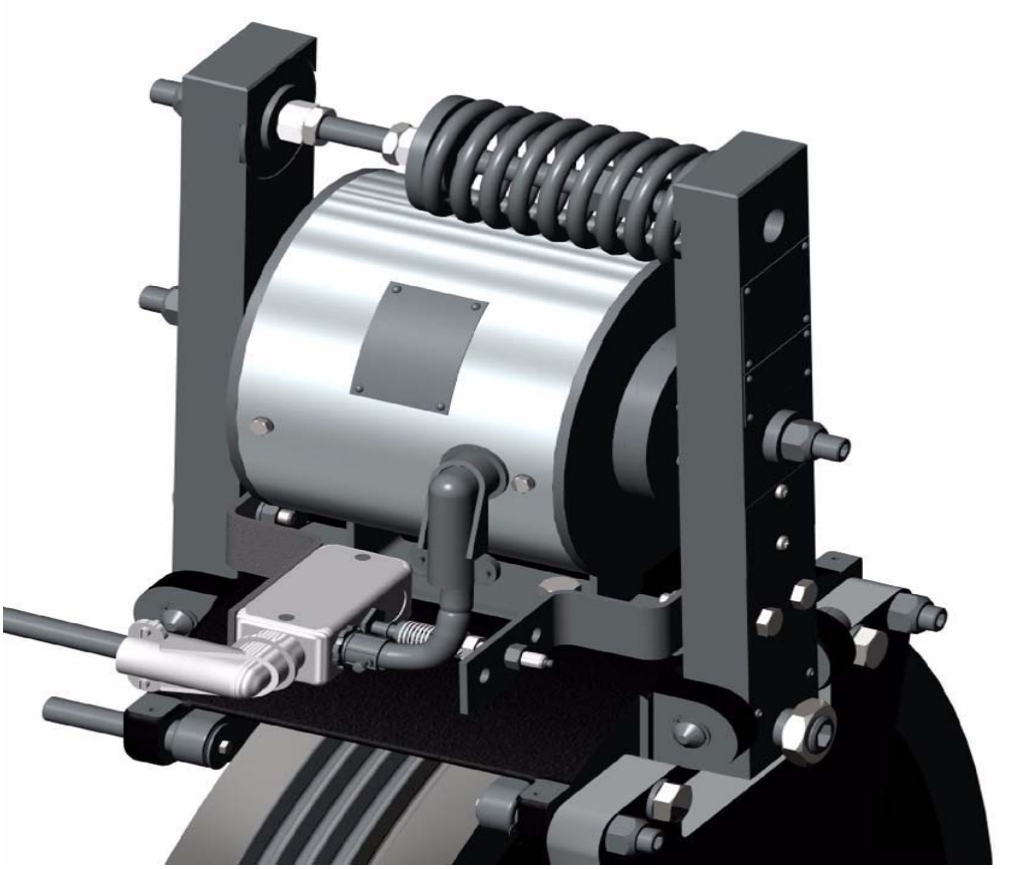
VERTICAL EXPRESS

GD-2 Machine



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Contents

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(*continued*)

Safety Precautions

IMPORTANT!

Read this page before any work is performed on elevator equipment. The procedures contained in this manual are intended for the use of qualified elevator personnel. In the interest of your personal safety and the safety of others, do not attempt any procedure that you are not qualified to perform.

All procedures must be accomplished in accordance with the applicable rules in the latest edition of the National Electrical Code, the latest edition of ASME A17.1, and any governing local codes.

Terms in This Manual

CAUTION

CAUTION statements identify conditions that may result in damage to the equipment or other property if improper procedures are followed.

WARNING

WARNING statements identify conditions that may result in personal injury if improper procedures are followed.

General Safety

CAUTION

Before applying power to the controller, check that all factory wire connections are tight on relays, contactors, fuse blocks, resistors, and terminals on cards and DIN rail terminals. Connections loosened during shipment may cause damage or intermittent operation.

Other specific warnings and cautions are found where applicable and do not appear in this summary. See the *Elevator Industry Field Employees' Safety Handbook* for electrical equipment safety information on installation and service.

Electrical Safety

All wiring must be in accordance with the National Electrical Code and be consistent with all state and local codes.

Use the Proper Fuse

To avoid fire hazards, use only a fuse of the correct type, voltage, and current rating. See the job specific drawings sheet (Power Supplies) for fusing information.

Electric shocks can cause personal injury or loss of life. Circuit breakers, switches, and fuses may not disconnect all power to the equipment. Always refer to the wiring diagrams. Whether the AC supply is grounded or not, high voltage will be present at many points.

Printed Circuit Cards

Printed circuit boards may be damaged if removed or installed in the circuit while applying power. Before installation and/or removing printed circuit boards, secure all power.

Always store and ship printed circuit cards in separate static bags.

Electrical Safety
(continued)

Mainline Disconnect

Unless otherwise directed, always Turn OFF, Lock, and Tag out the mainline disconnect to remove power from elevator equipment. Before proceeding, confirm that the equipment is de-energized with a volt meter. Refer to the *Vertical Express Employees' Safety and Accident Prevention Program Manual* for the required procedure.

Test Equipment Safety

Always refer to manufacturers' instruction book for proper test equipment operation and adjustments.

Megger or buzzer-type continuity testers can damage electronic components. Connection of devices such as voltmeters on certain low level analog circuits may degrade electronic system performance. Always use a voltmeter with a minimum impedance of 1M Ohm/Volt. A digital voltmeter is recommended.

When Power Is On

To avoid personal injury, do not touch exposed electrical connections or components while power is ON.

Mechanical Safety

See the *Elevator Industry Field Employees' Safety Handbook* for mechanical equipment safety information on installation and service.

Static Protection Guidelines

IMPORTANT!

Read this page before working with electronic circuit boards.

Elevator control systems use a number of electronic cards to control various functions of the elevator. These cards have components that are extremely sensitive to static electricity and are susceptible to damage by static discharge.

Immediate and long-term operation of an electronic-based system depends upon the proper handling and shipping of its cards. For this reason, the factory bases warranty decisions on the guidelines below.

Handling

- Cards shipped from the factory in separate static bags must remain in the bags until time for installation.
- Anti-static protection devices, such as wrist straps with ground wire, are required when handling circuit boards.
- Cards must not be placed on any surface without adequate static protection.
- Only handle circuit cards by their edges, and only after discharging personal static electricity to a grounding source. DO NOT touch the components or traces on the circuit card.
- Extra care must be taken when handling individual, discrete components such as EPROMS (which do not have circuit card traces and components for suppression).

Shipping

- Complete the included board discrepancy sheet.
- Any card returned to the factory must be packaged in a static bag designed for the card.
- Any card returned to the factory must be packaged in a shipping carton designed for the card.
- “Peanuts” and styrofoam are unacceptable packing materials.

Note: Refer to the Vertical Express Replacement Parts Catalog to order extra static bags and shipping cartons for each card.

Failure to adhere to the above guidelines will VOID the card warranty!

Arrival of Equipment

Receiving

Upon arrival of the equipment, inspect it for damage. Promptly report all visible damage to the carrier. All shipping damage claims must be filed with the carrier.

Storing

During storage in a warehouse or on the elevator job site, precautions should be taken to protect the equipment from dust, dirt, moisture, and temperature extremes.

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Overview

The GD-2 Machine is a geared machine designed for elevators. Its worm and gear configuration allows speeds up to 500 fpm, maximum, and an elevator capacity of up to 5,000 lbs. 1:1, and 10,000 lbs. 2:1 maximum. The GD-2 Machine uses a drum brake with single or dual brake solenoids. The independent gear adjustment eccentrics allow for fine backlash adjustments. Dependent on the controller drive, the GD-2 Machine can use an AC or a DC motor. The motor mounts onto a flange that will accept either motor.

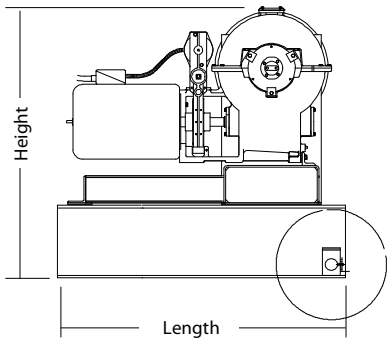
There are eight (8) basic machines that may be placed in basement or overhead machine rooms:

1. RH Basement
2. LH Basement
3. RH Overhead with deflector sheave (mounted on the bedplate)
4. LH Overhead with deflector sheave (mounted on the bedplate)
5. RH Overhead with deflector sheave (mounted on the machine beams)
6. LH Overhead with deflector sheave (mounted on the machine beams)
7. RH Overhead without deflector sheave
8. LH Overhead without deflector sheave

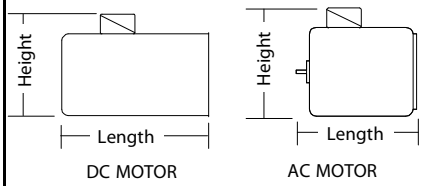
Specifications

- Maximum Sheave Shaft Load: 24,000 lbs. (10,886kg) with 1 to 1 Roping
- Maximum Speed: 500 fpm (152 M/min.)
- Maximum Capacity: 10000 lbs. (4536kg) @ 45% Counterweighting with 2 to 1 Roping
- Maximum Horsepower: 50 (32.3KW)
- Gear Ratios: S-57, D-65, D-83
- Brake Voltages: 140V
- Brake Gap: .003 - .005 (.076mm - .127mm)
- End Thrust: .0005” - .002” (.0127mm - .051mm)
- Backlash: .006” - .008” (.152mm - .203mm)
- Gear Oil Type for machine shipped before 02/01/03: SAE 85W-140 Non-Phosphorous additive, 7EP ISO 460
- Gear Oil Type for machine shipped after 02/01/03: Synthetic; Mobil Oil SHC 634; Print No.564AA2
- Gear Oil Capacity: 9 quarts (8.5L)
- DC Motor Voltage: 500V (30HP and 40HP)
- AC Motor HP: 40 (29.8KW) and 50 (32.3KW)
- NOTE: To convert inches to millimeters, multiply by 25.4. To convert pounds to kilograms, multiply by .454. To convert HP to KW multiply by .745.

Dimensions

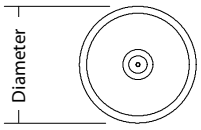


Dimensions		Height	Length	Width	Total Weight
Overhead Machine with Machine Room Deflector	w/DC Motor	61.00 "	75.12 "	41.07 "	4500#
	w/AC Motor	61.00 "	67.95 "	41.07 "	4300#
Overhead Machine with Deflector on Machine Beams	w/DC Motor	45.80 "	51.12 "	37.93 "	3700#
	w/AC Motor	45.80 "	57.94 "	37.93 "	3500#
Basement Machine	w/DC Motor	45.40 "	51.12 "	36.93 "	3700#
	w/AC Motor	45.40 "	57.94 "	36.93 "	3500#



	AC - Baldor		DC - Imperial - 500V	
	40 HP	50 HP	30 HP	40 HP
Height	21.71 "	21.71 "	22.31 "	23.657 "
Length	28.275 "	28.275 "	25.75 "	31.125 "
Diameter	17.14 "	17.14 "	15.75 "	17.688 "
Weight	560#	572#	605#	760#

NOTE: Motors other than the ones listed will vary in size and weight. See manufacturer's documents.



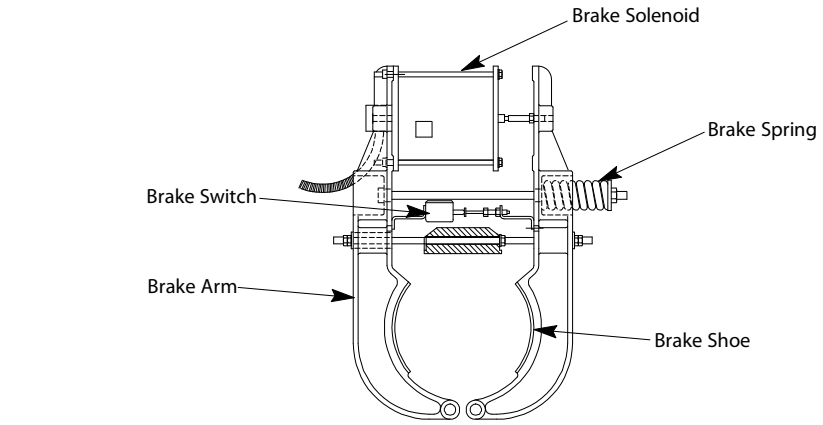
Deflector Sheave		25" Diameter Sheave
Weight	sheave only	400 #

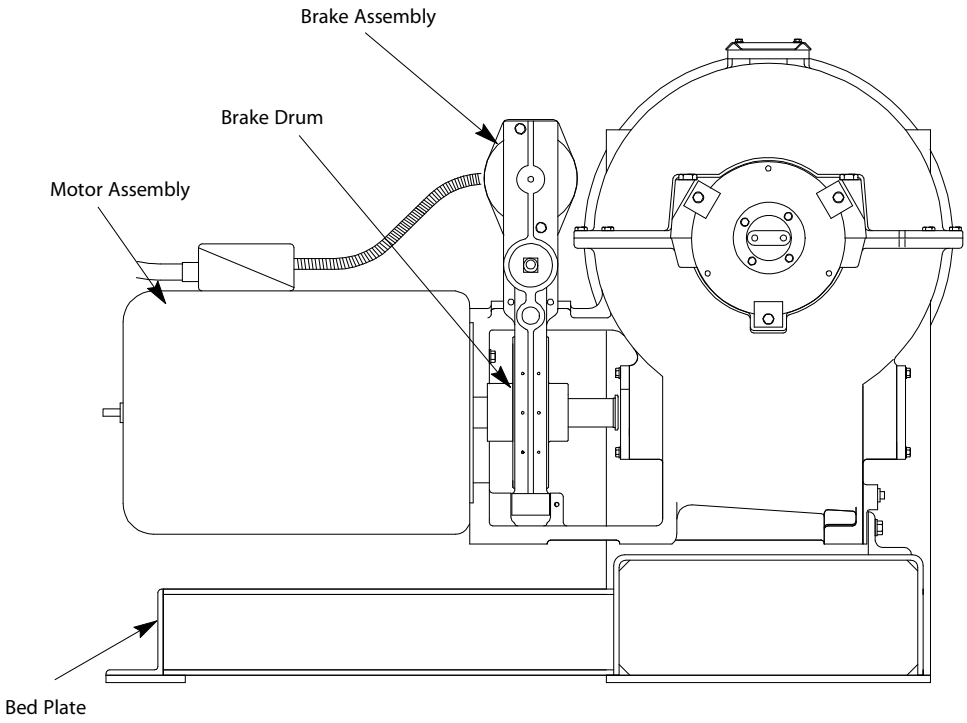
Machine Components

These are the major components of the GD-2 Machine. See“Machine Assembly” on page 10.

- Bearing Plate - The steel plate (under one end of a beam) distributes the load through the supporting member.
- Bedplate - The steel platform on which the machine is placed, and it attaches to the lower machine mounting assembly.
- Blocking Beams - These steel beams (placed on the machine beams) raise the level of the machine room equipment.
- Brake Arms - The mechanical arms press the brake shoes against the brake drum. Each arm operates independently.
- Brake Arm Spring - Two supplied brake arm springs function independently to supply the necessary force to the brake shoes when the brake is de-energized. The springs create friction between the brake shoe and the brake drum to hold the suspended load. These springs work in compression, and their length is determined by the force required to hold the load.
- Brake Drum - The smooth-surfaced end of the drive sheave. When energized, the brake shoes are released from the brake drum.
- Brake Shoes - Two independent operating devices provide friction between the brake drum and the brake shoes.
- Brake Solenoid - Two independent electrically controlled solenoids that, when energized, remove pressure between the brake shoes and the brake drum.
- Brake Spring Adjustment Nut - This nut sets the proper length of the required brake spring for proper holding capacity of the brake assembly when the brake is de-energized.
- Deflector Sheave Beams - The steel beams, used for mounting the deflector sheave, when the deflector sheave is located in the machine room.
- Drive Sheave - A grooved sheave connected directly to the hoist motor armature shaft. The grooves provide the proper factor of traction between the sheave and the hoist ropes.
- Isolation Pads - Insulating material that prevents the transfer of mechanical vibration or noise from the running machine assembly to the building structure.
- Machine Beams - Overhead beams that distribute the load on the hoist motor assembly to the proper building structure.
- Motor - Provides the necessary torque and speed to move the elevator.
- Rope Gripper - An Emergency Brake that satisfies A17.1-2000 Code requirements of Section 2.19 Ascending Car Overspeed and Unintended Car Movement Protection.
- Sheave Brake - An Emergency Brake that satisfies A17.1-2000 Code requirements of Section 2.19 Ascending Car Overspeed and Unintended Car Movement Protection.
- Structural Slab - A floor slab that supports the loads normally carried by the machine beams.
- Velocity Encoder -This device is directly coupled to the armature shaft of the hoist motor. It is provided to give absolute speed feedback of the hoist motor to the elevator controller.

