

Installation and Adjustment of the Hollister-Whitney Rope Gripper™

by Walt Glaser

Learning Objectives

After reading this article, you should have learned about

- ◆ the history of and code requirements for elevator emergency brakes.
- ◆ the principle behind the Rope Gripper™ emergency brake.
- ◆ the components and basic operation of the Rope Gripper.
- ◆ proper mounting of the brake unit and pump unit.
- ◆ Rope Gripper control circuits.
- ◆ testing and inspection procedures for the Rope Gripper.

History

The Rope Gripper from Hollister-Whitney is a commonly used emergency brake for geared traction elevators in North America. There are tens of thousands already installed and working, with thousands more installed every year. Elevator mechanics need to understand this important safety device – how it is installed, how it works and how to make sure it keeps working properly.

The Rope Gripper was developed by Hollister-Whitney and its sister company GAL Manufacturing in the late 1980s. A series of elevator accidents pointed out the need for a backup device to be deployed if the driving machine of a traction elevator became somehow disengaged from the machine brake. In these cases, because the counterweight is often heavier than the car, the elevator would often move up. Hollister-Whitney was quick to recognize this potentially dangerous situation and develop the proper device to prevent it.

Code Requirements

In 1990, the CSA B44 standard was the first to codify a requirement for an elevator emergency brake such as the Rope Gripper. This came after a directive was issued in 1988 in the province of Ontario, where several accidents had occurred. In 2000, the ASME A17.1 code (now harmonized with B44) added the emergency-brake requirements. These are contained in the current ASME A17.1 and CSA B44 codes in section 2.19, and provide an extra measure of protection against two potentially life-threatening situations.

Although there are many requirements that an elevator emergency brake must conform to, its primary purpose is to protect against 1) ascending car overspeed and 2) unintended car movement with doors open. The applicable code rules for these are found in ASME A17.1/CSA B44 sections 2.19.1 and 2.19.2, respectively. This article will delve deeper into the code requirements in later sections.

Why a Rope Brake?

There are other elevator emergency brakes, but the rope brake is effective and widely accepted.

Sheave Brakes – devices to arrest the rotation of the driving sheave have been available as emergency brakes. The major drawbacks of these designs are that they are very hard on other machine components (specifically the sheave itself), and there is the potential to stop the sheave without stopping an ascending car (i.e., given enough momentum, the ropes could slip traction when the drive sheave is suddenly stopped).

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Value: 1 contact hour

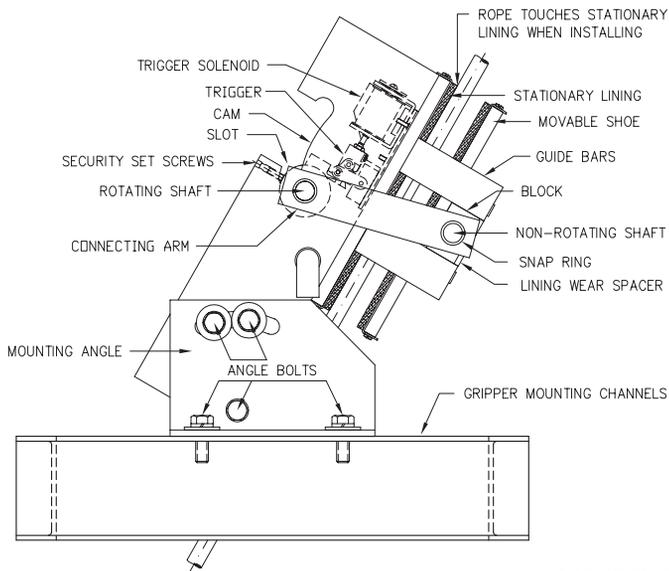
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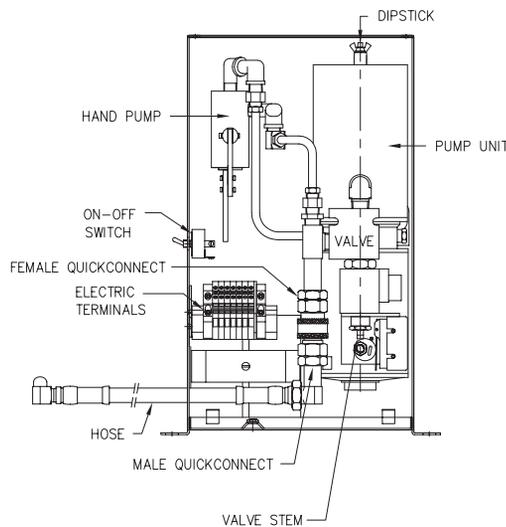


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ROPE GRIPPER™ BRAKE UNIT



PUMPING UNIT FOR #626 ROPE GRIPPER™



PUMPING UNIT FOR #622, #624, AND #625 ROPE GRIPPER™

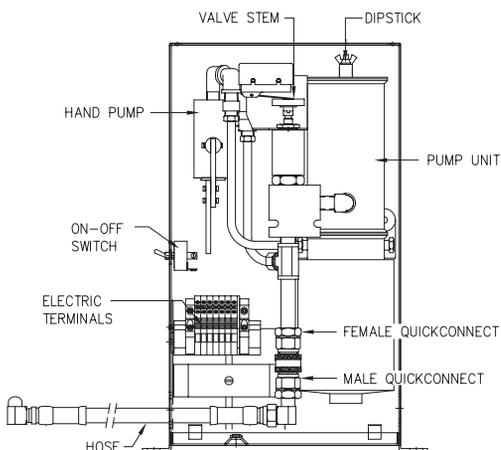


Figure 1

Bidirectional Safeties – These devices work a lot like traditional down directional safeties, but are capable of deploying – grabbing the rails to stop the car – in both directions. Bidirectional safeties can be effective in protecting against ascending car overspeed, as they can be set using a traditional centrifugal governor. Protection against unintended car motion is a little more difficult to accomplish with bidirectional safeties. However, some newer designs do.

A rope brake can safely, quickly, effectively, repeatedly and economically protect against both situations without any damage to equipment. Barring catastrophic rope failure, in which case safeties will set, there is no potential to stop the ropes without stopping the car.

Rope Gripper Overview

Rope Gripper consists of two components: a **pump unit** and a **brake unit** (See Figure 1).

