit) is switch 2, the next switch (up limit) is switch 3, and the highest switch in the stack (up overtravel) is switch 4.
- Rotate the adjusting screw to adjust the limit cam lobe to a position where the selected limit switch is just actuated (audible click).
- Once the limit cam is at the proper place, tighten the cam stack clamping screw.

Test Limit

- Drive winch away from limit until limit is cleared (use overtravel bypass switch to move winch off overtravel limit).
- Drive winch toward limit until limit stops motion.
- Assess stopping position (measurement vs. target)
- Drive winch off limit (use overtravel bypass switch to move winch off overtravel limit).

Refine Limit Adjustment

- Repeat the Adjust Limit procedure, as detailed above.
- Move cam lobe closer to switch to make switch trip sooner (decrease travel distance).
- Move cam lobe further from switch to make switch trip later (increase travel distance).
- Make sure to tighten cam stack clamping screw after each adjustment!
- Retest limit adjustment until winch stops at desired position.

Adjust Remaining Limits

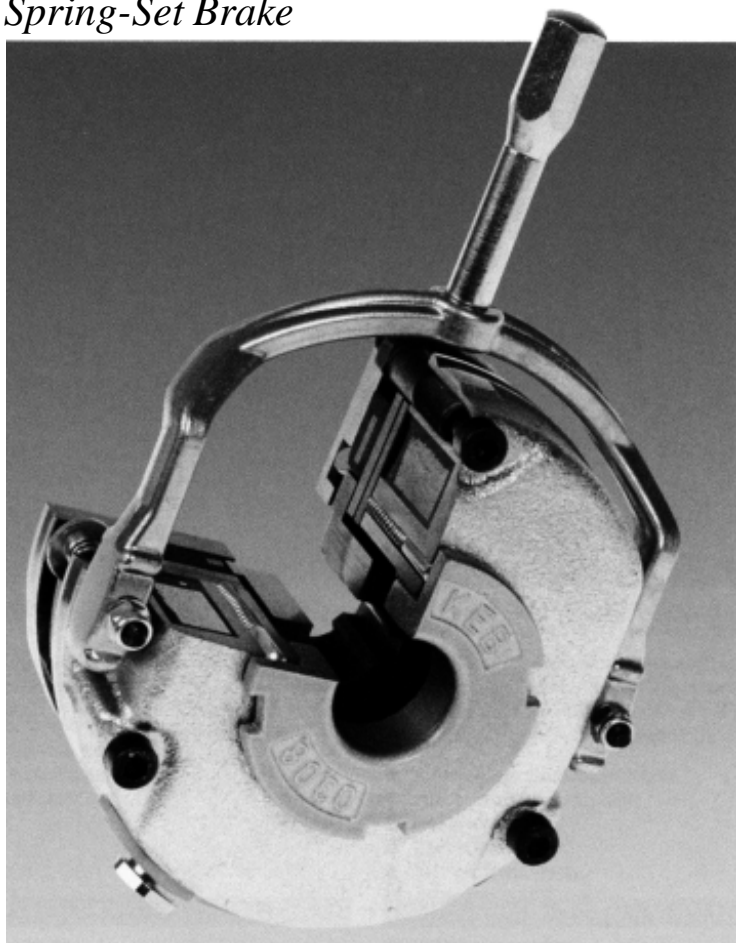
- Once overtravel limit is set, set normal limit at same end of travel.
- Check to ensure that there is sufficient distance between normal limit and overtravel limit – if the winch strikes both limits before stopping, increase the distance between the limits by moving the normal limit to stop the load sooner.
- Once all limits are set, check that cam stack clamping screws are tightened, and then replace the limit switch cover.

REVISION HISTORY

Rev	Date	Description
0	27APR07	INITIAL RELEASE
1	25MAR08	ADDED GENERAL CONDITIONS MAINTENANCE SECTION

KEBCO COMBISTOP

Spring-Set Brake



08

MOUNTING INSTRUCTIONS

COMBISTOP MOUNTING INSTRUCTIONS

- Do not install/operate brake in an area containing explosive gases. This style brake is not explosion-proof or rated for hazardous duty.
- To prevent electrical accidents, disconnect and lockout power to the brake or rectifier before attempting any service work.
- To prevent injury or damage to equipment, support or secure any load or mechanism that is being held in position by the brake prior to servicing the brake.
- If the brake has a manual hand release, do not override the brake by "tying back" the handle.
- When storing or handling the friction disc, keep the friction surface clean of oil or grease.