Machine Assembly





Installation

Recommended Hoisting Methods

Recommended Hoisting Equipment

- 5/8” Screw Pin Anchor Shackle, with minimum safe working limit of two (2) tons.
- 1/2” 6 x 19 Independent Wire Rope Center (IWRC) eye and eye sling with a heavy duty thimble for each eye, mechanical splice with a minimum safe working limit of 2.2 tons.
- Center-of-Gravity Deflection Bracket

WARNING **The center-of-gravity deflection bracket must not be used as a hoisting point.**

Installation
(continued)

Preparation

1. Ensure that the two (2) bolts holding the hoisting bar in place are securely tightened.
2. Attach the center-of-gravity deflection bracket. See Figure 1.
   a. Remove the two (2) bolts that hold the drive sheave guard in place.
   b. Install the deflection bracket on top of the sheave guard bracket.
   c. Tighten the bolts.

WARNING **Ensure that the hoisting bar, center-of-gravity deflection bracket, and screw pin anchor shackle are securely fastened and that the sling is in the proper position for the machine configuration.**

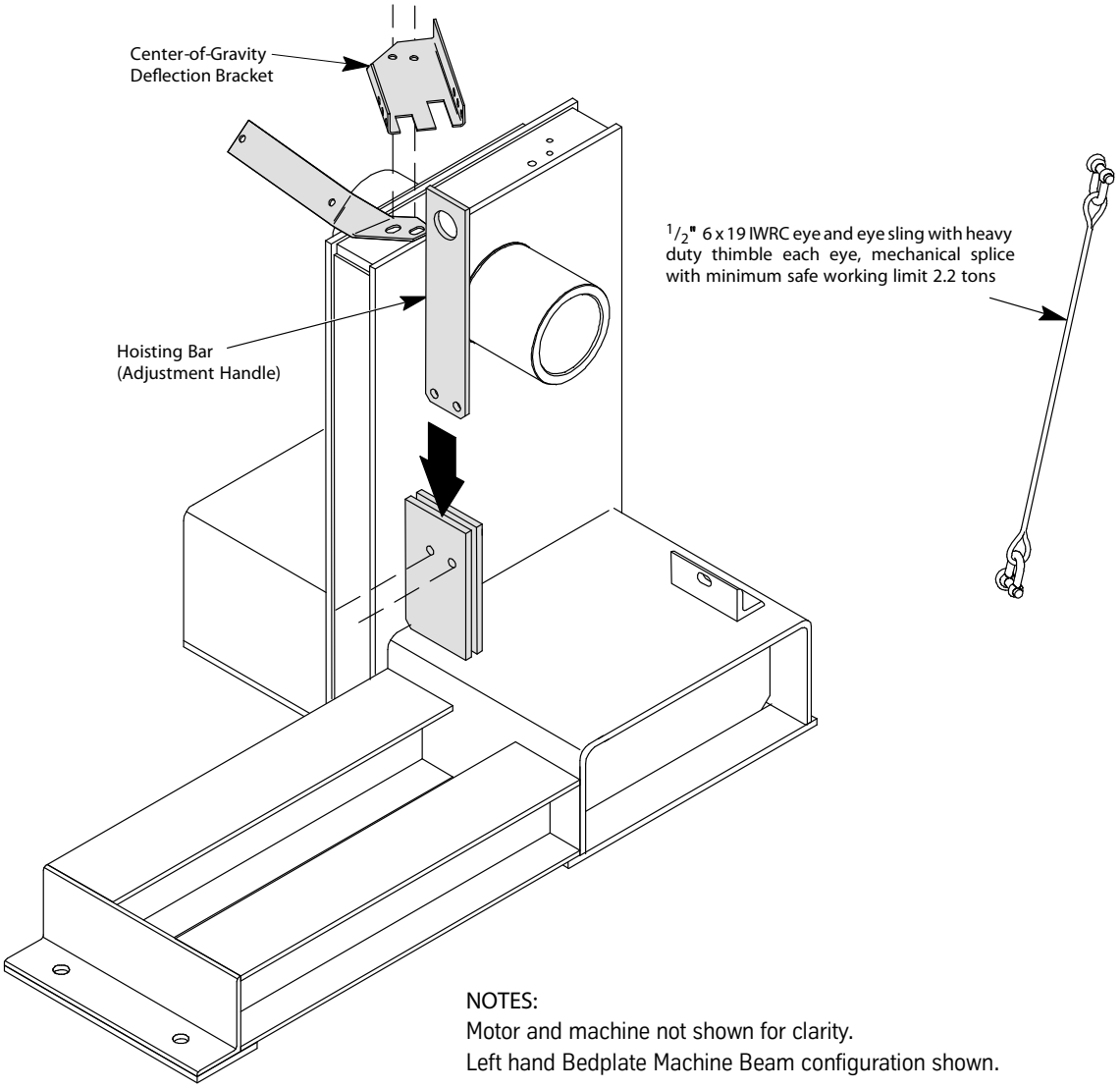


Figure 1 - Recommended Hoisting

Installation
(continued)

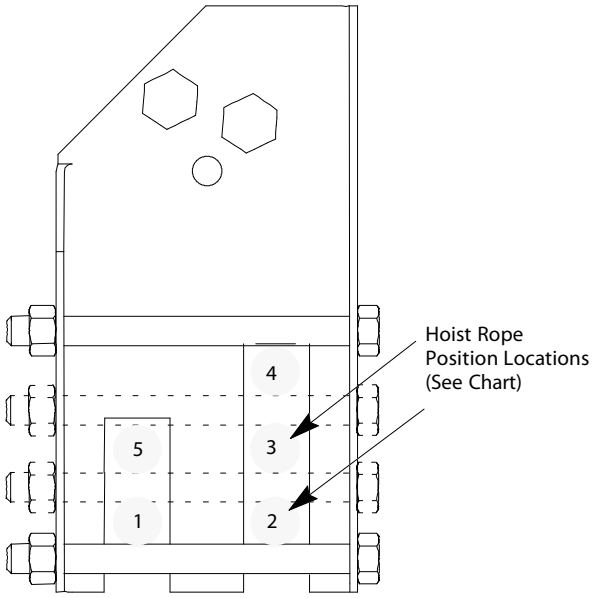
3. Install the screw pin anchor shackle through the eye of the wire rope sling, then through the hole in the hoisting bar.

4. Route the 1/2” wire rope sling through the proper position of the center-of-gravity deflection bracket. The bracket positions limit the tilting of different configuration machines. SeeFigure 2 for the proper location.

5. Make sure that the sleeve of the wire rope sling is not contacting the center-of-gravity deflection bracket.

WARNING **If excessive tilting of the machine occurs, verify the machine configurations, and that the wire rope is positioned correctly in the center-of-gravity deflection bracket.**

Center-of-Gravity Deflection Bracket



Note: Left hand configuration shown.

Deflection Bracket Hole Location

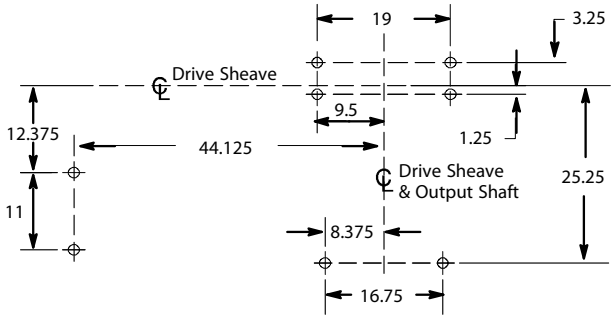
Motor Size & Type	Sheave Dia. / No. Ropes {	Machine Beam Configuration	Bedplate with Deflector Mounted in Machine Room ‡
		Rope Position / Bracket Hole	
40 H.P., AC	36/8	3	4
	32/8	3	4
	32/6	3	4
	26/6	3	3
50 H.P., AC	36/8	3	4
	32/8	3	4
	32/6	3	3
	26/8	3	4
	26/6	3	3
30 H.P., DC	36/8	3	4
	32/8	3	4
	32/6	1	5
	26/8	1	5
	26/6	1 or 2	5
40 H.P., DC	36/8	1	5
	32/8	1	5
	32/6	1	5
	26/8	1	5
	26/6	1	5

{ Number of ropes is based on $^{5}/_{8}$" dia. ropes.
‡ Bedplate mounted deflector sheave removed for hoisting.

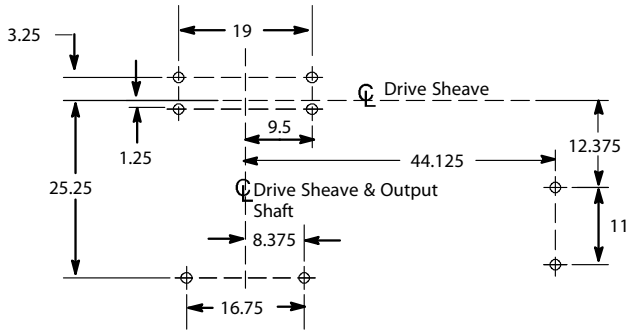
Figure 2 - Center-of-Gravity Deflection Bracket

Machine Anchor Bolt Layouts and Isolation Details

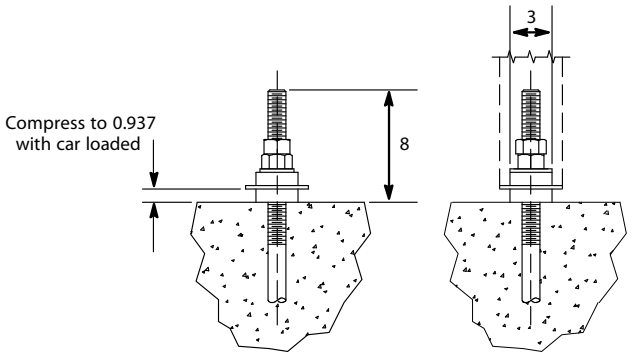
Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).



Template for GD-2 Anchor Bolts, LH Pattern



Template for GD-2 Anchor Bolts, RH Pattern



BOLT DETAILS

Figure 3 - LH and RH Machine Layout (Basement)

Blocking and Isolation Layouts

Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm). Left hand configuration shown, right hand opposite.

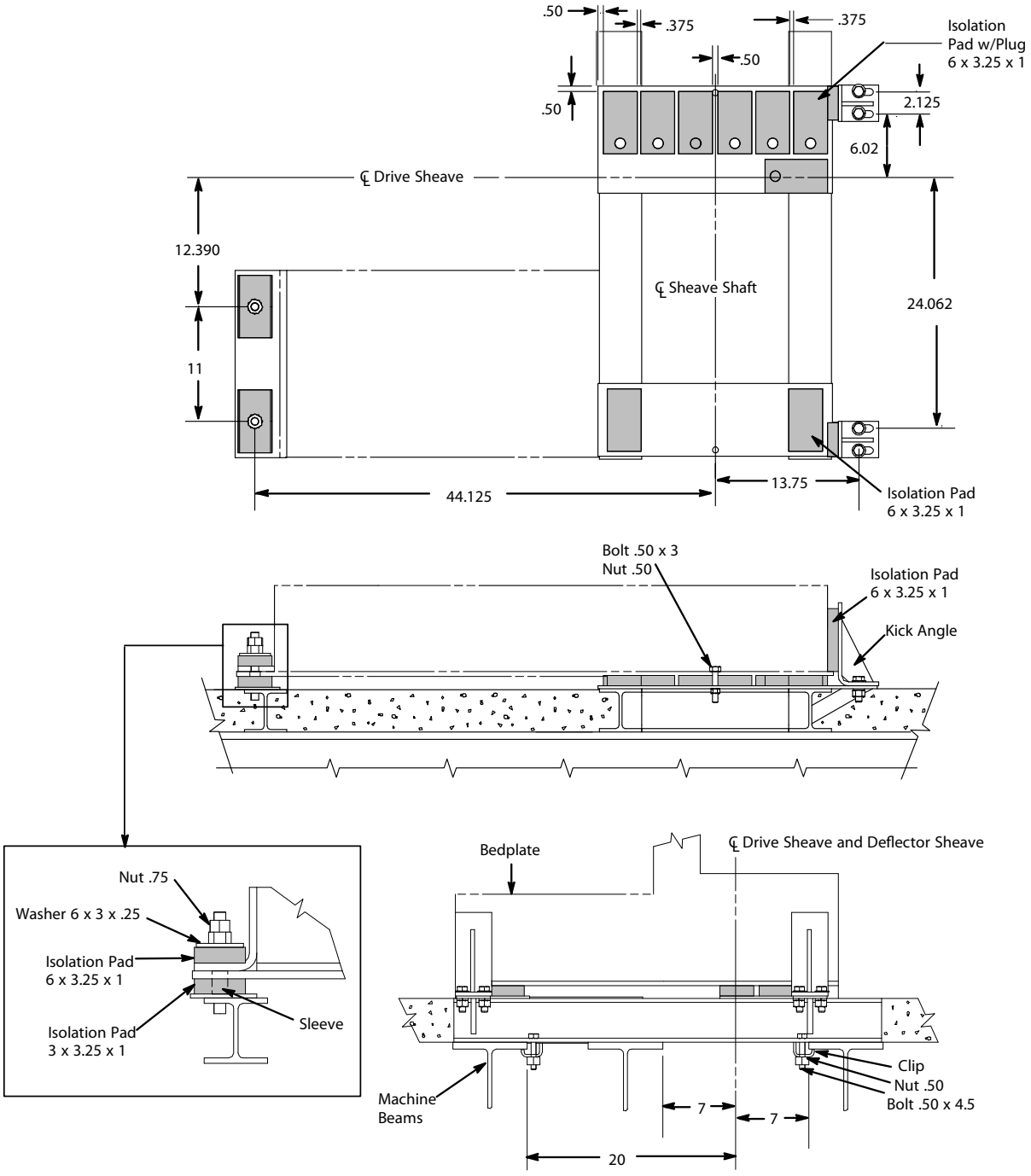


Figure 4 - LH Machine Mounting and Isolation Overhead Forward Pulloff

Blocking and Isolation Layouts
(continued)

Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm). Left hand configuration shown, right hand opposite.