The **pump unit** consists of a pump, valve and control circuits that are used to open the brake unit and trigger its activation. The pump compresses the springs and opens the movable shoe on the brake unit to accommodate the elevator ropes and put the Rope Gripper into the “ready” (“running”) position.

The **brake unit** is the device that actually clamps the elevator ropes to stop elevator movement. It uses a combination of a hydraulic cylinder and springs to push a rotating shaft up a stationary power cam, which applies pressure to the elevator ropes. The brake unit also has a solenoid assembly that is used to hold the movable shoe in the “ready” (open) position, and it applies the movable shoe when a fault signal is received from the elevator controller.

The Rope Gripper is opened hydraulically (with a pump and valve) but held open electrically. It is triggered by the loss of electricity (of the solenoid assembly) and activated mechanically by way of springs, rotating shaft and power cam.

The Rope Gripper activation signals come from the elevator control. It is the responsibility of the control manufacturer to provide the proper and necessary circuitry to operate this device in a manner that is code compliant.

Understanding Basic Operation

The Rope Gripper comes pre-adjusted from the factory. It is unlikely that a mechanic will need to adjust it in the field. Still, a mechanic needs to understand how it operates and how to make sure it is functioning properly.

The most common mistake we see with Rope Gripper setup relates to a basic misunderstanding. The Rope Gripper uses hydraulics (a pump) to open it into the “ready” (“loaded”) position, but it is held open electrically. Once a Rope Gripper reaches the proper open position, the Brake-Ready micro-switch contact will open and turn off the pump. The pump should run just long enough to get the latch hook past the trigger, and then it should shut off. The hydraulic pressure will slowly bleed off until the trigger and latch are resting together. At this point, the trigger and latch are engaged and the hydraulic portions could be disconnected with no effect. If/when the hydraulic pressure is improperly used to hold the Rope Gripper open, it quickly results in leaky seals and/or broken cylinders.

When properly adjusted, the Brake-Ready micro switch will turn off the pump when the trigger and latch are engaged, and while there is still approximately a 1/32-inch clearance between the rotating cam and the bottom of the cam slot.

Anytime the Rope Gripper pumps the movable shoe into the open position, the mechanic needs to look for two things:

- 1) The solenoid assembly latches – electricity to the solenoid plunger is designed to hold the shoes open (Figures 2 and 3).

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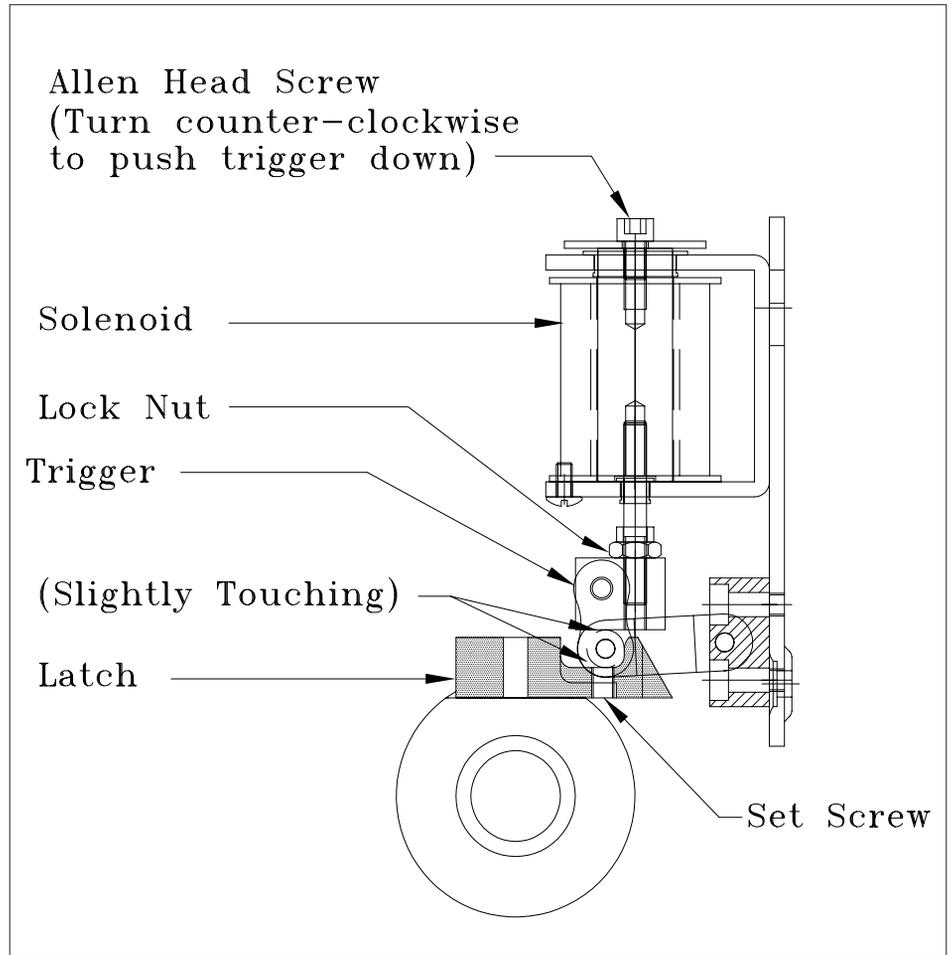