OPERATING PRINCIPLE

- The KEBCO COMBISTOP, as shown in Figure 1, is an electromagnetically released, spring set brake.
- The brake produces torque by squeezing the rotating friction disc (7) between the stationary mounting surface and a spring-loaded armature (3).
- The armature is pulled away from the friction disc by the magnet coil (2) when the proper DC voltage is applied.
- With the coil energized and the armature pulled across the airgap, the friction disc is free to spin.
- The necessary axial movement of the friction disc is provided by hub (6) splines.
- The hub is keyed and axially locked to the shaft by proper means. This can be accomplished with shaft shoulders, snap rings, shaft collars, set screws or a combination of such as the application demands.

- 1) HEX SOCKET CAPSCREW
DIN 912 OR 6912 GR. 8.8
(Length depends on application)
- 2) MAGNET
- 3) ARMATURE
- 4) TORQUE ADJUSTMENT RING
- 5) SPRING PLUNGER
- 5.1) PRESSURE SPRING
- 6) HUB
- 7) FRICTION LINING
- 8) FRICTION SURFACE (Optional)
- 9) HOLLOW SPACER-BOLT
- 10) HAND RELEASE (Optional)

Spacing distance from hub to mtg. surface.
0.5...1 mm
0.020....039 in.

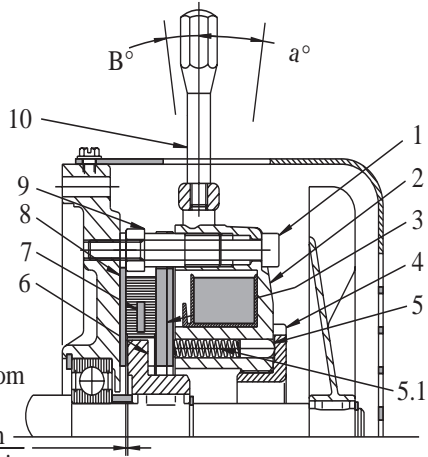


Figure 1

SPECIFICATIONS AND CONDITIONS NECESSARY FOR MOUNTING

1. The mounting/friction surface must be made out of cast iron, steel or stainless steel.
2. The surface roughness R_z should not exceed $25 \mu\text{m}$ ($1000 \mu \text{ in.}$) or R_A should not exceed $0.80 \mu\text{m}$ ($32 \mu \text{ in.}$)
3. The friction surface to shaft perpendicularity should be no greater than 0.05mm on 100mm length.
4. The eccentricity of the brake mounting bolt circle to the shaft should not exceed the following Size 00...02 = 0.2mm ; Size 03...06 = 0.4mm ; Size 07...10 = 0.5mm .
5. The maximum shaft runout is 0.05mm T.I.R. The maximum end-float of the shaft is 0.5mm .
6. The friction surfaces must be free of grease and oil.
7. Humidity, fumes and corrosives can cause rusting on the friction surfaces. In such cases stainless friction surfaces are available.
8. Protection may be needed against objects, particles, or substances that could penetrate into the airgap and hinder the proper movement of the armature. In such cases enclosures and dust-rings are available.