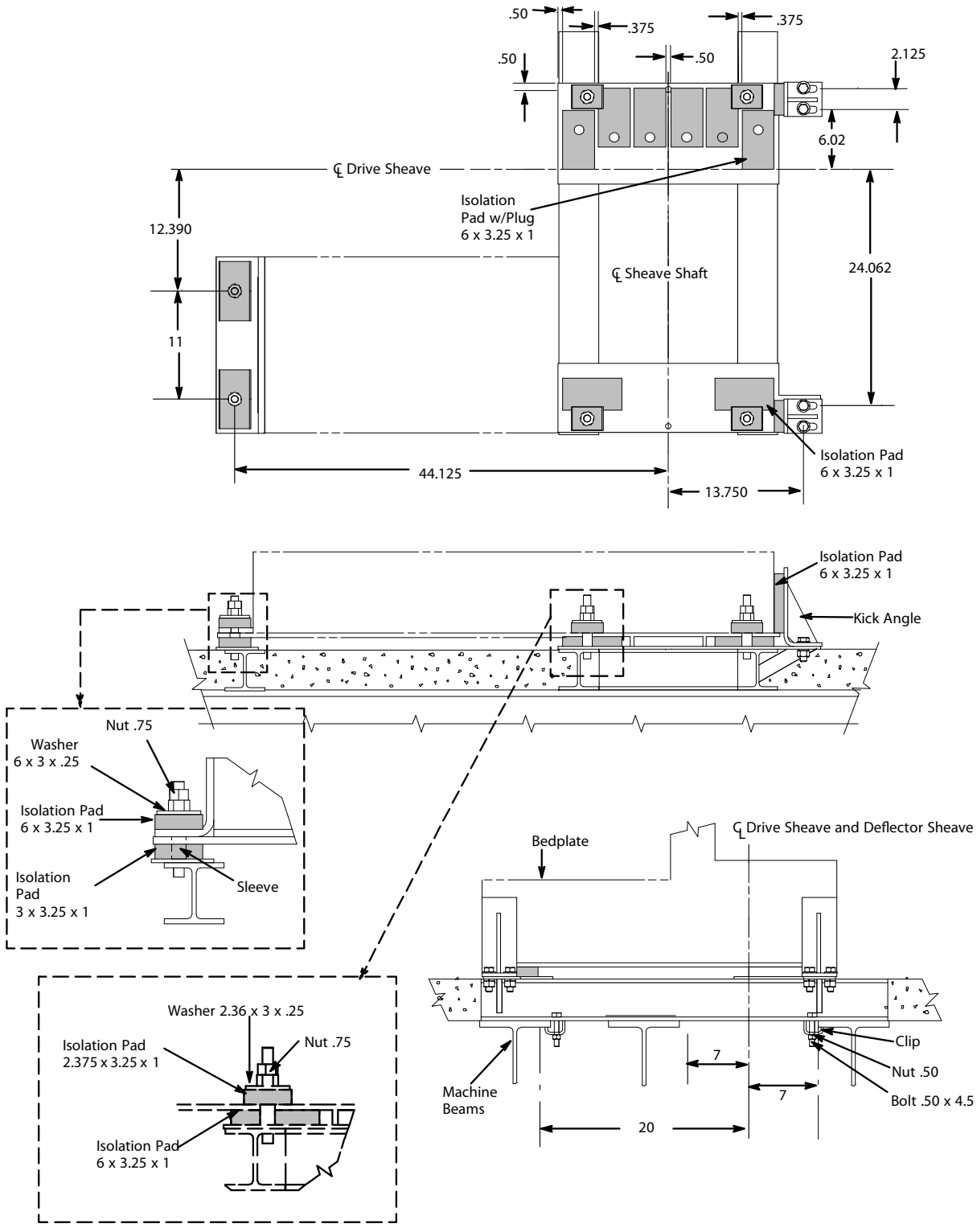


Figure 5 - Machine Mounting and Isolation Overhead Forward Pulloff (Seismic)

Blocking and Isolation Layouts
(continued)

Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm). Left hand configuration shown, right hand opposite.

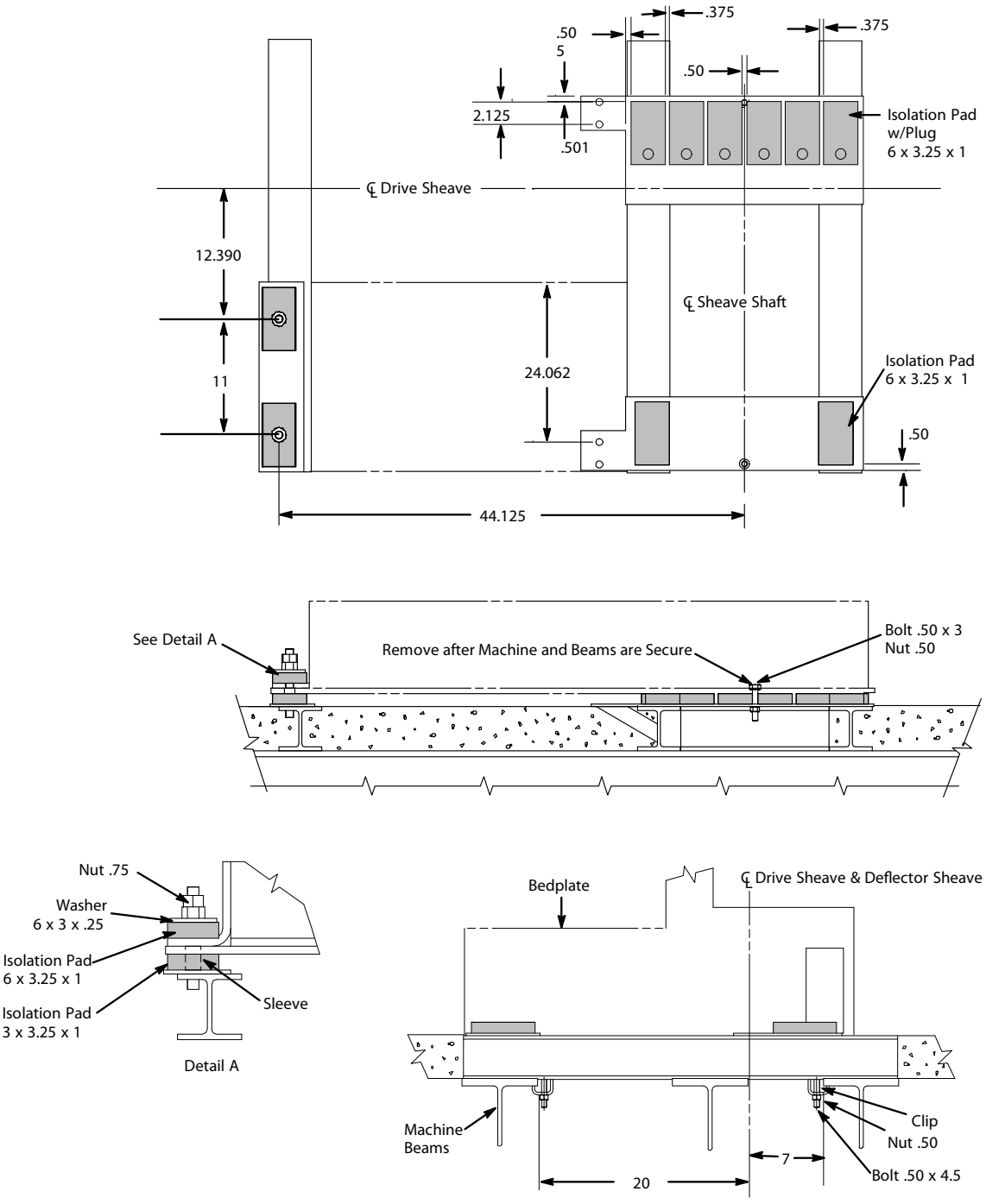


Figure 6 - LH Machine Mounting and Isolation Overhead (No Pulloff)

Blocking and Isolation Layouts
(continued)

Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm). Left hand configuration shown, right hand opposite.

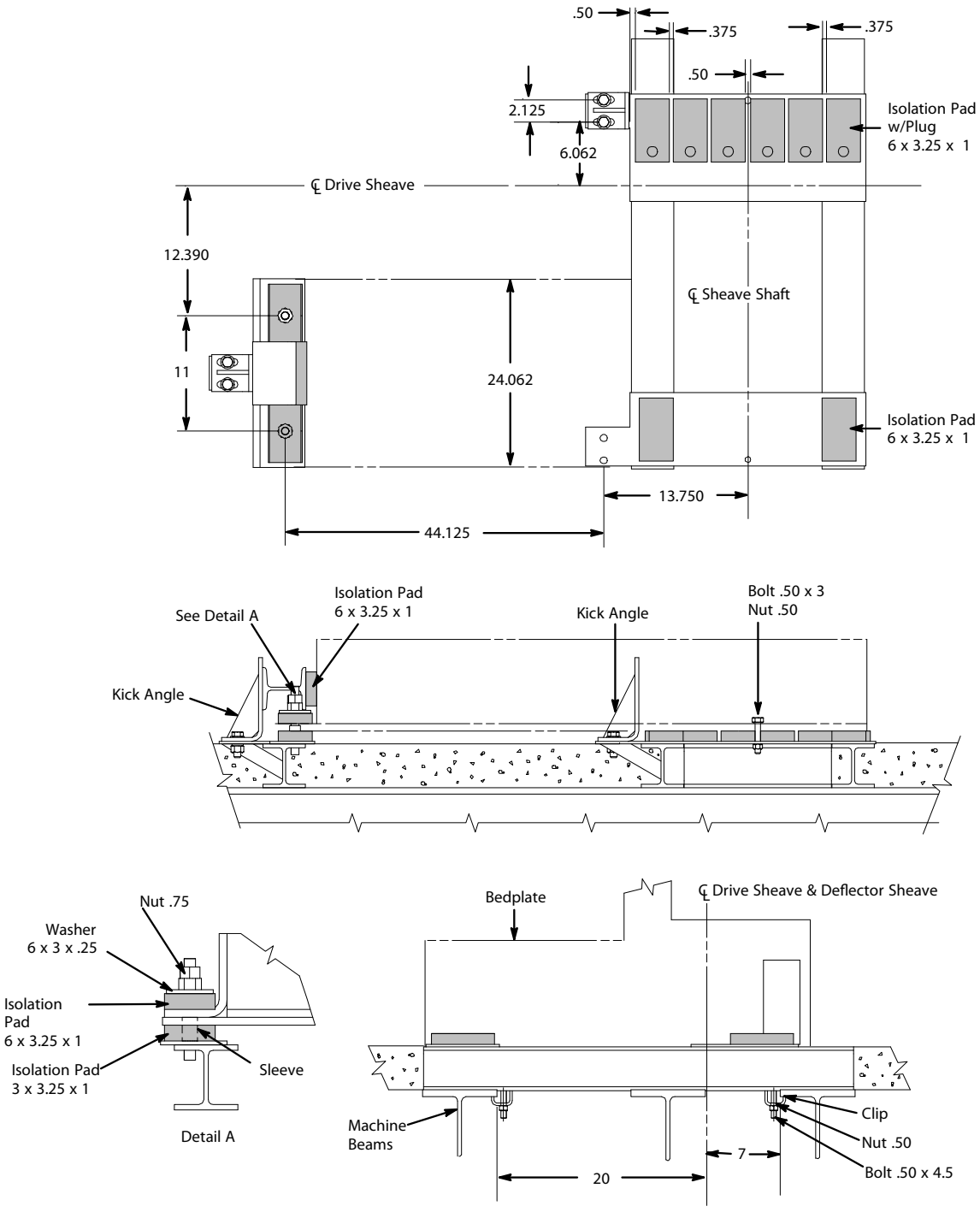
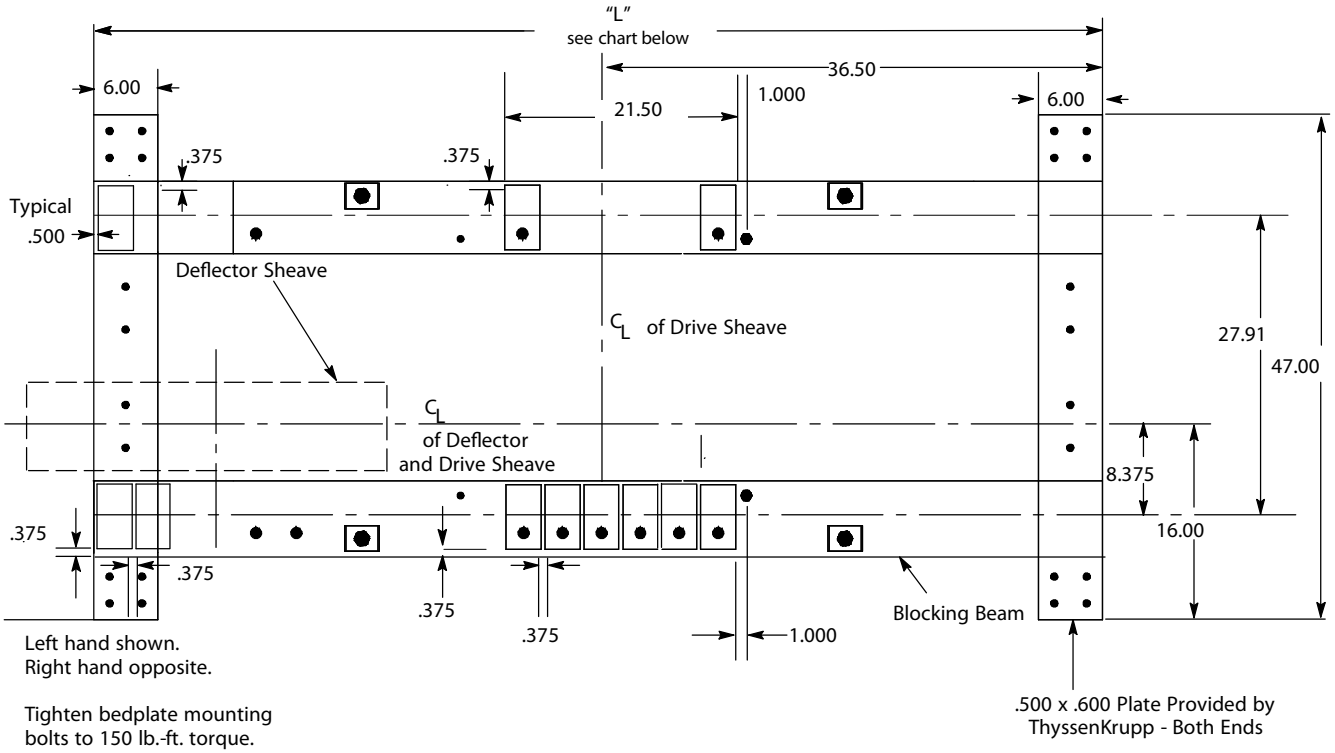


Figure 7 - LH Machine Mounting and Isolation Overhead (Reverse Pulloff)

Blocking and Isolation Layouts
(continued)

Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm). Left hand configuration shown, right hand opposite.