Figure 2

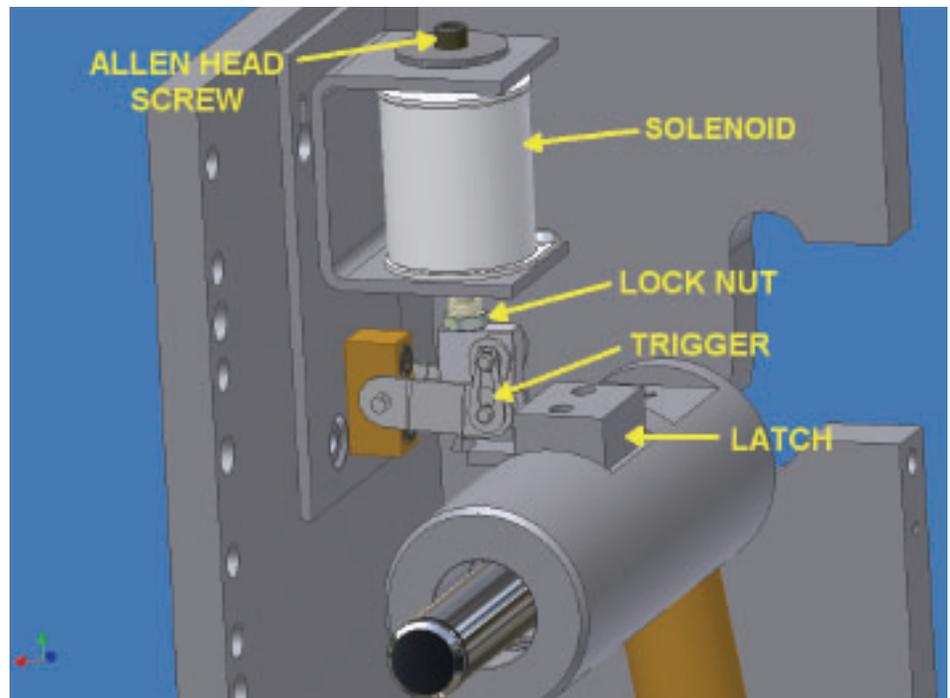


Figure 3

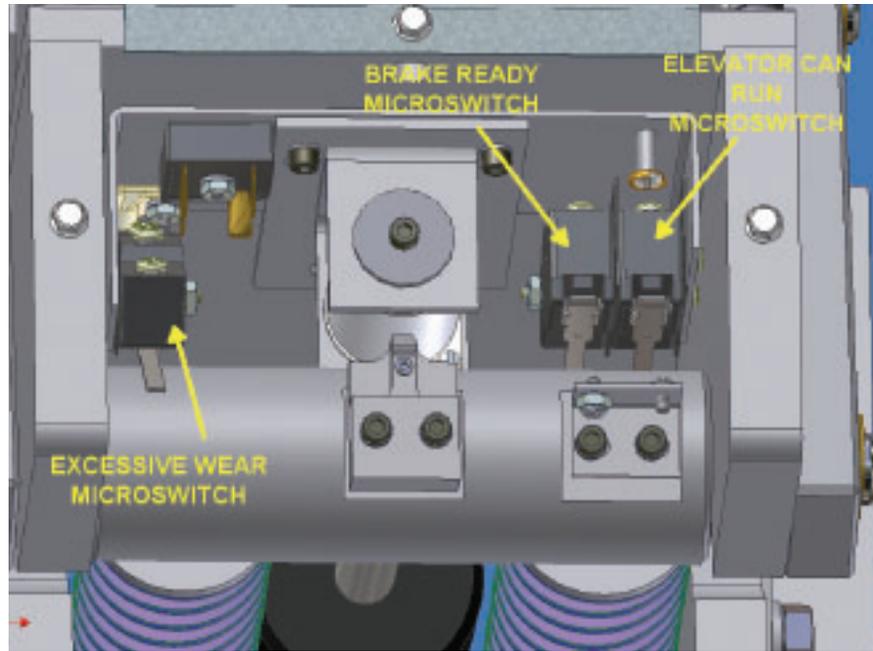
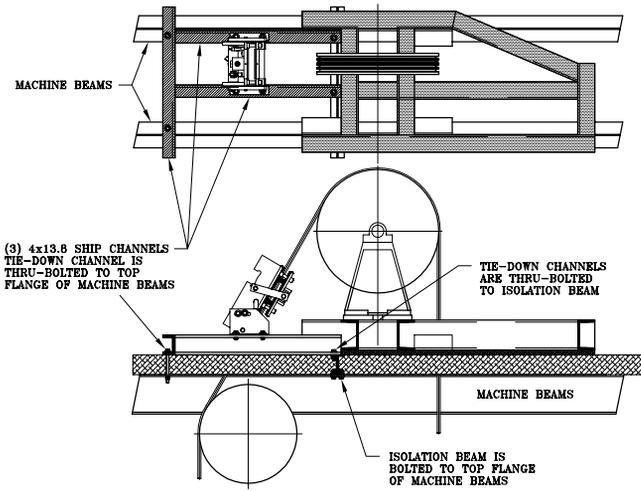


Figure 4

Typical Mounting Arrangement for Overhead Machines
- New Installations -



Typical Mounting Arrangement for Overhead Machines
- Existing Installations -

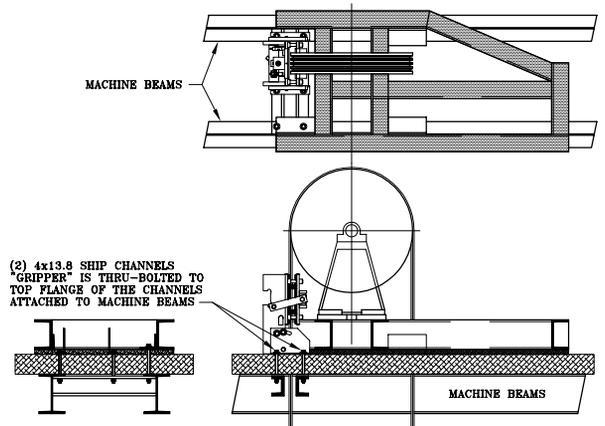
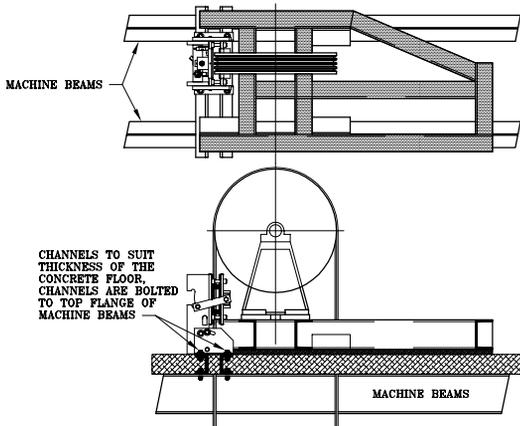
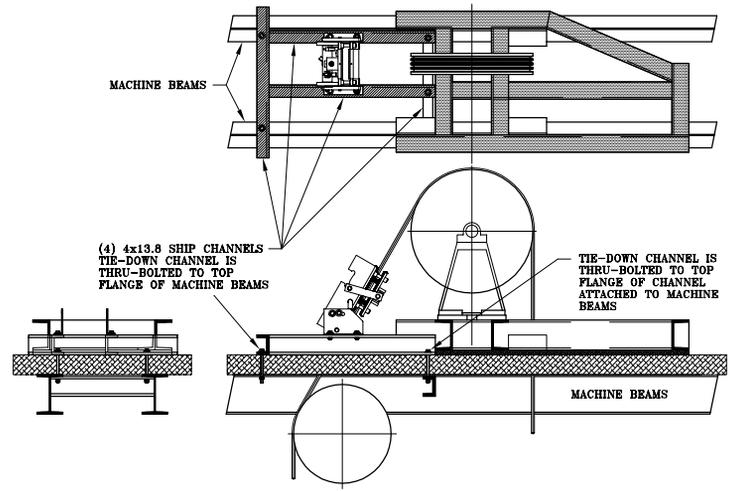


Figure 5

2) The Brake Ready micro switch turns off the pump (Figure 4).