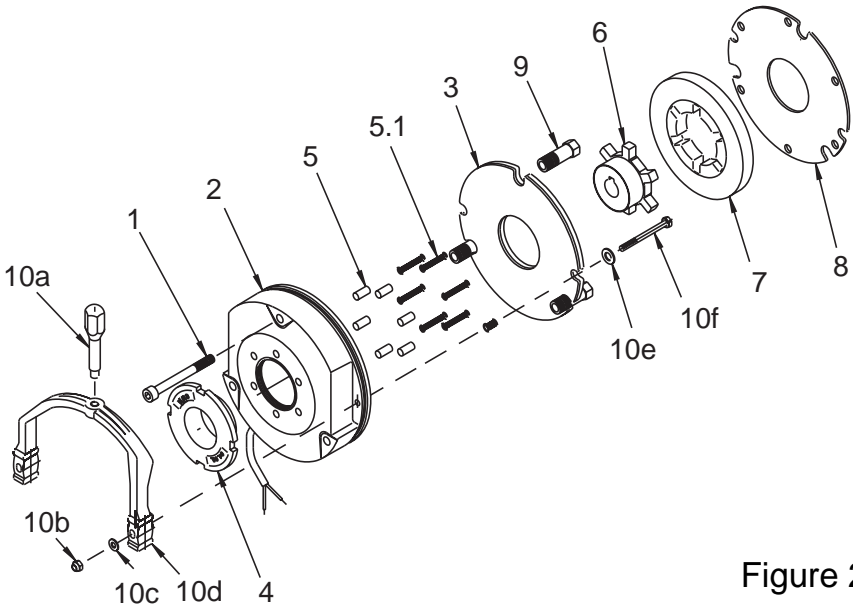


Figure 2

INSTALLATION AND ASSEMBLY INSTRUCTIONS

1. If a suitable friction surface is not an integral part of the machine, mount a flange or friction surface (8) to the machine with correct machine screws.
2. Mount the hub (6) on the keyed shaft and secure it axially. The normal method is with shoulders or spacers and snap rings. Axial clearance of 0.5 to 1mm from the mount surface is necessary. See Figure 3. Other methods of hub location can be used as long as the method used meets the security needs of the application. In cases where dynamic stopping is anticipated the hub should be axially locked by snap rings, shaft collars, tension pins or other positive means. The set screws provided are for convenience only. The shaft key needs to be retained for a secure mounting. If the key is not captured by the hub retaining method, screws, pins or collars are other possible methods. LOCTITE is recommended on all fasteners. Tighten all fasteners to a torque consistent with normal mechanical practice.

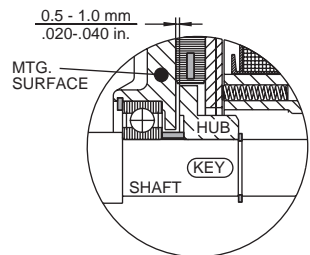
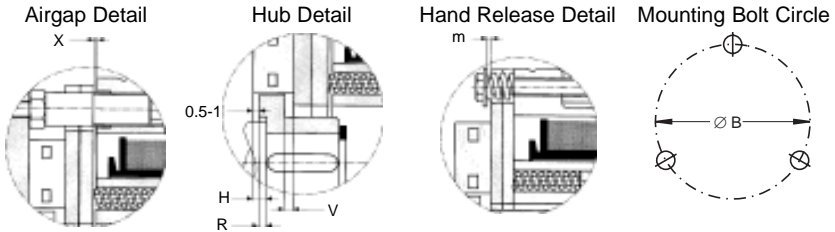


Figure 3



Brake Size	Static Torque ¹⁾ (Nm)	Nominal Airgap X (mm)	Max. Wear V (mm)	Readjustment recommended at Xn (mm)	Min. Lining Thickness (mm)	Angle of Hand Release		R (mm)	m (mm)	Ø B (mm)
						a°	B°			
1	3	0.2	1.5	0.4	5.0	10	8	-	1.0	66
2	4	0.2	2.0	0.4	5.5	8	8	0.5	0.8	72
3	8	0.2	1.5	0.5	6.5	8	8	1.5	1.0	90
4	16	0.2	2.5	0.6	8.0	8	8	1.5	1.4	112
5	32	0.2	2.0	0.6	10.0	8	8	2.0	1.5	132
6	60	0.3	2.0	1.0	10.0	8	8	2.0	1.88	145
7	100	0.3	4.0	1.0	10.0	10	6	2.0	2.0	170
8	150	0.4	5.0	1.2	11.0	10	6	3.5	2.0	196
9	250	0.4	6.0	1.2	12.0	10	-	4.0	2.3	230
10	400	0.5	8.0	1.5	14.0	10	-	8.5	2.7	278