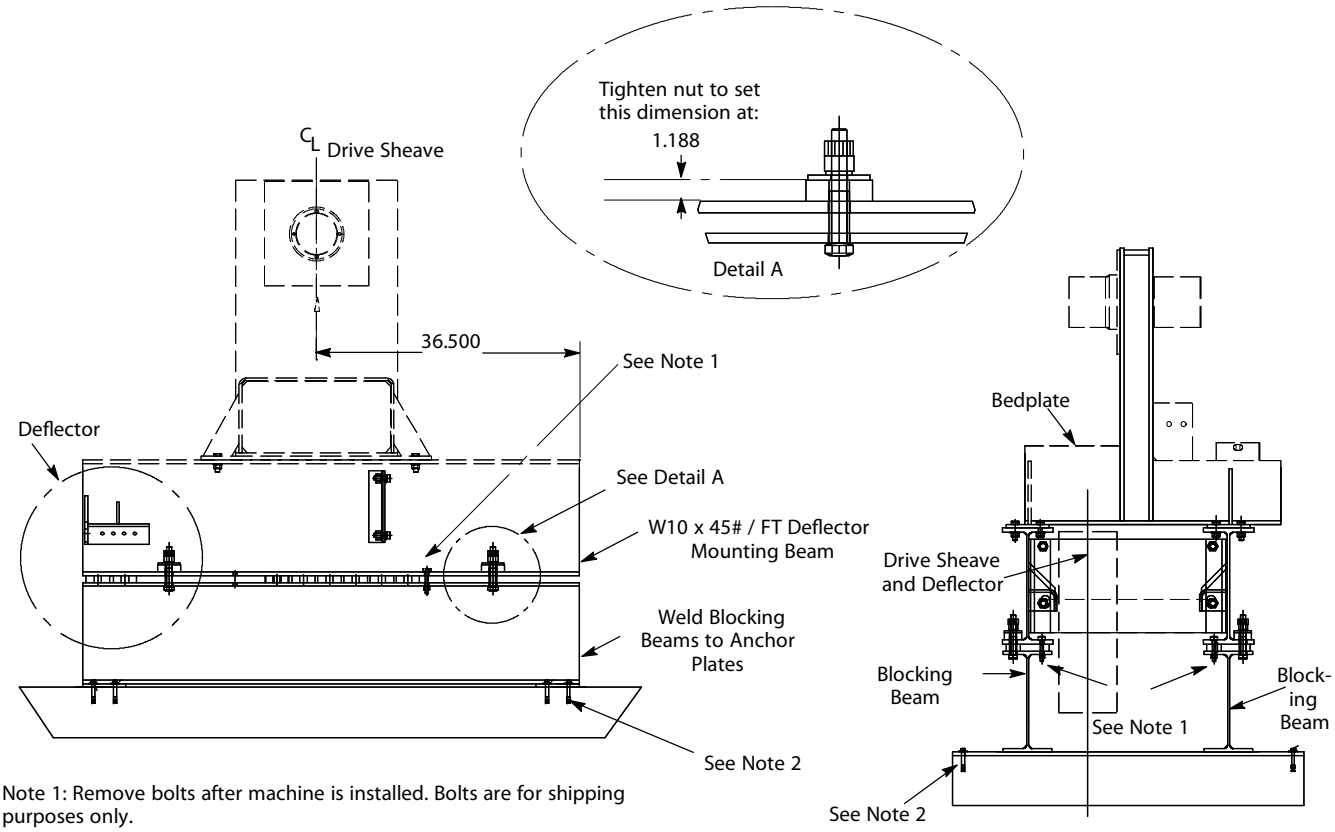


ThyssenKrupp Part No.	"L"	Distance Between Pick Up Points	Drive Sheave Diameter
120DM2	69.000	52.000-55.000	26.000
120DM3	60.000	46.000-49.000	32.000
ThyssenKrupp Part No.	"L"	Max. Distance Between Pick Up Points	Drive Sheave Diameter
120DM1	See Note	57.000	26.000
		63.500	32.000
		68.000	36.000
Note: "L" = Distance between pickup points - (Drive Sheave Diameter/2) + 28.000			

Figure 8 - Machine Mounting and Isolation (OH) with Bedplate Mounted Deflector

Blocking and Isolation Layouts
(continued)

Note: All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm). Left hand configuration shown, right hand opposite.



Note 1: Remove bolts after machine is installed. Bolts are for shipping purposes only.

Note 2: Use Anchor bolt 390AH1. Following the manufacturer's instructions, bolts must be embedded 4" into the slab. Use four bolts per Anchor Plate; outermost holes are preferred.

Figure 9 - Machine (OH) with Bedplate Mounted Deflector Details

Mounting the Deflector Sheave to the Machine Beams

CAUTION **When making overhead installations, keep the hoistway clear at all times.**

The following instructions apply to Deflector Sheave Assemblies, designed specifically for clamp-type hanger installations, where I or WF beams are used as machine beams. This installation type simplifies alignment of the sheave.

1. Assemble the clips and clamp bar assemblies to the clamp plate assemblies, and then attach to the machine beams. See Figure 10.

2. Place the two clamp assemblies close together by sliding the clamp plate assembly along the beams. With the clip bolts positioned closely against the toe of the flange on the beam, snug up, but do not tighten the cap screws.

Note: Maintain a minimum distance between the clip bolts and the clamp bar bolts.

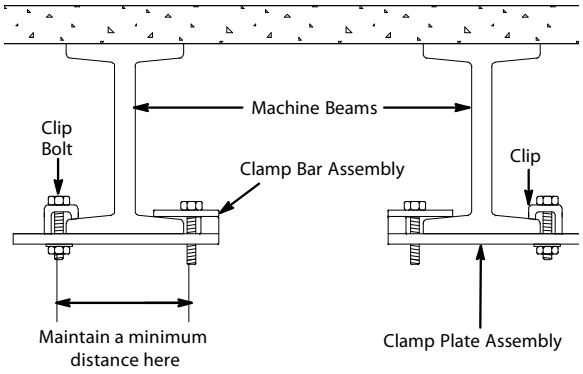


Figure 10 - Clip and Clamp Bar Assembly

3. Raise the deflector sheave into position with the shaft flat engaging clamp plate assembly.

4. Use the provided lockwashers and locknuts to install the shaft clamps. Snug up all bolts.

5. Plumb the deflector sheave, and align it with the drive sheave.
   a. Slide the clamp plate assemblies along the machine beams.
   b. Move the deflector sheave from side-to-side (shimming as required).

6. When the deflector sheave is plumb, and in true alignment with the drive sheave, tighten all of the connections. See Figure 11 on page 21.

Mounting the Deflector Sheave to the Machine Beams
(continued)

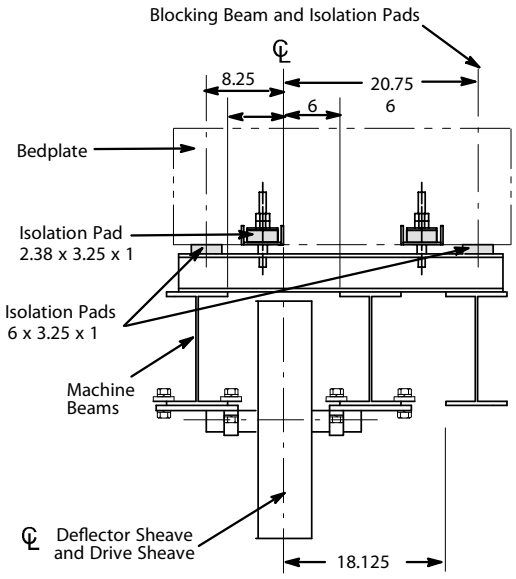


Figure 11 - Aligned Deflector Sheave

7. With the sheave bolted into final position, drill one (1) 21/32" diameter hole through each clamp plate and beam flange. See Figure 12.
   a. Insert 5/8" bolts (with beveled washers) into the hole and securely fasten.
   b. Make a 3/16" fillet weld, 3" long, between each clamp plate and the beam.

Note: As an alternative to through-bolting, the clamp plates can be welded to the beams.

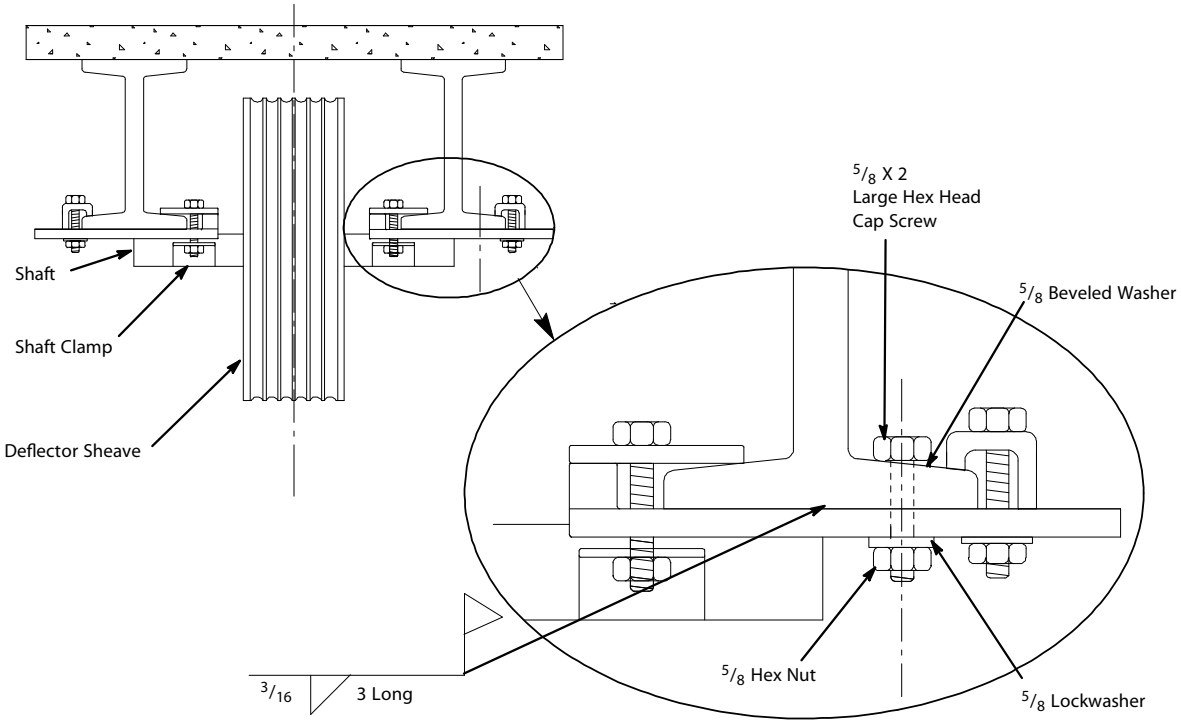


Figure 12 - Shaft Clamps to Machine Beams

Mounting the Deflector Sheave to the Machine Beams
(continued)

8. Mount the deflector guard to shaft clamps. See Figure 13.

Note: When special blocking is required for adequate sheave clearance, refer to the job layout.

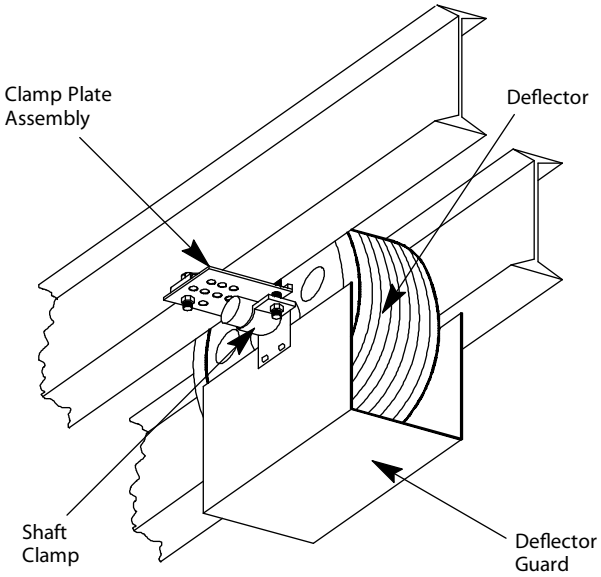


Figure 13 - Deflector Sheave to Machine Beam

Bedplate, Deflector Mounting Beams and Blocking Beam Installation (with deflector in the machine room)

CAUTION **When making overhead installations, keep the hoistway clear at all times.**

For all steps in this procedure, see Figure 14 through Figure 18 on page 27.

1. Use four (4) 5/8" x 1 1/2" screws, flat and lock washers, and 5/8" nuts to install and secure the deflector mounting beam gusset to the deflector mounting beams.

Notes:

- Proper distance between center punched holes must be maintained.
- Ensure that the beams are level and square as the gusset bolts are tightened.

2. Locate eight (8) scribed and center-punched holes in the top flange of the deflector mounting beams, and drill 1/4" pilot holes.

3. Drill all pilot holes to 11/16" (for mounting the bedplate).

4. Set the blocking beams in place.

5. Position the isolation pads on the blocking beams.

Bedplate, Deflector Mounting Beams and Blocking Beam Installation
(continued)

6. Set the deflector mounting beams in position. Install temporary 1/2" bolts through the deflector mounting beam flange and the blocking beam flange.

7. Install the bolts and the isolation pads.

8. Mount the deflector sheave.

9. Set the machine in position by aligning the mounting holes in the bedplate foot with those in the deflector mounting beams. Install 5/8" bolts, lockwashers, nuts and tighten to 150 ft/lbs.

10. Align the sheave with the car and the counterweight lift points.

11. Weld the blocking beams to the machine beams.

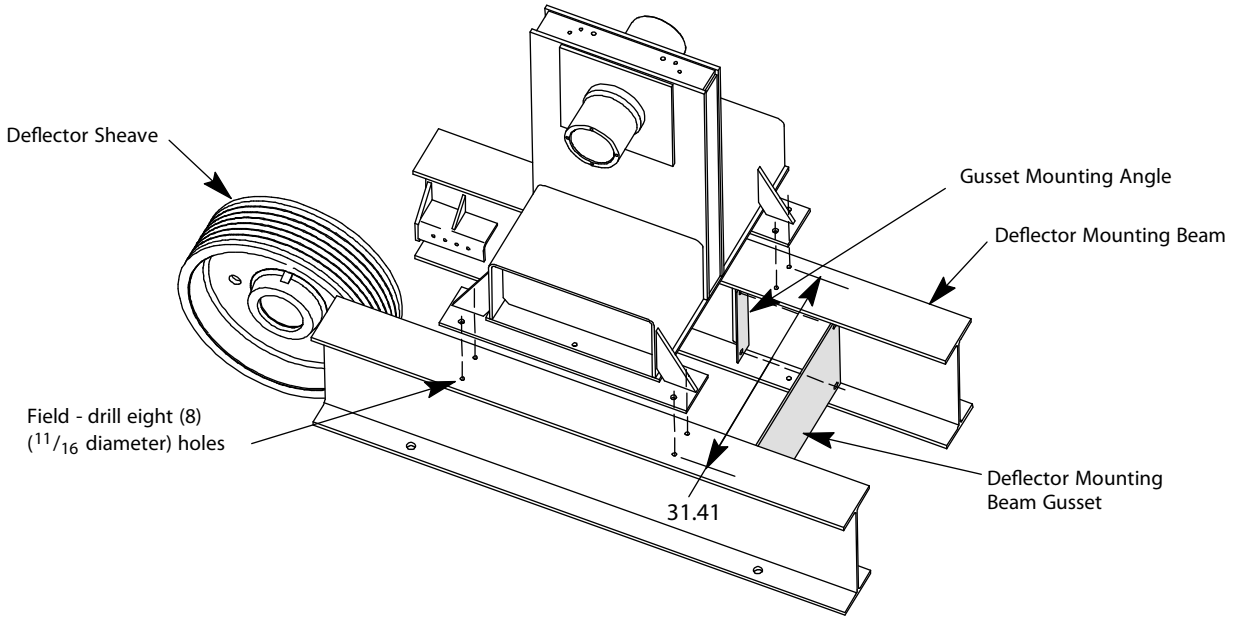


Figure 14 - Bedplate, Deflector Mounting Beams and Blocking Beam Installation

Bedplate, Deflector Mounting Beams and Blocking Beam Installation
(continued)

NOTES:
All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).
Left hand configuration shown, right hand opposite.