The Rope Gripper is triggered and will grip the ropes when a fault is detected or when there is loss of power (Suggested Control Circuits section). There is a manual mode available for the pump unit so that during a prolonged power outage, the Rope Gripper brake unit can be manually opened to facilitate releasing any trapped passengers. When placed in the manual mode, power is removed from the machine or elevator brake.

Proper Mounting

A mechanic needs to understand the tremendous forces that will be exerted on the Rope Gripper brake unit. By code (ASME A17.1/CSA B44 section 2.19.4), the supports for the Rope Gripper must be able to withstand the same forces and stresses as the machine, machine beams and bed plates. This is a crucial issue. (See Figure 5 for several typical mounting configurations for the brake unit.) If you don't have complete structural/stress analysis, a good rule of thumb is to use the same support for the Rope Gripper brake unit that is used for the machine, i.e., if the machine is supplied on 6-inch I-beams, mount the Rope Gripper brake unit on 6-inch I-beams. If the machine is through-bolted on a floor plate, do the same for the Rope Gripper brake unit.

Note that the overspeed protection from the emergency brake is only required by code in the up direction. This being said, most of the time it is considered desirable to trigger the Rope Gripper if overspeed is detected in either direction. When considering mounting configurations, understand that extreme forces will be applied in both directions.

Due to space constraints, you may need to get inventive with the mounting of the brake unit. On some gearless machines or basement traction sets, the mounting of the brake unit will be a challenge. Hanging the

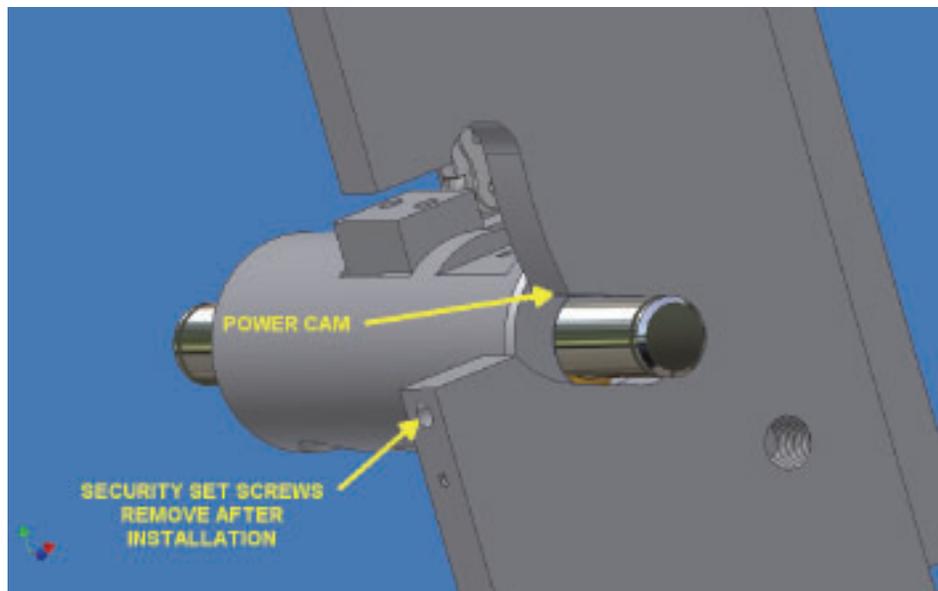


Figure 6

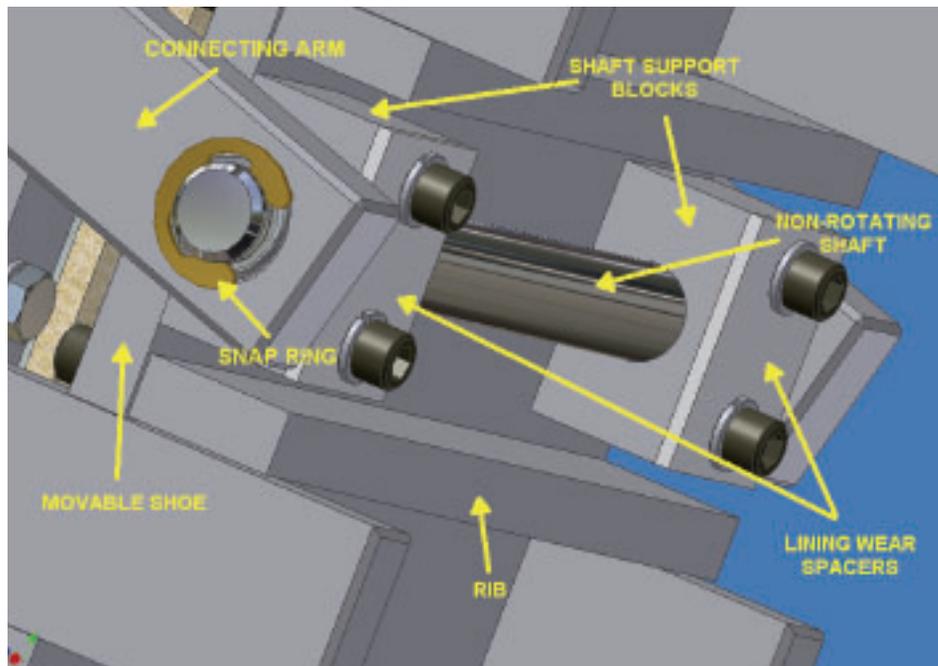


Figure 7

brake unit upside down from the underside of the machine-room floor is an option. Sometimes, the brake unit winds up being horizontal between two sheaves on a basement machine. For a special application, you may want to contact Hollister-Whitney.