Power Assist features Brake Size 4

Table 1

- Slide the friction lining (7) on the hub. Be careful not to damage the hub splines or the lining through misalignment. The lining should slide easily on the hub and should not require tools.
- Attach the magnet and armature as an assembly using mounting bolts of proper length. Tighten to normal torque. Use removable LOCTITE for maximum security. Bolts of nonstandard length may be needed due to special mounting surfaces. Please consult KEBCO if special conditions exist.
- The brake comes with preadjusted airgap LOCTITED into position, but before commissioning it is best to check the airgap. This is also the procedure to follow for readjustment due to wear. Check airgap "x" with a feeler gage in 3 locations. If airgap "x" is not as shown in Table 1, loosen mounting bolts (1) slightly and turn the hollow spacer-bolts (9) 1/4 turn, retighten bolts (1) and measure airgap. Turning the hollow spacer-bolts into magnet will reduce the airgap. Repeat the procedure as necessary. Finish by checking all three mounting bolts for proper torque.
- If the brake is equipped with a hand release the "m" dimension should be checked with the value shown in Table 1. Adjust as necessary. The "m" dimension is measured with the armature pulled across the airgap.

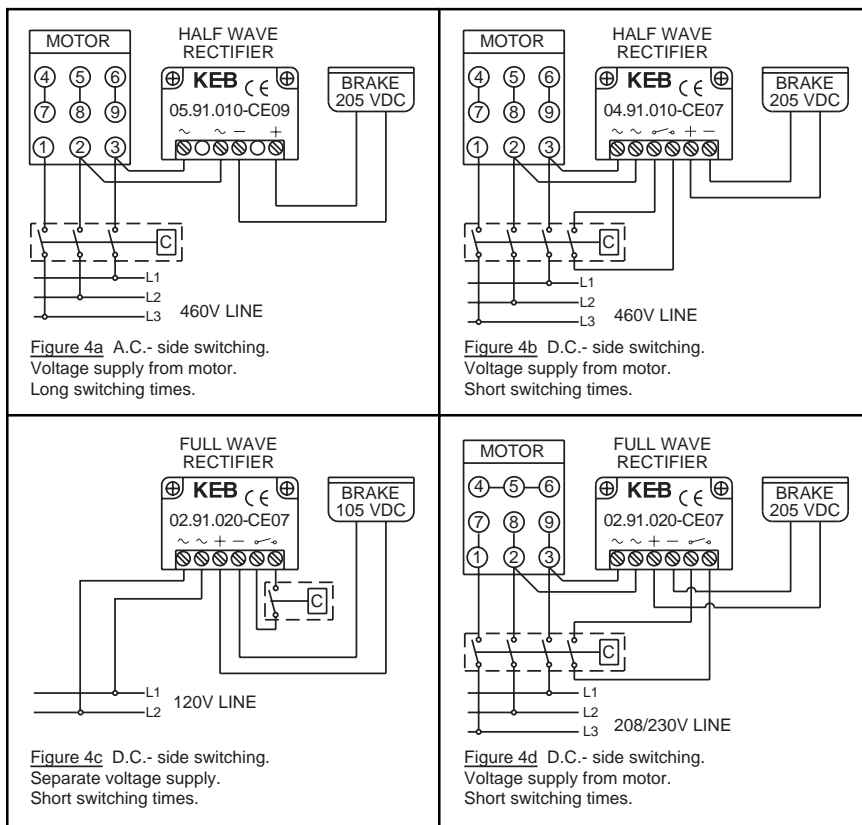


Figure 4

RECTIFIER SPECIFICATIONS

Full or Half Wave Rectifier	U in max. input voltage (VAC)	U out output voltage (VDC)	In nominal current		Switching	U v max. max. switch-off voltage	Varistor for fast switching	
			45 C	80 C				
Full	275V	0.9*U in	2.0A	1.0A	AC or DC	450 V	00.90.045-2752	02.!
Full	500V	0.9*U in	2.0A	1.0A	AC or DC	900 V	00.90.045-5105	04.!
Half	275V	0.45*U in	1.0A	0.5A	AC or DC	450 V	00.90.045-2752	02.!
Half	500V	0.45*U in	1.0A	0.5A	AC or DC	900 V	00.90.045-5105	04.!
Half	600V	0.45*U in	1.0A	0.5A	AC	1000 V	00.90.045-6252	05.!
Half	720V	0.45*U in	1.0A	0.5A	AC	1600 V	00.90.045-4202 *	06.!
Half ¹⁾	275V	0.45*U in	1.0A	0.5A	AC or DC	450 V	00.90.045-2752	02.!