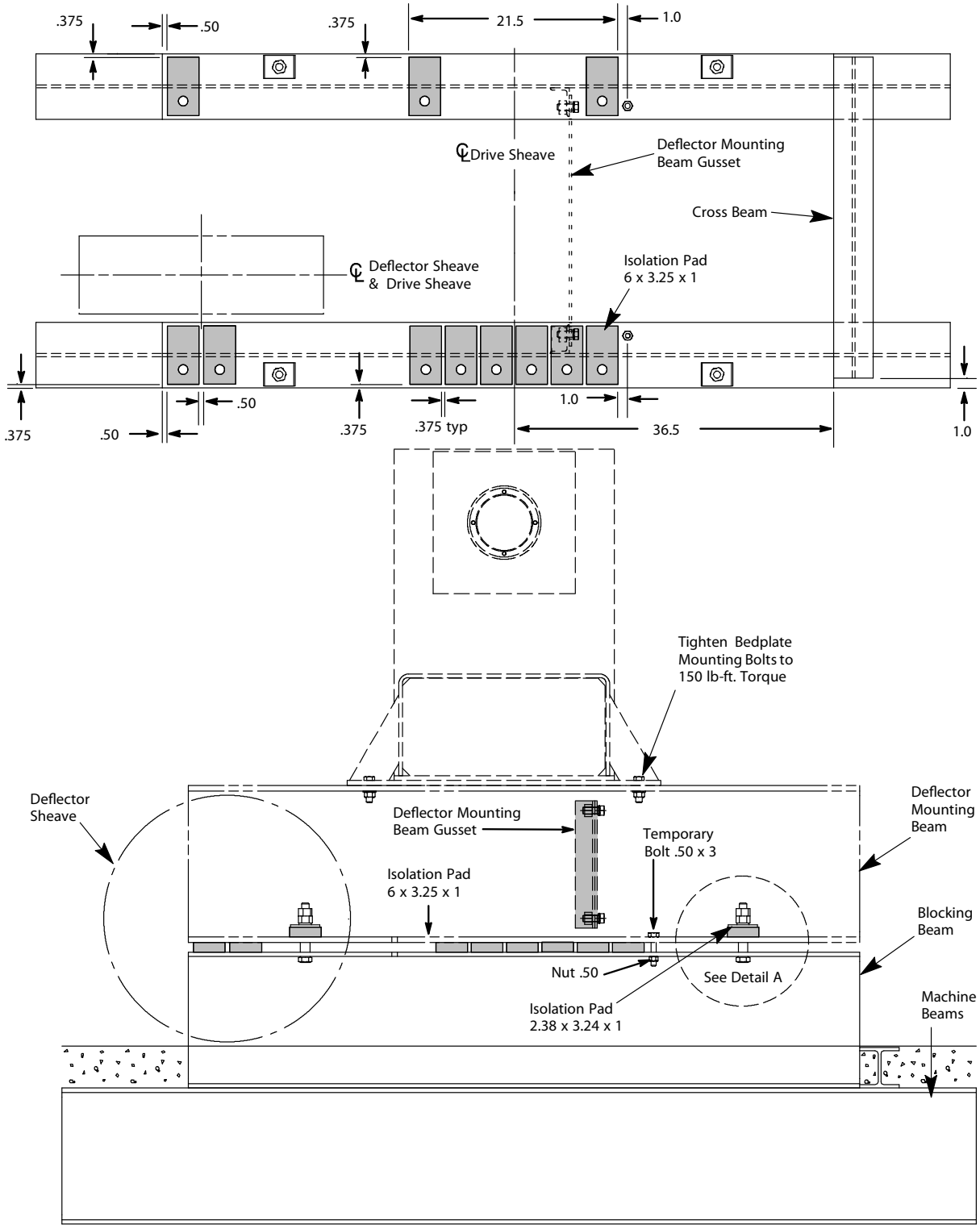


Figure 15 - LH Machine Mounting and Isolation with Deflector Sheave in Machine Room Overhead Forward Pulloff (1 of 2)

Bedplate, Deflector Mounting Beams and Blocking Beam Installation
(continued)

NOTES:
All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).
Left hand configuration shown, right hand opposite.

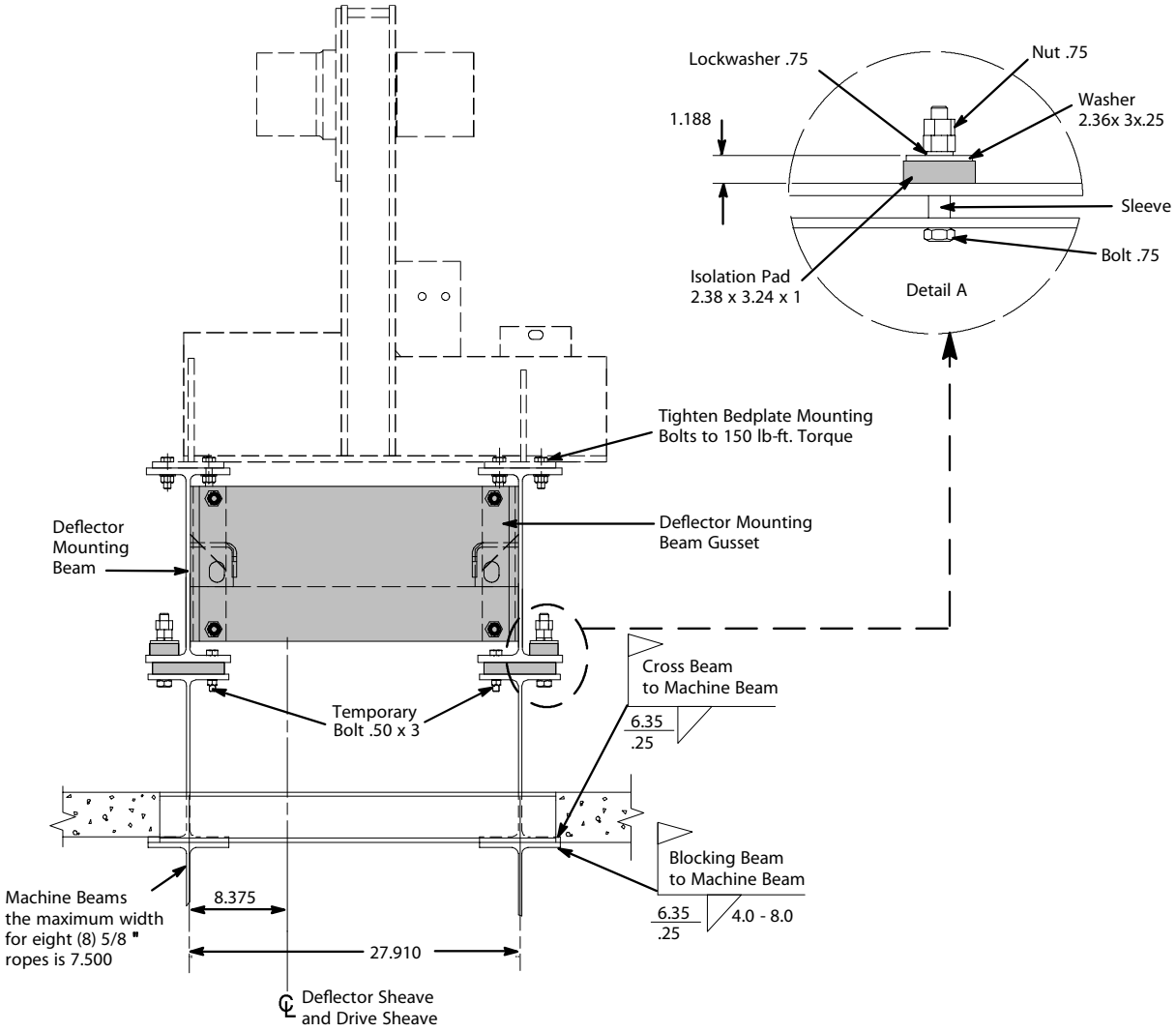


Figure 16 - LH Machine Mounting and Isolation with Deflector Sheave in Machine Room Overhead Forward Pulloff (2 of 2)

Bedplate, Deflector Mounting Beams and Blocking Beam Installation
(continued)

NOTES:
All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).
Left hand configuration shown, right hand opposite.

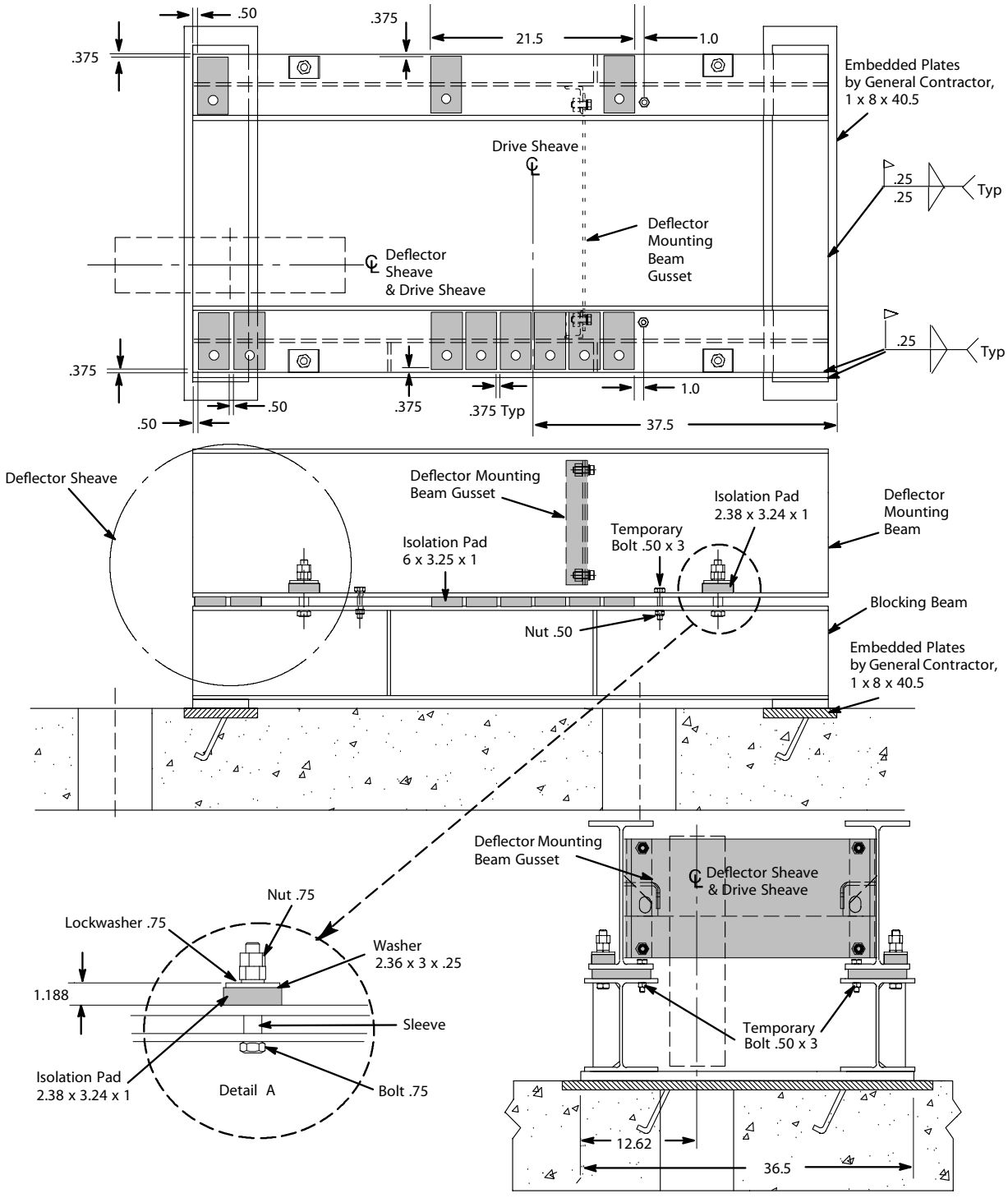


Figure 17 - LH Machine Mounting and Isolation with Deflector Sheave in Machine Room (on Structural Slab) Overhead Forward Pulloff

Bedplate, Deflector Mounting Beams and Blocking Beam Installation
(continued)

NOTES:
All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).
Left hand configuration shown, right hand opposite.

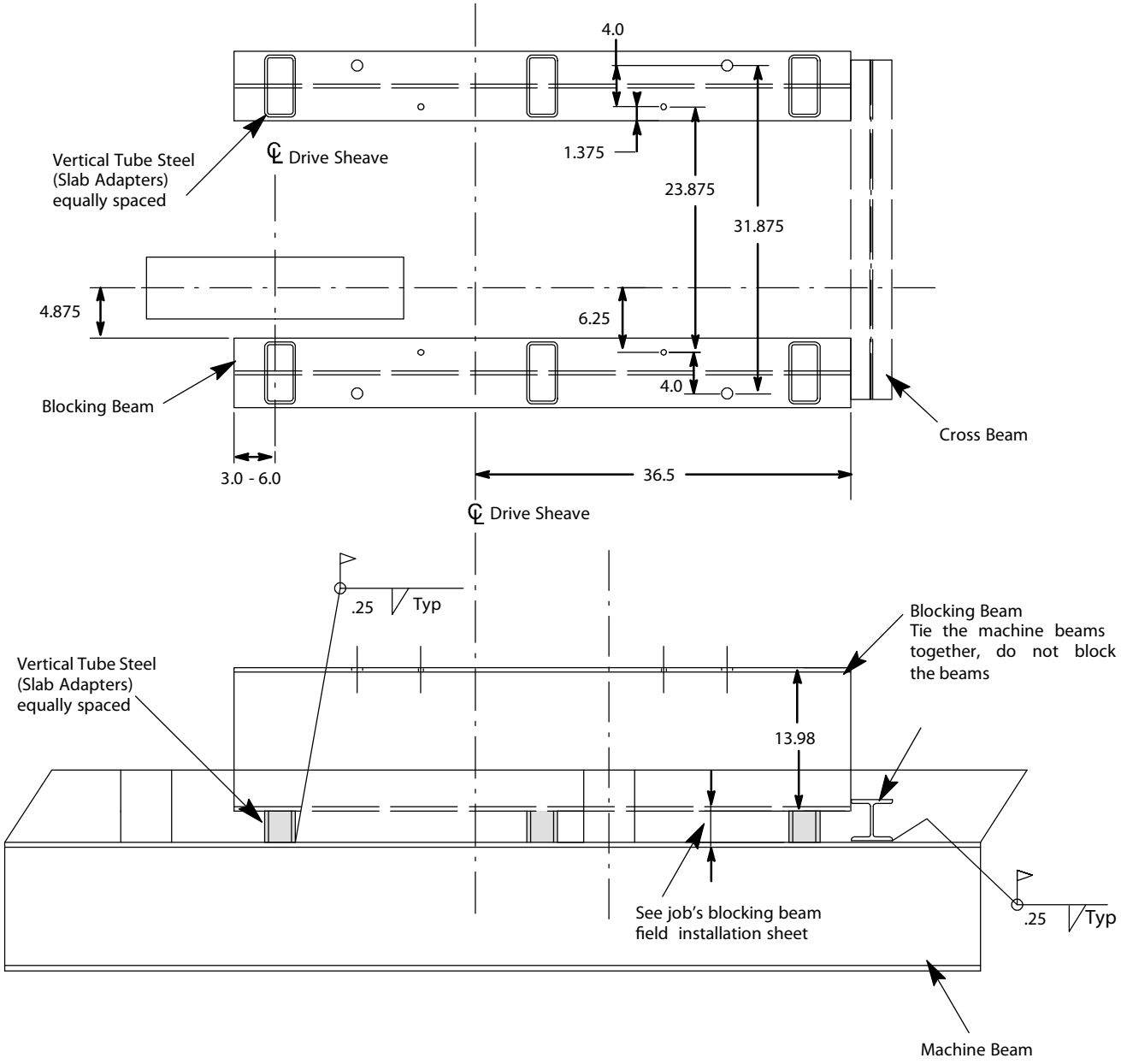


Figure 18 - LH Machine with Deflector Sheave in Machine Room (for machine room floors greater than 6")

Mounting the Deflector Sheave to the Deflector Mounting Beams

CAUTION **When making overhead installations, keep the hoistway clear at all times.**

1. After the bedplate, deflector mounting beams, and blocking beams are secured in place, remove two (2) 0.5" x 3" bolts. See Figure 19.
2. Use the 1" x 6" bolt to adjust the horizontal position of the following:
   - 2:1 Applications: The deflector sheave to the counterweight or car's compounding sheave
   - 1:1 Applications: The center of the pickup point of the counterweight or car.
3. Once adjusted, lock the deflector mounting bracket into place with the locking bolt.
4. Tack weld the 1" x 6" bolt into place.
5. Install the deflector rope guard on the set screws (located on the front of the deflector mounting brackets).