Mounting the Brake Unit

Make sure that security set screws are in place and holding the rotating shaft in the "ready" position (movable shoe open) as shown in Figure 6. Brake units are shipped this way.

Remove the four snap rings and the two connecting arms shown in Figure 7.

Remove the movable shoe assembly. Place the brake unit into position on its mounting structure and, with the angle bolts loosened, align the brake unit so that the ropes are in contact with the stationary shoe lining from top to bottom and centered side to side. **It is important that the ropes barely touch the stationary shoe lining, and that the contact**

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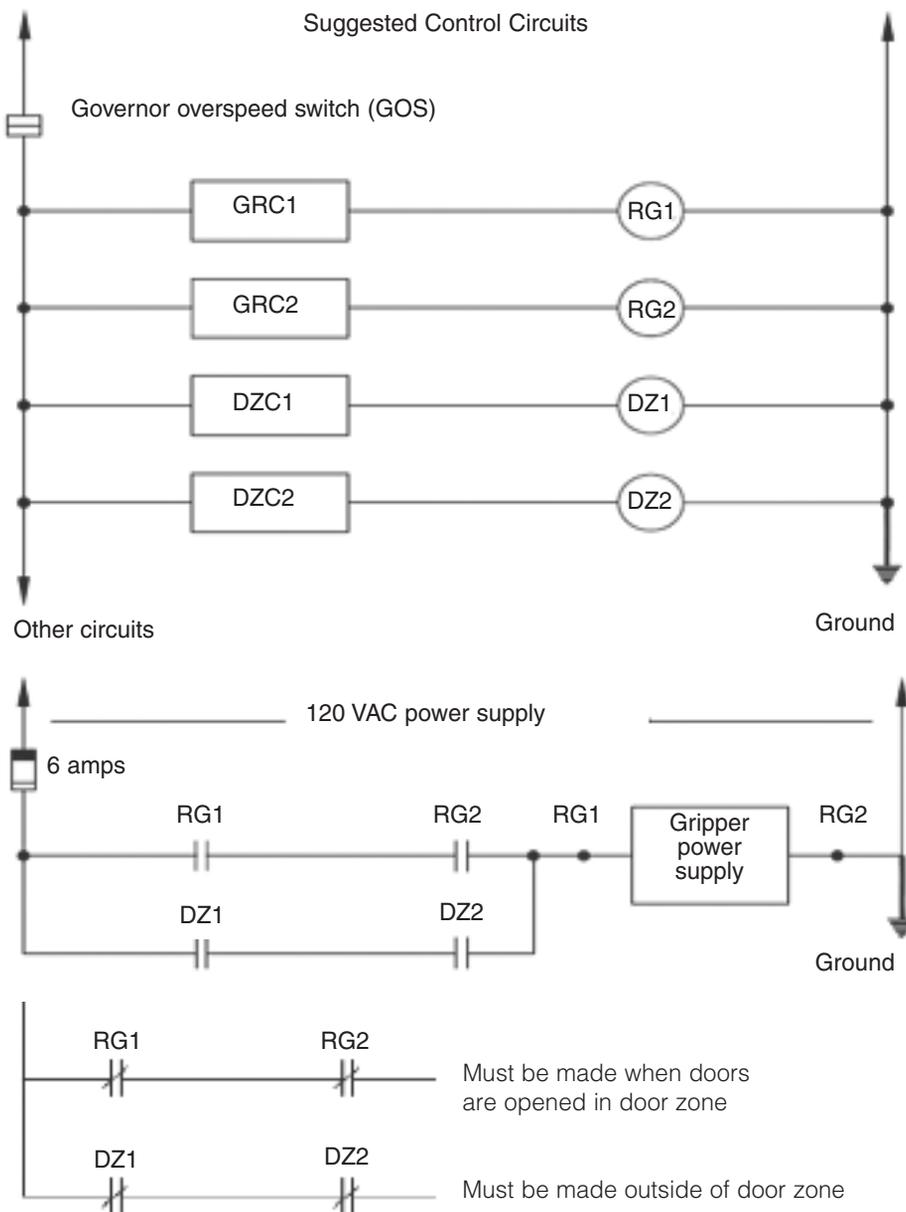


Figure 8

is even over the entire contact area. Misalignment can cause uneven and/or excessive lining wear.

Securely tighten the mounting bolts and the angle bolts.

Double check alignment after the brake unit is tightened into final position. Readjust if necessary.

Replace the movable shoe assembly, making certain that the chamfered corners of the connecting arms face in (toward the brake unit) and replace the

connecting arms and their snap rings. Make sure that the snap rings seat properly into the groove on the shaft.

Mounting the Pump Unit

Mounting the pump unit is much easier – only two requirements: 1) it needs to be fixed in place, right-side up, and 2) it needs to be within hose reach of the brake unit. Extra hose length can be obtained if necessary.

It is important to remove the shipping cap on the top of the

pump unit and insert the dipstick strapped to the inside of the pump-unit enclosure. DO NOT OPERATE THE ROPE GRIPPER UNTIL THE SHIPPING CAP HAS BEEN REMOVED. Check the oil level – oil should be at least 1 inch up on the dipstick.

Suggested Control Circuits

The Rope Gripper is a dumb device. Its function is a result of signals from the elevator control. (See attached suggested circuits for the control of the Rope Gripper in Figure 8.) Any time the Rope Gripper is activated, power is removed from the elevator machine and brake.

The Rope Gripper is designed so that it can and will automatically reset if it is triggered due to simple loss of power. On resumption of power, the pump unit will start and return the brake unit to the open and ready position.

By code, when the Rope Gripper sets due to a detected fault (over-speed or unintended motion with doors open), it must be manually reset. A mechanic must correct the fault before the Rope Gripper is reset and be sure he knows what the elevator is going to do when the ropes are released. If a fault has been detected, there is very likely some sort of failure of the machine brake. Very often, the Rope Gripper is the only thing keeping the car from moving. If the Rope Gripper is reset without correcting the problem that caused the fault, it is very likely that the car will take off – most likely in the up direction. This is a potentially dangerous situation. A mechanic needs to understand this and be prepared to react.