1) with EMC Protection

* requires 2 components i

Table 2

7. Connect the magnet leads to the correct DC voltage. Rectifiers are available from KEBCO to produce DC power from the AC mains. They have built in arc suppression and voltage peak protection to protect customer contacts and switches. All internal components are encapsulated in plastic for high temperature resistance and vibration protection. Any standard AC line voltage is acceptable by using our half or full wave rectification.

For AC side switching (see Figure 4a) simply apply AC voltage across the rectifier and the brake releases. The brake is wired in parallel with the motor. It is important to understand that this kind of hookup results in relatively slow brake engagement times, i.e. 1/4-1/2 sec, and a more gentle braking action is observed. This may or may not be desirable for a given application.

For DC side switching (see Figure 4b) when fast brake action is desired, i.e. 25-50 ms engagement times, the brake is switched across the DC side of the rectifier. The switch terminals should be wired into an auxiliary motor contact so that when the motor is running the terminals are connected, and when the motor is turned off the terminals are disconnected, AC voltage needs to be present across the rectifier when the motor is running

For even faster switching cycles an external varistor can be connected in parallel with the brake or the +/- terminals of the rectifier. See Table 2.

For applications requiring the following:

- rapid switch-on
- higher wear reserve
- shorter switch-off times
- reduced heating,

the KEBCO-Powerbox for 300vAC supply replaces half or full wave rectifiers. This rectifier was developed to give improved switching response of spring-set brakes.

Consult KEBCO for more Powerbox information: (800)899-3226

8. If the power supplied is much greater than the rated voltage of the brake or if an overexcitement power supply such as the KEBCO Powerbox is used, more attention to the hand release "m" dimension is needed. A larger "m" dimension or the elimination of the hand release may be required to ensure braking torque is maintained. Consult KEBCO on applications described above.

ADJUSTMENT OF BRAKING TORQUE

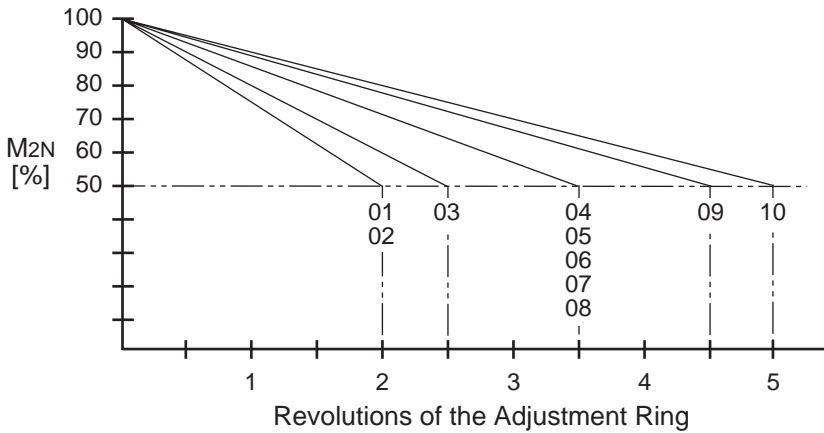


Figure 5

As delivered the brake is set to rated torque. To reduce torque, the adjustment ring is turned out from the brake. Figure 5 above shows the approximate torque change. Note: the switching times will change as the torque is reduced.

BOLT TIGHTENING TORQUES

The following torque values are approximate. They are based on DIN 912 grade 8.8 bolts into mild steel with a thread engagement of twice the bolt diameter.

- M4 x 0.7 = 3 Nm
- M5 x 0.8 = 6 Nm
- M6 x 1.0 = 10 Nm
- M8 x 1.25 = 24 Nm
- M10 x 1.5 = 50 Nm

CONVERSION FACTORS

- mm/25.4 = inch
- Nm x 0.738 = ft lb

Please consult KEBCO with any questions you may have regarding this or any of our other fine power transmission products.

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