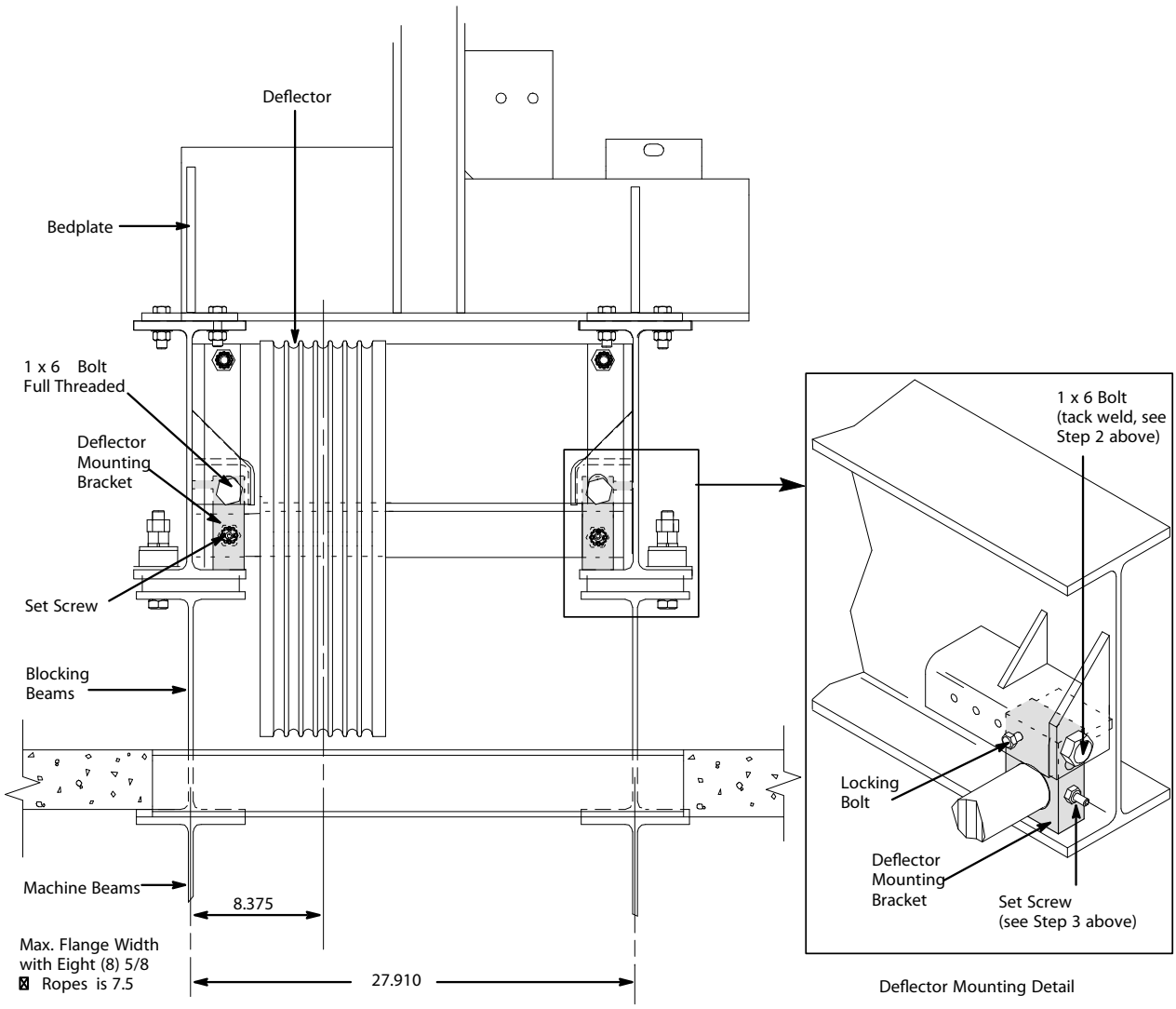
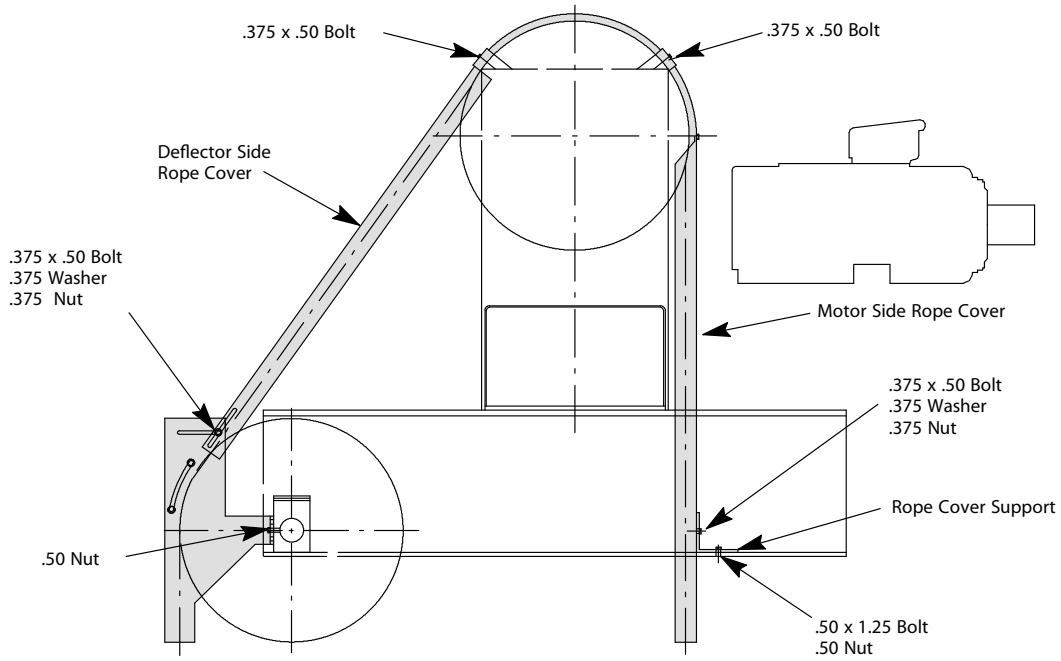


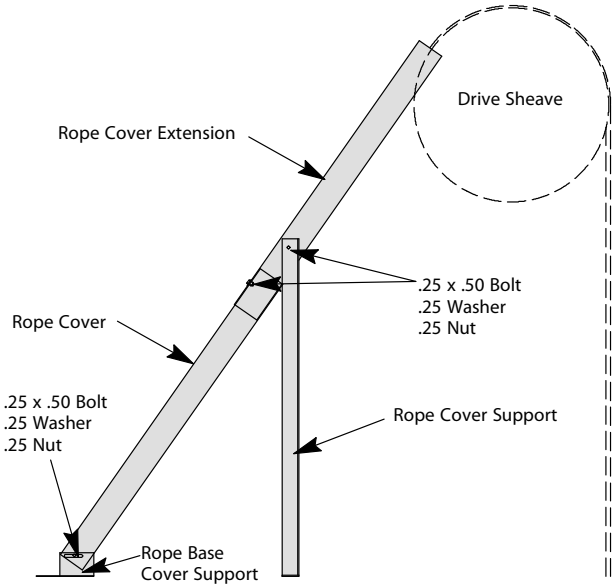
Figure 19 - Mounting the Deflector Sheave to the Deflector Mounting Beams

Mounting the Rope Cover Kit (machines without the Hollister-Whitney "Rope Gripper")

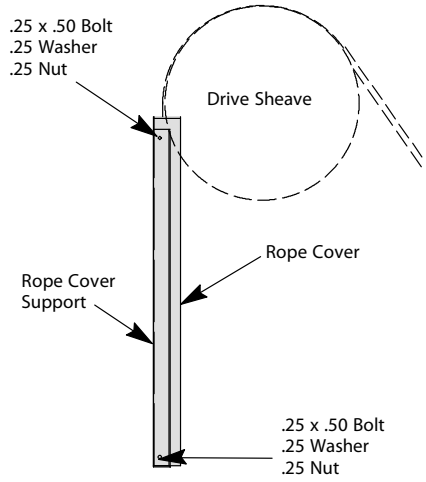
All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).



Rope Cover Kit for Deflector Sheave in Machine Room (Overhead)



Anchor the Sheave Support Base and the Rope Cover Support to the floor. Extend the Rope Cover Extension (for the assembly) to cover the ropes from the sheave to the floor.

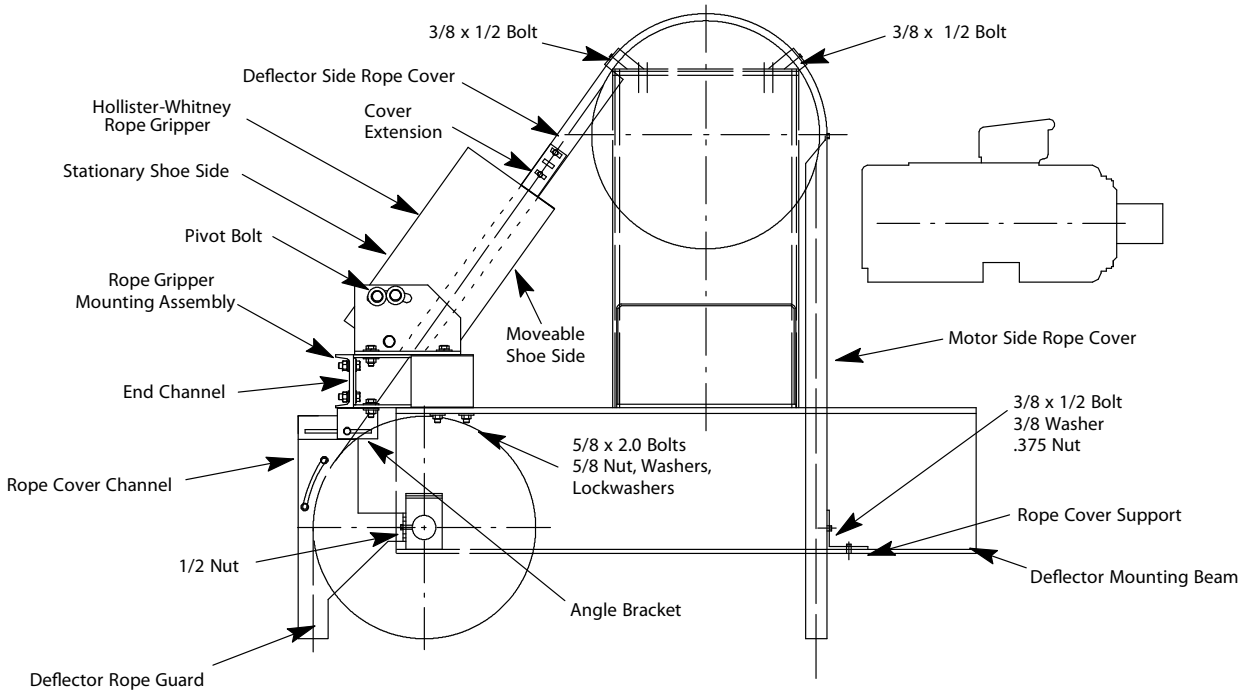


Rope Base Cover Support is not used on vertical applications. Field drill the rope cover support and the rope cover at the top and at the bottom.

Rope Cover Kit - Overhead

Mounting the Rope Cover Kit (machines with the Hollister-Whitney "Rope Gripper")

All measurements are in inches. To convert inches to millimeters, multiply by 25.4 (in. X 25.4 = mm).



Installation of the Hollister-Whitney "Rope Gripper"

These instructions are to be used in conjunction with the Hollister-Whitney Rope Gripper component manual. Consult the manual for instructions on hose connections, alignment, wear-in, wiring, test, and operation. For installation, also see Figure 20 on page 31.

Note: The car should be roped prior to installing the rope gripper.

1. Unbolt the end channel on the mounting frame assembly.
2. Place the rope gripper mounting assembly around the hoist ropes with the open end facing away from the machine.
3. Temporarily clamp the rope gripper mounting frame assembly to the deflector mounting beams.
4. Remove the retainer rings on either side of the rope gripper (per the Hollister-Whitney Rope Gripper component manual), and take out the moveable shoe.
5. Place the rope gripper on the mounting frame assembly and install the 4" x 5/8" bolts without the washers and nuts (at this time).
6. Loosen the pivot bolts on the rope gripper.
7. Match the angle of the rope gripper to the angle of the hoist ropes.
8. Tighten the pivot bolts on the rope gripper.
9. To obtain proper alignment, slide the complete mounting assembly onto the deflector mounting beams.

Note: To align the rope gripper with the hoist ropes, see the Hollister-Whitney Rope Gripper component manual.

Installation of the Hollister-Whitney "Rope Gripper"
(continued)

CAUTION **Use caution as the assembly may overhang the deflector mounting beams.**

10. Mark through each of the four (4) holes of the mounting assembly onto the deflector mounting beam.
11. Remove the rope gripper and the mounting assembly from the deflector mounting beam.
12. Drill clearance holes (to accept a 3/4” bolt) through the deflector mounting beams at each of the four (4) marked locations.
13. Use the provided 3/4” x 2" bolts, washers, and lockwashers to reinstall and bolt the rope gripper mounting frame assembly to the deflector mounting beams.
14. Bolt the end channel back onto the mounting frame.
15. Place the rope gripper back on the mounting frame. Ensure that the hoist ropes are against the stationary shoe.
16. Use the 5/8” bolts, washers, and nuts to bolt the rope gripper to the mounting frame.
17. Replace the moveable shoe on the rope gripper.
18. Mount the rope gripper power unit to the floor near the gripper channel frame assembly.

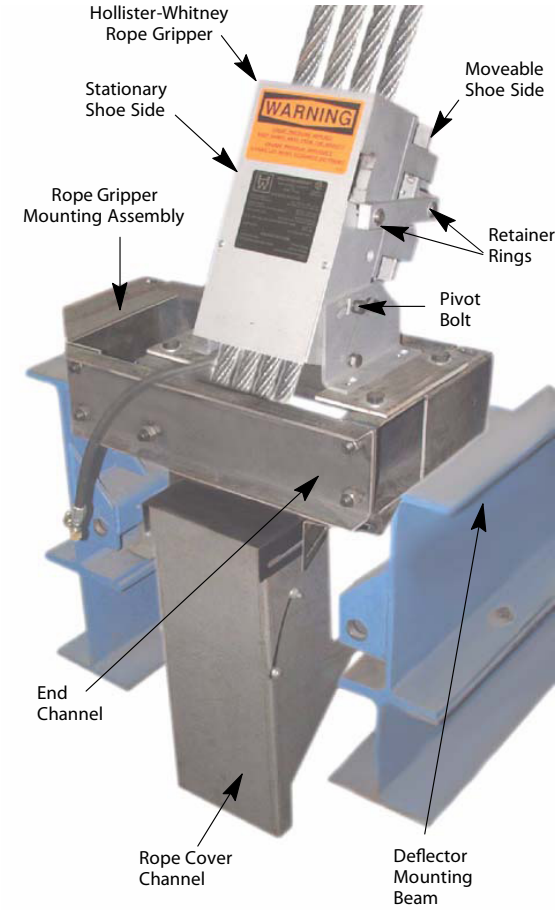


Figure 20 - Rope Gripper Assembly

Sheave Brake Mounting

Sheave Brake and Brake Mount

These instructions are to be used in conjunction with the *GD-1/GD-2 Sheave Brake* component manual. The sheave brake is shipped separately and must be assembled to the machine in the field.

WARNING **The sheave brake spring is compressed from manufacturing. Do not remove the temporary shipping fasteners until instructed.**

Roping

- Prior to installation, check the ropes for nicks and abrasions.
- Do not install ropes that are damaged.
- Do not allow ropes to become nicked, bruised, or kinked.
- Do not pull ropes over edges.
- Do not twist the ropes in any direction.
- Do not slide the rope in the drive, or in the counterweight sheave grooves. Use blocks or protective metal bands.