Test and Lining Wear-in

Check for proper trigger and latch setup (Figures 2 and 3). Starting with the Rope Gripper held open with the security screws (like it was shipped), do the following:

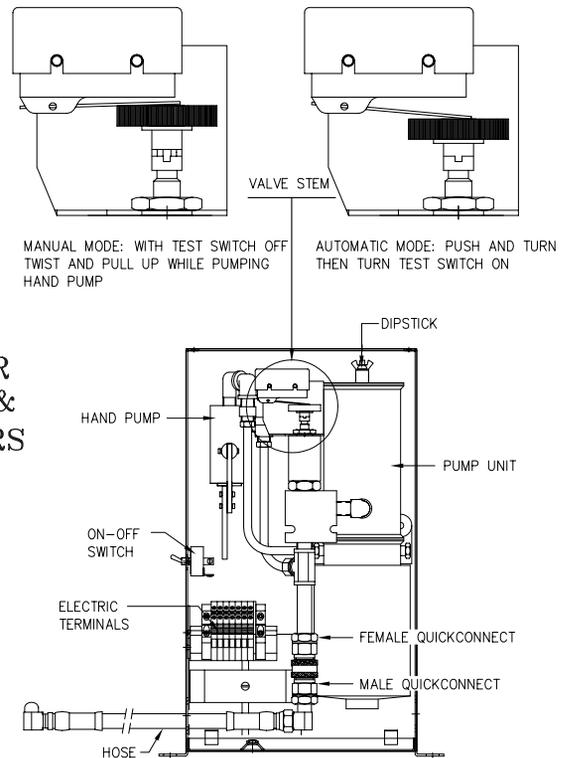
- ◆ Flip the off/on switch to the on position. The latch should engage the trigger mechanism and electrically hold the movable shoe in the open (ready) position. If the solenoid does not activate, check the controller wiring.
- ◆ After the solenoid has activated, remove the security set screws. If the connecting arms move up the cam when the security set screws are removed, the latch did not hold, and it will be necessary to manually return the brake unit to the ready position. To do this, place the valve in the Pump Unit into the manual mode (Figure 9) and use the hand pump to reopen the brake unit. If the wiring has been corrected, when it reaches the ready position, the solenoid will activate and the latch will hold the brake unit in the ready position.
- ◆ Security set screws must be completely removed in order to operate the Rope Gripper. Store them inside the pump unit. Security set screws should always be in place when performing maintenance on or working on an opened Rope Gripper.

Basic Function Test

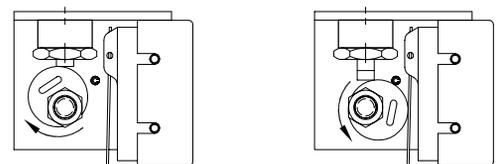
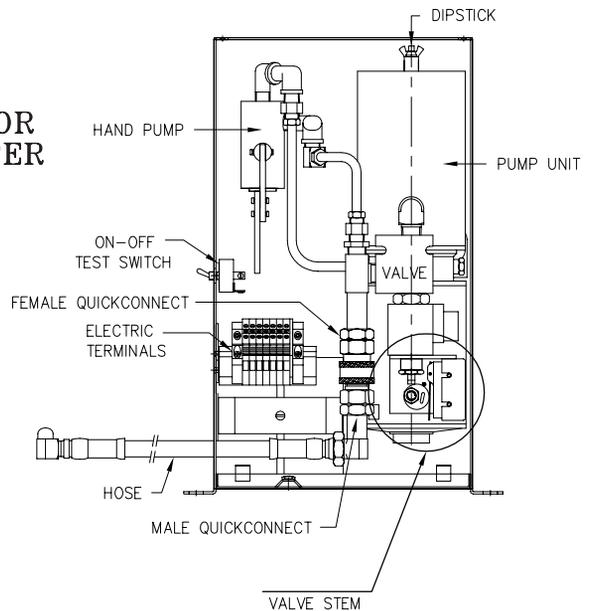
- ◆ Check to make sure that while the valve is in the manual mode, the manual-mode micro switch contact is open and the car is prevented from running.
- ◆ Check to make sure that with the valve in the automatic position and the off/on switch in the on position, the Rope Gripper is in the “ready” position (not clamping the ropes).
- ◆ Move the off/on switch into the off position. This should: 1) activate the Rope Gripper and clamp the ropes and 2) open the contacts on the “elevator can run” micro switch, which removes power from the elevator motor and machine brake.

Continued

PUMPING UNIT FOR #620, #622, #624, & #625 ROPE GRIPPERS



PUMPING UNIT FOR #626 ROPE GRIPPER



FOR ROTATING CAM, INSERT SCREW DRIVER IN CAM SLOT

MANUAL: WITH TEST SWITCH OFF, ROTATE CAM CLOCKWISE WHILE PUMPING HAND PUMP.

AUTOMATIC: ROTATE CAM COUNTER CLOCKWISE, THEN TURN TEST SWITCH ON.

Figure 9

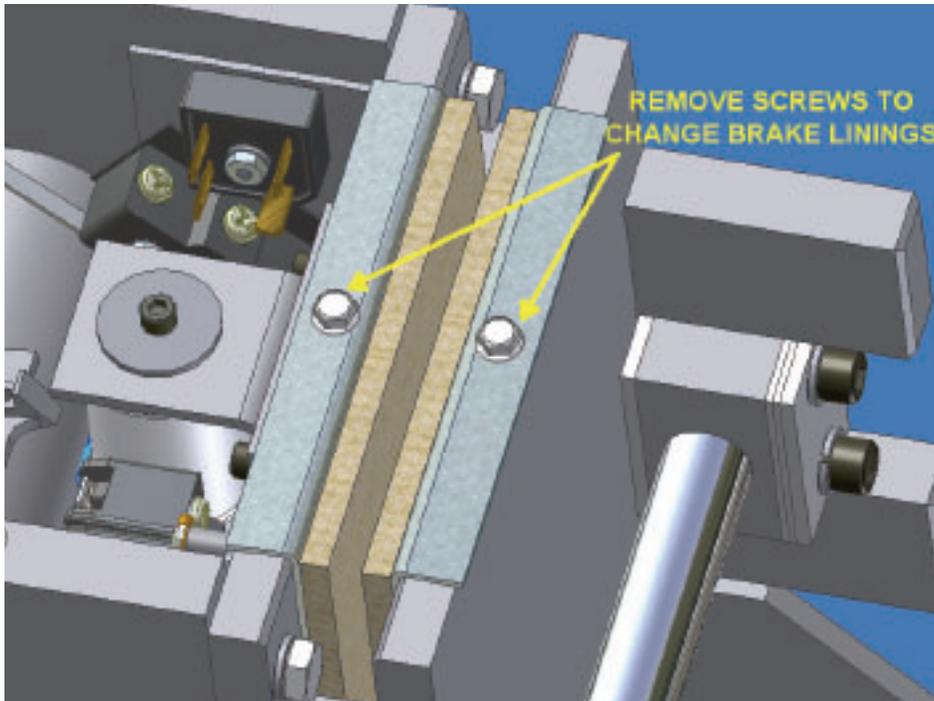


Figure 10

Lining Wear-in

Ideally, when linings are properly worn in, you should see: 1) there is approximately a 1/16-inch groove depth in the lining of both the stationary and movable shoe linings and 2) the rotating shaft and connecting arms should have moved around the bottom corner of the power cam and stopped approximately 1/2 inch up the cam.