Shackling

WARNING **Before roping the car, set the car on safeties. Install the safety slings around the crosshead to a suitable support.**

1. Place a wedge over the drawing in Figure 21 to confirm the correct color and size of the wedge.

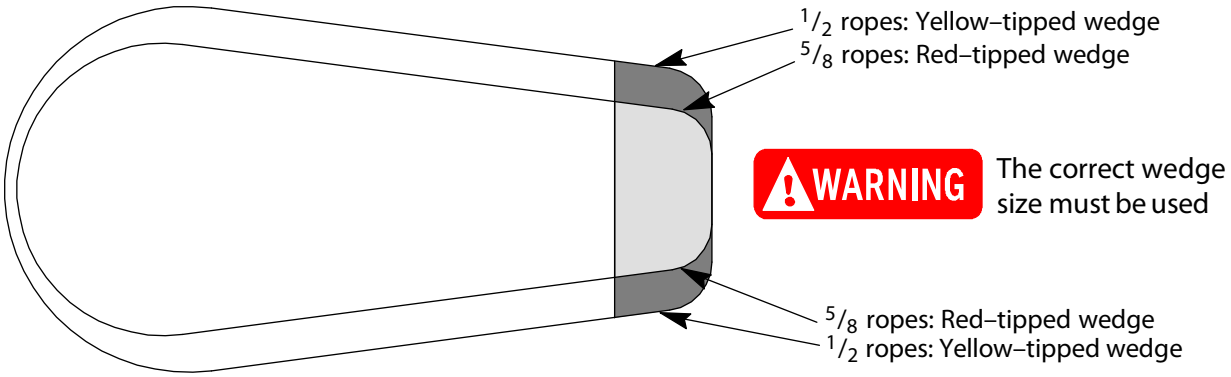


Figure 21 - Confirm Actual Wedge Size and Correct Wedge Color

Shackling
(continued)

2. Insert the end of the hoist rope through the clamp body (of the wedge clamp and rod assembly), taking up all the slack in the hoist rope. See Wedge Shackle Assembly, Figure 22.

3. Make a loop, insert the wedge in the loop, then run the free end of the rope back through the shackle body.

4. While pulling on the rope with one hand to keep it tight, pull the loose end of the rope until the rope and the wedge are seated in the shackle body.

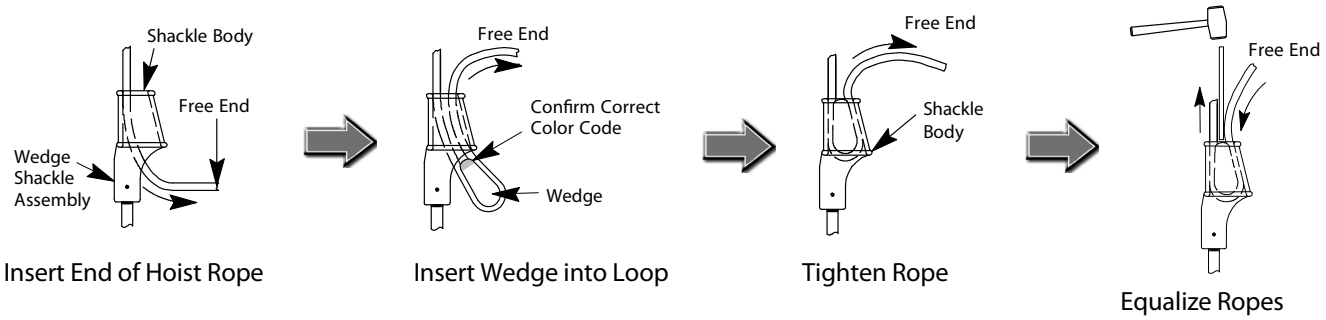


Figure 22 - Wedge Shackle Assembly

5. Install the shackles at the car. See Figure 23.
   a. Pass a shackle rod through the hitch plate springs and the load weigher plate.
   b. Assemble the bushing, washers, nuts, and cotter key onto the shackle rod.
   c. Run the nuts up 2" (51mm) from the cotter key, and lock the nuts together.
   d. Repeat Steps a through c to install the remaining ropes at the car.

Note: The loadweigher transducer and card are adjusted at manufacturing to match specific job requirements. These items must be kept together and installed per the specific job number.

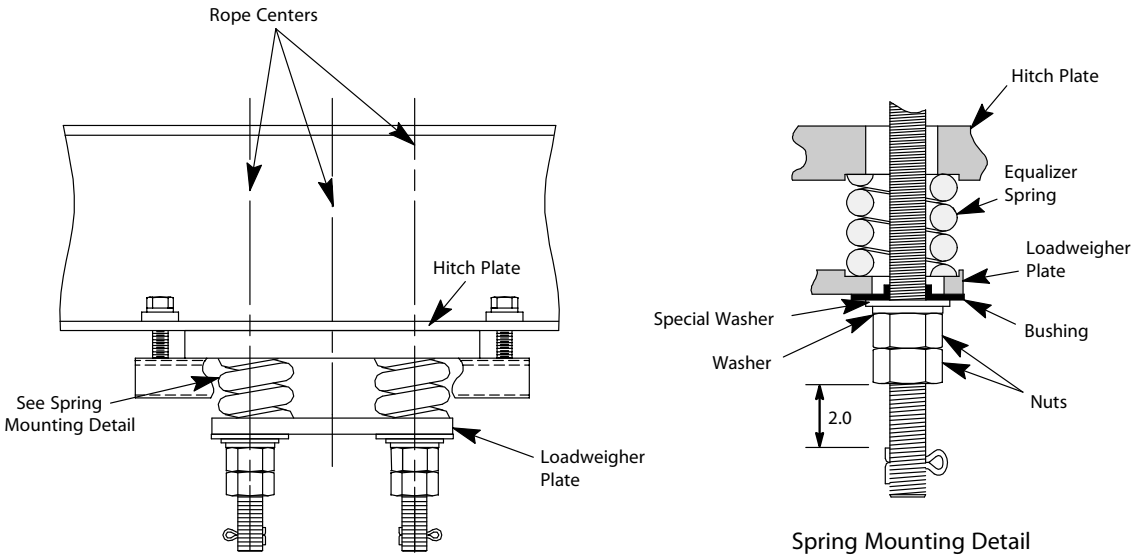


Figure 23 - Car Rope Shackle Installation

Shackling
(continued)

6. On the counterweight, assemble each rope into a wedge shackle assembly.

7. Install the shackles at the counterweight. See Figure 24.
   a. Pass a shackle rod through the hitch plate.
   b. Assemble the bushing, equalizer spring, washers, nuts, and cotter key onto the shackle rod.
   c. Run the nuts up 2" (51mm) from the cotter key, and lock the nuts together.
   d. Repeat Steps a through c to install the remaining ropes at the counterweight.

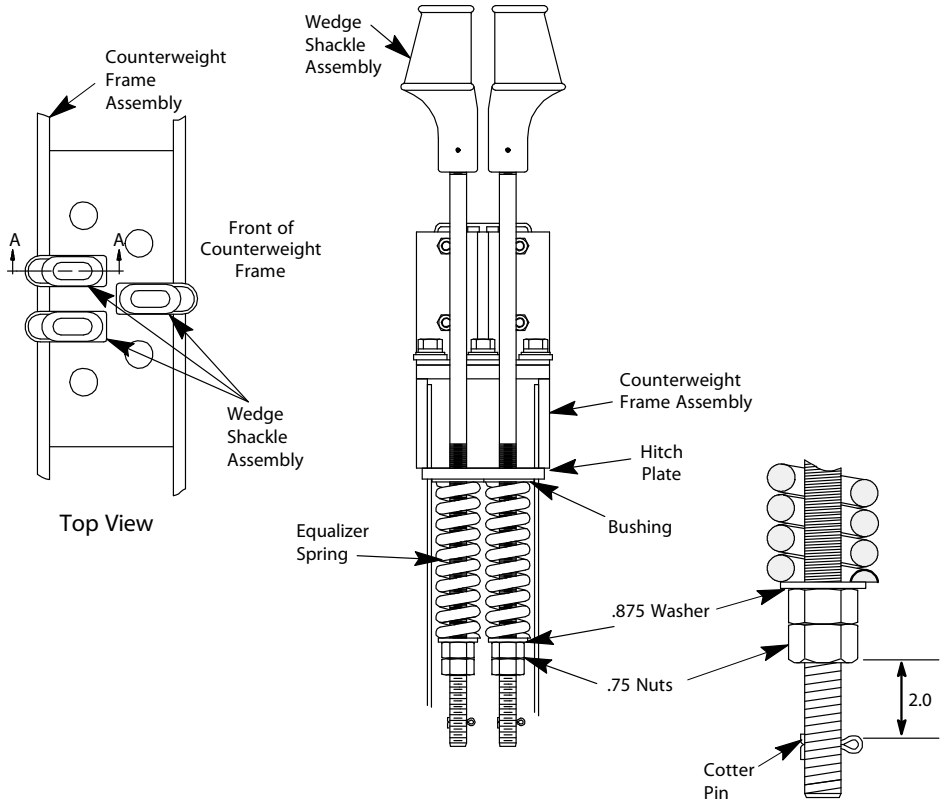


Figure 24 - Counterweight Rope Shackle Installation

8. After all ropes are installed, allow the weight of the car and the counterweight to rest on the ropes as follows:
   a. Remove the safety sling from the crosshead.
   b. Release the safeties.

9. Use a hammer and a drift pin or rod and roughly equalize any rope(s) that are tighter than the rest by tapping the wedge at the narrow end until the rope slides through. See Wedge Shackle Assembly, Figure 22 on page 33.

Shackling
(continued)

10. Install a wedge locking clip on each rope. See Figure 25.
11. Arrange wedge clamps so that clamps will not rotate, then feed a small cable through the clamp bodies, and tie the cable off with a crosby clip.
12. Cut off any rope more than 6" (152mm) above the top of the wedge clamp, and tape the end of the remainder.
13. Repeat Steps 10 through 12 at the counterweight.

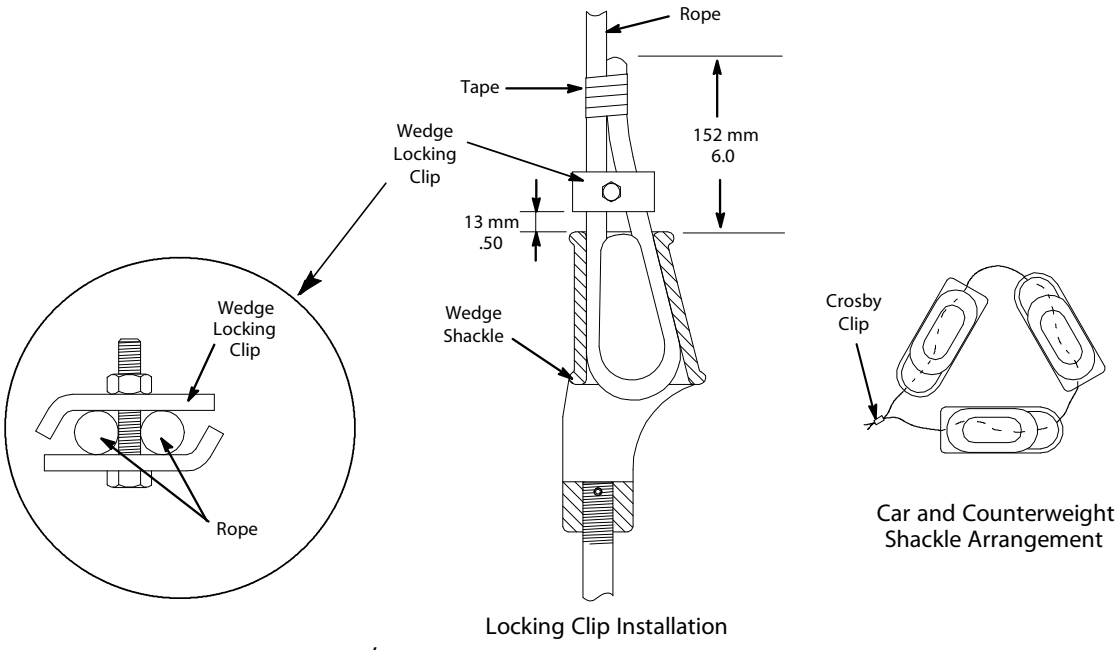


Figure 25 - Locking Clip Installation and Rope Clipping

Rope Tension Adjustment

Note: Perform the rope tension adjustment as soon as the car can be run on temporary operation.

1. Place the car and counterweight at the middle of the hoistway so that car and counterweight ropes and adjustment nuts can be accessed easily without moving the car. See Figure 26.

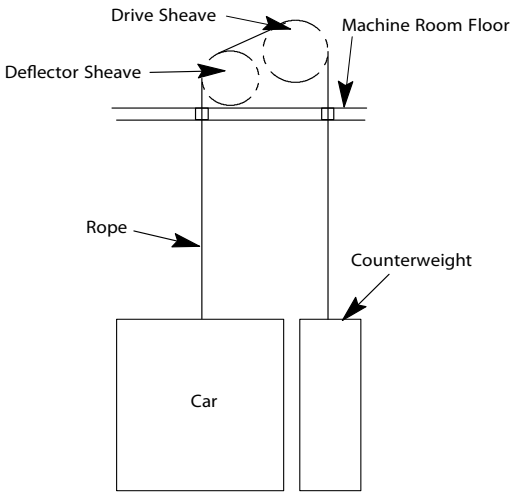


Figure 26 - Typical 1:1 Roping

Rope Tension Adjustment
(continued)

2. Check all car side rope tensions with a cable tension tool.

Note: Use one of the following cable tension tools in conjunction with a standard 1/2" torque wrench:

- Part number = 9727012 - 1/2" rope
- Part number = 9727000 - 5/8" rope

3. Adjust the rod nuts until the tension readings are within 5 ft/lbs. of each other. See Figure 27.
4. Check all counterweight side rope tensions, and adjust to within 5 ft/lbs. of each other.
5. Run the car to the top of the hoistway and back to the middle of the hoistway, then check the car side and counterweight side tensions. Record the readings for each rope in the chart.
6. Add the car side and the counterweight side tensions together for each rope, and record the total in the Total ft/lbs. column in the chart.

Notes:

- Each total must be within 10 ft/lbs. of the other totals.
- If any total is not within 10 ft/lbs. of one or more of the other totals, repeat Steps 1 through 5.

7. Lock the rod nuts together on the shackle.

Rope No.	Car Side ft-lbs.	+	Counter-weight side ft-lbs.	=	*Total ft-lbs. (Car & Cwt.)
1		+		=	
2		+		=	
3		+		=	
4		+		=	
5		+		=	
6		+		=	
*Each total must be within 10 ft.-lbs of each of the other totals.					

Cable Tension Readings

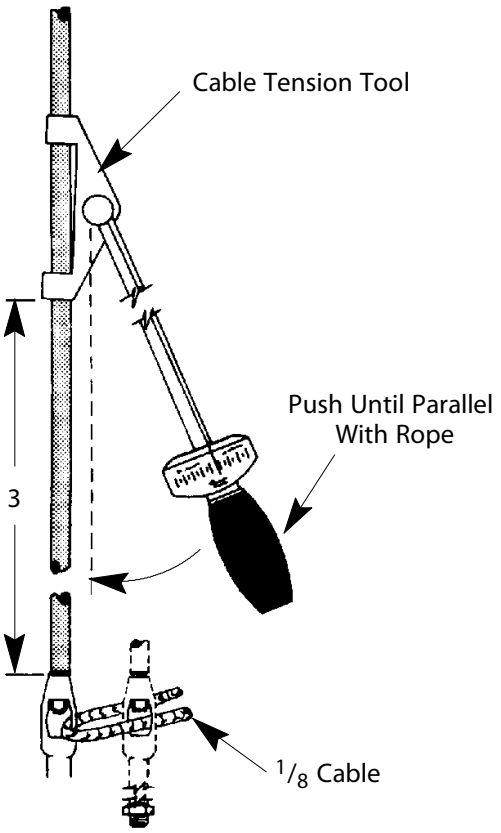


Figure 27 - Cable Tension Tool and Chart

Brake Switch Wiring

The Brake Switch Wiring Harness is shipped disconnected from the brake switch. Because different controller designs can require the use of a normally open (NO) or normally closed (NC) contact, it will be necessary to refer to your specific job wiring diagrams to wire the harness to the correct NO or NC contact on the brake switch.

1. Connect the brake switch harness to the NO or NC contact on the brake switch as specified by the job specific wiring diagrams.