- ◆ Run the car in the slow speed from top to bottom and wipe down the ropes – remove dirt, oil and grease.
- ◆ Jump terminals RG5 to RG6 – this will close the gripper on the ropes but still allow the car to run.
- ◆ With the off/on switch in the off position, run the car slowly up and/or down. The Rope Gripper will exert light pressure on the ropes, and the linings will begin to wear in. As linings wear, the rotating shaft will begin to move in its slot, and will turn the corner and begin to move up the power cam.
- ◆ For Models 620, 622, 624 and 625 – Once the rotating shaft has turned the corner on the power cam, stop the car and remove the jumpers from RG5 and RG6. The connecting arms (rotating shaft

ends) should have moved upward approximately 1/2 inch during lining wear-in.

- ◆ For Model 626 – To be effective, the groove depth needs to be about 1/16-inch deep. Sometimes you can make several trips with the car while setting the Rope Gripper and get a groove depth of about 1/16 inch, though the rotating shaft has still not made the turn and started up the power cam. If this happens, once you have sufficient groove depth, remove the jumpers from RG5 and RG6 and then remove the shim (lining-wear spacers) from between the shaft support block and movable shoe (Figure 7). NOTE: Anytime it is necessary to work on a Rope Gripper in the open position, a mechanic must first reinstall the security set screws. Having removed this shim, the rotating shaft should have moved approximately 1/2 inch up the power cam.

Adjusting for Lining Wear

Linings are 1/4-inch thick when new. **Linings must be replaced when the groove depth reaches 3/16 inch (1/16-inch wear remaining on each pad).** (See next section, Replacing Brake Linings.)

As the linings wear, the rotating shaft will continue to move further up the power cam. Near its travel limit, it will open the contact in the “excessive wear” micro switch (Figure 4) and the Rope Gripper will not automatically reset. If this occurs before the groove depth is 3/16 inch, you can adjust the gripper to put it back in service. To do this:

- ◆ With the off/on switch in the off position, set the valve for manual operation (Figure 9) and pump the brake unit into the ready position.
- ◆ Install the security set screws (Figure 6) so that they are holding the rotating shaft in position.
- ◆ Remove the lining-wear spacer from behind the shaft support block on the movable shoe assembly and reinstall the spacer between the shaft support block and the movable shoe itself (Figure 4).
- ◆ Set the valve back into the automatic mode (Figure 9).
- ◆ Put the off/on switch in the on position.
- ◆ Remove the security set screws (Figure 6).
- ◆ Confirm that the rotating shaft will make the turn and travel approximately 1/2 inch up the power cam.

Replacing Brake Linings

- ◆ With the off/on switch in the off position, set the valve for manual operation (Figure 9) and pump the brake unit into the ready position.
- ◆ Install the security set screws so that they are holding the rotating shaft in position (Figure 6).
- ◆ Remove old brake-lining assemblies by loosening the lining mounting screws (Figure 10).
- ◆ Install new brake linings and replace their mounting screws.
- ◆ Set the valve back into automatic mode (Figure 9).
- ◆ Put the off/on switch in the on position.
- ◆ Remove the security set screws.
- ◆ Follow the procedure found earlier under “Lining Wear-in.”
- ◆ Confirm that the rotating shaft will make the turn and travel approximately 1/2 inch up the power cam.

Test & Inspection

Figures 11 and 12 are test and inspection check sheets for Rope Gripper installations. Assuming that the mounting was done properly, following the check sheet will ensure that your installation is working properly and is code compliant.

Continued

Walter Glaser, executive vice president of GAL Manufacturing, vice president of Hollister Whitney Elevator Corp. and president of Elevator Components Industries Inc. of Canada, is active in the everyday affairs of all three companies. With a background in electrical and mechanical engineering, Glaser has been involved in many product designs. His electrical designs include elevator

control systems, door-operator control systems and a disc-brake monitor. Glaser's mechanical designs include elevator disc brakes, governors, safeties and other devices. With 45 years of experience in the elevator industry, Glaser holds several U.S., Canadian and British patents, authors frequent technical articles in the industry and is generally recognized as the inventor of the Rope Gripper.

Hollister-Whitney Rope Gripper

Recommended Acceptance Inspection Criteria For models 620, 622, 624, 625 and 626

**WARNING: Whenever working on Rope Gripper, KEEP HANDS CLEAR.
Forces created can cause injury.**

Tests: Tests are performed after the Rope Gripper has been installed per manufacturer instructions in the installation manual. All tests begin with the Rope Gripper in the "ready" position and the ON/OFF switch in the ON position.

No.	Description	Results	On Failure
1	With car not moving, move the ON/OFF switch into the OFF position.	The Rope Gripper should activate and power should be removed from the driving machine and brake.	Remove the car from service, check circuitry and retest before returning to service.
2	With the car level at a floor and the car and hoistway doors open, manually open the brake and allow the car to drift up (empty) and down (125% of rated load) away from the floor.	The Rope Gripper should activate in 10 inches (250 millimeters) and stop the car inside 48 inches (1220 millimeters), and power should be removed from the driving machine and brake. Manual reset is required.	Remove the car from service, check circuitry and retest before returning to service.
3	Manually lift the brake and overspeed the empty car in the up direction so that the governor switch is activated. Caution: be prepared to apply the brake.	The Rope Gripper should activate and stop the car. Power should be removed from the driving machine and brake. Manual reset is required.	Remove the car from service, check circuitry and retest before returning to service.
3alt	If it is impractical to overspeed the car, manually lift the brake, run the car in the up direction at high speed and manually trip the governor overspeed switch.	The Rope Gripper should activate and stop the car. Power should be removed from the driving machine and brake. Manual reset is required. NOTE: independently check the governor tripping speed.	Remove the car from service, check circuitry and retest before returning to service.
4	With the ON/OFF switch in the OFF position, and the Rope Gripper clamping the ropes, place the pump valve in the manual mode.	Manual-mode microswitch contacts should open and the car should be prevented from running. The hand pump should work to open the Rope Gripper.	Remove the car from service, check circuitry and retest before returning to service.
5	With the ON/OFF switch in the OFF position and the Rope Gripper clamping the ropes, while manually activating the "excessive wear" microswitch, move the ON/OFF switch to ON.	The Rope Gripper should not reset. The car should be prevented from running.	Remove the car from service, check circuitry and retest before returning to service.

Figure 11

Hollister-Whitney Rope Gripper
Recommended Acceptance Inspection Criteria
For models 620, 622, 624, 625 and 626

WARNING: Whenever working on Rope Gripper, KEEP HANDS CLEAR.
Forces created can cause injury.

Visual Inspection: Observe the following conditions when inspecting a Rope Gripper.

No.	Observe	Look For	Action
1	How the ropes pass between the stationary and movable shoes on the Rope Gripper	Ropes should be an even distance from the shoes, side to side and top to bottom. Ropes should almost touch the stationary shoe lining.	Uneven ropes or a gripper that is installed at a bad angle will cause excessive and accelerated brake-lining wear. Test for proper operation. Corrective action is required. (Verify at acceptance.)
2	The depth of the grooves that the ropes have worn in the brake linings	A groove depth of no more than 3/16 inches (4.8 millimeters) or a remaining lining thickness of less than 1/16 inches (1.6 millimeters.)	3/16 inches (4.8 millimeters) is the maximum groove depth. Test for proper operation. The “excessive wear” microswitch will soon keep the Rope Gripper from resetting. Linings should to be replaced soon.
3	The distance that the rotating shaft extends up the power cam when the gripper is activated (clamping the ropes)	The rotating cam should make the corner at the bottom and extend about 1/2 inches (12.5 millimeters) up the power cam.	Assuming that there is adequate lining thickness left, the wear shims can be used to return the rotating shaft to the correct position. Test for proper operation and shim between movable shoe and support block.
4	Hydraulic fluid level	With the Rope Gripper in the “ready” position, the pump-reservoir dipstick should show approximately 1 inch (25 millimeters) of oil.	Low hydraulic fluid is not normal. Look for leaks. Test for proper operation. Fluid should be replaced immediately.
5	Exposed metal surface	A thin layer of general-purpose grease on the cam surface and the four shoe guides.	Rust has the potential to cause malfunction. Test for proper operation. Lightly lubricate moving parts.
6	Data tag attached to the Rope Gripper	Masses and speeds that match or exceed those of the car (to be verified at acceptance).	Remove from service if the Rope Gripper capacities do not exceed those of the elevator.

Figure 12

Learning-Reinforcement Questions

Use the below learning-reinforcement questions to study for the Continuing Education Assessment Exam available online at www.elevatorbooks.com or on page 111 of this issue.

- ◆ What are the two primary things an elevator emergency brake must protect against?
- ◆ How does the Rope Gripper differ from sheave brakes and bidirectional safeties?
- ◆ What are the components of the Rope Gripper and how are they installed?
- ◆ When is a manual reset required with the Rope Gripper?
- ◆ How is the Rope Gripper tested and adjusted?



ELEVATOR WORLD Continuing Education Assessment Examination Questions

Instructions:

- ◆ Read the article **“Installation and Adjustment of the Hollister-Whitney Rope Gripper”** (page 59) and study the learning-reinforcement questions.
- ◆ To receive **one hour** of continuing-education credit, answer the assessment examination questions found below online at www.elevatorbooks.com or fill out the ELEVATOR WORLD Continuing Education Reporting Form found overleaf and submit by mail with payment.
- ◆ Approved for Continuing Education by **NAEC for CET**.

1. Elevator emergency brakes are required to protect against:
 - a. Failure of the traditional safety.
 - b. Unintended motion and ascending car overspeed.
 - c. Catastrophic rope failure.
 - d. Overweighted elevator cars.
2. The Rope Gripper has been used as an elevator emergency brake since the:
 - a. Late 1960s.
 - b. Late 1970s.
 - c. Late 1980s.
 - d. Late 1990s.
3. The Rope Gripper consists of:
 - a. A brake and a solenoid unit.
 - b. A safety and a pump unit.
 - c. A brake and a pump unit.
 - d. A governor and a brake unit.
4. The Roper Gripper is opened and put into the ready state using:
 - a. A hydraulic pump.
 - b. Electricity.
 - c. Springs and cams.
 - d. All of the above.
5. The Rope Gripper is held in the open and ready position using:
 - a. A manual check valve.
 - b. Electricity and a solenoid.
 - c. Springs and cams.
 - d. All of the above.
6. The signal to activate the Rope Gripper comes from:
 - a. Control circuits on the pump unit.
 - b. The elevator control.
 - c. The “elevator can run” micro switch on the brake unit.
 - d. A solenoid on the pump unit.
7. Manual reset of the Rope Gripper is required when it is activated due to:
 - a. Unintended motion with doors open.
 - b. Loss of power.
 - c. Up direction overspeed.
 - d. A and B.
 - e. A and C.
8. Shoes must be replaced when the groove depth reaches:
 - a. 1/2 inch.
 - b. 3/16 inch.
 - c. 1/16 inch.
 - d. 3/8 inch.
9. Security screws for the Rope Gripper:
 - a. Hold the Rope Gripper in the open position.
 - b. Provide extra backup for Rope Gripper operation.
 - c. Fasten the Rope Gripper to its mounting structure.
 - d. Must be in place during normal operation.
10. The brake unit on the Rope Gripper must be mounted:
 - a. So that it can withstand the same stresses as the machine.
 - b. With the ropes touching the stationary shoe.
 - c. Within hose reach of the pump unit.
 - d. All of the above.
11. When the test switch is turned to the “off” position, the Rope Gripper should:
 - a. Activate and clamp the ropes.
 - b. Remove power from the driving machine and brake.
 - c. Electrically release the solenoid.
 - d. All of the above.

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