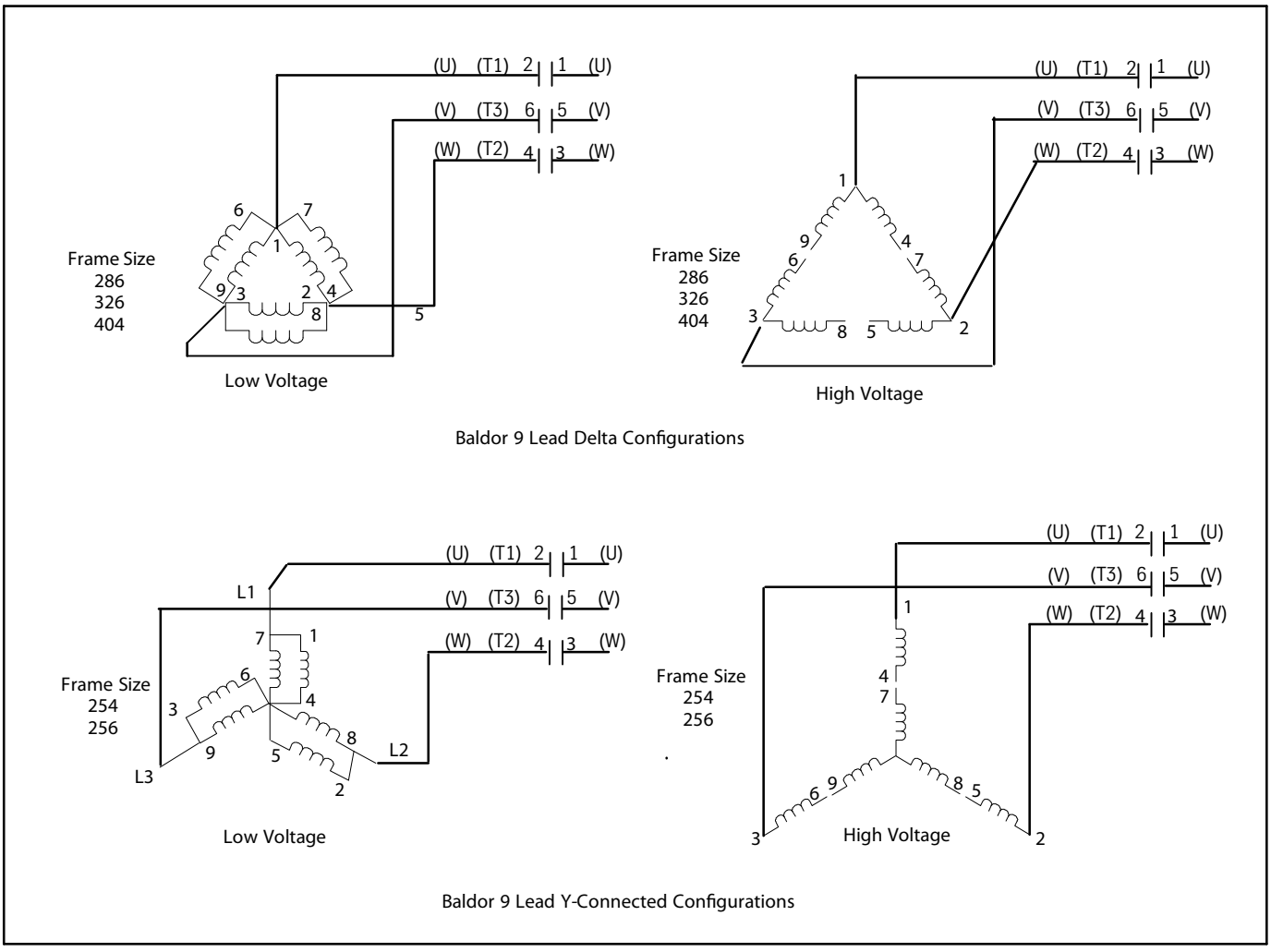
2. Connect the opposite end of the brake switch harness to the designated controller terminals. Refer to the job specific wiring diagrams.

Motor Connection

Use the job wiring diagrams with the motor configuration information to connect the motor to the controller. See Figure 28 and Figure 29 on page 38.

CAUTION **Before operating the machine, refer to the appropriate product manual and verify that the drive parameters for the job are set correctly.**

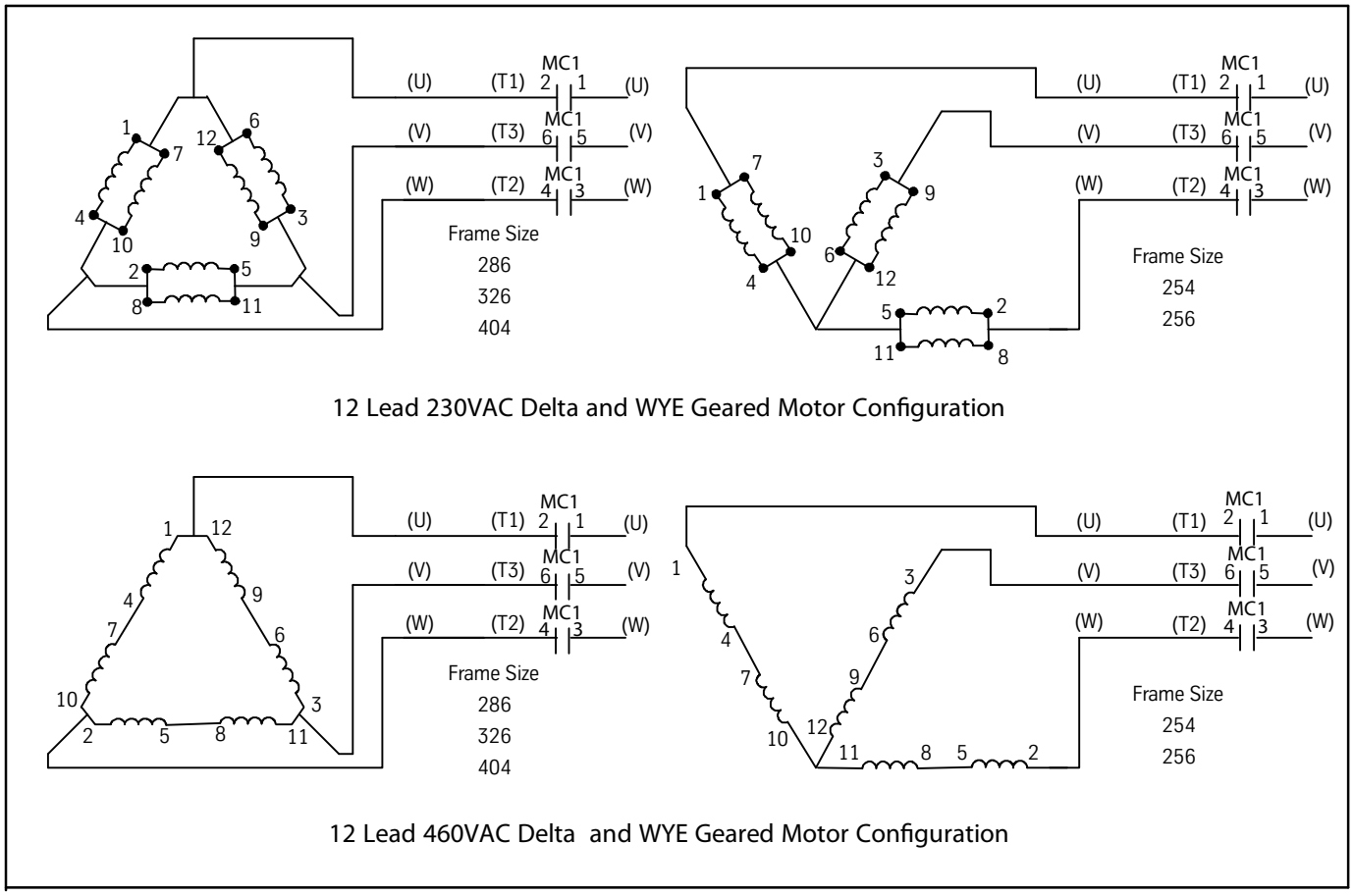
Wiring Diagrams



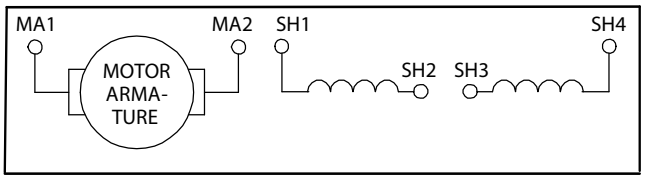
AC Motor Configurations

Figure 28 - Motor Configuration Wiring (1 of 2)

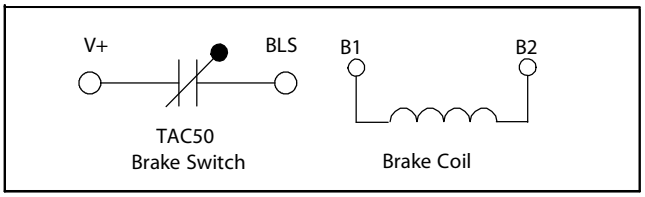
Wiring Diagrams
(continued)



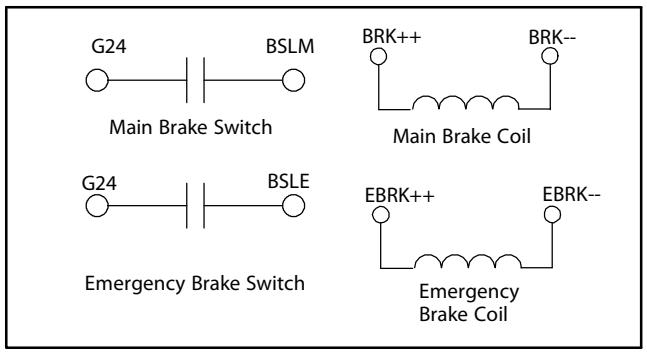
12 Lead AC Motor Configuration



DC Motor Lead Configuration



TAC50 Brake Configuration



TAC50-04 Brake Configuration

Figure 29 - Motor Configuration Wiring (2 of 2)

Adjustment

Single Solenoid Brake Adjustment

WARNING **Before anyone is allowed to ride on the platform, adjustment of the brake must be complete.**

Required Tools and Materials

- Bearing Oil
- Flint Paper (Grade 240 or finer)
- Degreaser (biodegradable, non-polluting)
- 1/4" (6mm) Flat Screwdriver
- Tape Measure
- Hex Wrenches
- Wire Brush
- M6 Bolt
- Torque Wrench and Adaptor
- Feeler Gauges
- Open End Wrenches: 10mm, 11mm, 12mm, 13mm, 14mm, 15mm, 16mm, 17mm, 19mm

Preparation

1. Verify that any required compensation chains or rope assemblies have been installed.
2. On construction jobs, verify that hoistway barricades are in place to prevent unauthorized access.

Disassembly, Cleaning, and Lubrication

CAUTION **Take care that no contaminants come in contact with brake parts.**

1. Land the counterweight of the empty car onto the buffers.
2. Turn OFF, Lock, and Tag out the mainline disconnect.
3. Remove the spring adjustment nut and washer, the brake spring, the spring locator, and the spring bolt. See Figure 30 on page 40 for all steps in this procedure.
4. Clean the threads of the spring bolt with a wire brush, and lubricate them with grease.
5. Measure and record the uncompressed brake spring length. Verify that the brake spring diameter is 2 3/4"(70mm).
6. Disconnect the brake wiring from the junction box (mounted on the motor).
7. Remove the flex conduit from the junction box.

Single Solenoid Brake Adjustment
(continued)

8. On the sheave side:
   a. Measure and record the length of the brake stop adjustment bolt that extends past the stop adjustment locknut.
   b. Remove the stop adjustment locknut, the nut, and the flat washer from the brake stop adjustment bolt.

9. On the gear side:
   a. Loosen the brake stop adjustment locknut and nut.
   b. Loosen the inside locknut, and remove the brake stop adjustment bolt from the machine housing.

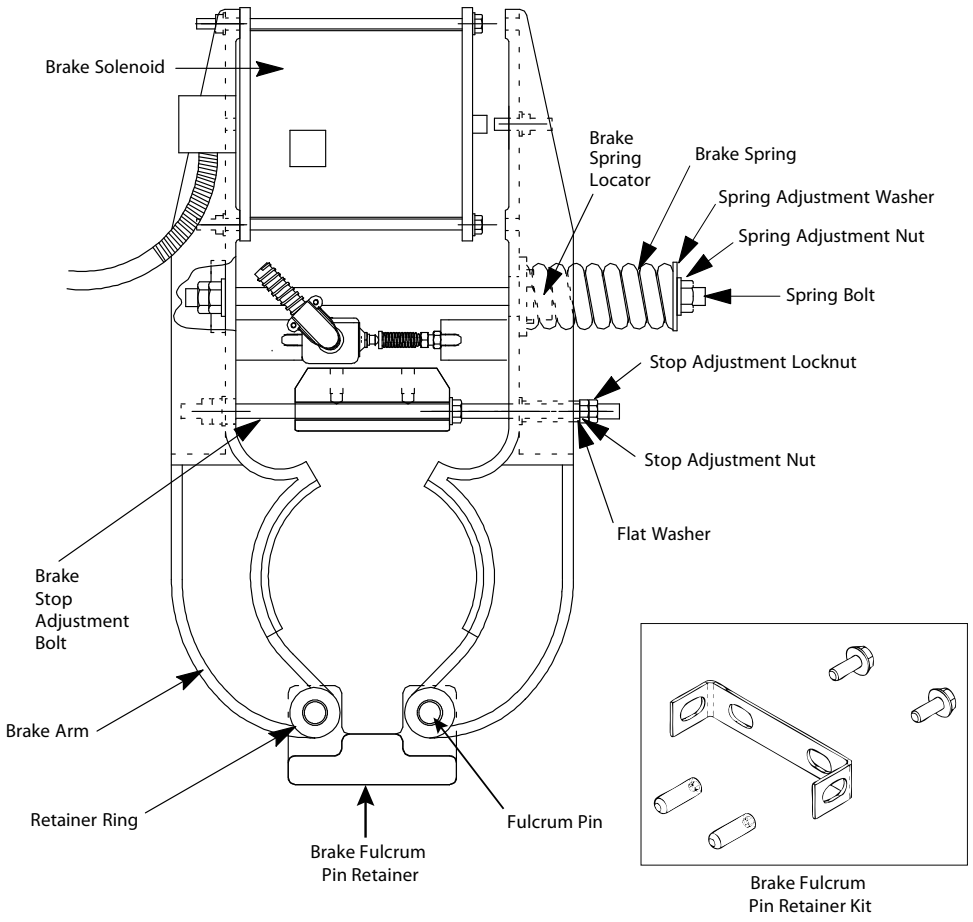


Figure 30 - Single Solenoid Brake Assembly

Single Solenoid Brake Adjustment
(continued)

Remove and Clean the Brake Arm Assemblies

CAUTION **If the brake fulcrum pin retainer is not present, order one from the Warranty Department.**

1. From the brake fulcrum pin retainer, remove the set screws and the retainer on the gear housing side.
   a. Install an M6 bolt in the brake arm pins.
   b. Remove the brake arm pins by pulling on the M6 bolt installed in Step a.
   c. Remove the brake arms.

Note: The brake arm pins can be removed only toward the motor.

2. Lightly sand, thoroughly wash, and coat with bearing oil the brake arm pins and the brake arm bores.
3. Ensure that the brake linings are tightly riveted to the brake shoe assemblies, that the rivets are recessed a minimum of 1/16" (1.6 mm) within the brake linings, and that the brake linings are a minimum of 1/8" (3.2 mm) thick.

Remove and Clean the Solenoid

1. Remove the brake solenoid from the brake arm, and ensure that the dust seal is not damaged.
   a. Remove the front plate of the brake solenoid. See Figure 31.
   b. Remove the solenoid sleeve and plunger.
2. If the solenoid armature is coated with a manufacturing-applied dry lubrication (black coating), wipe it with a clean, dry cloth. If the coating is worn, replace it with a new armature that has the proper coating.
3. Store the armature to prevent any damage or contamination.
4. Thoroughly clean the inside of the solenoid sleeve and the front plate assembly.

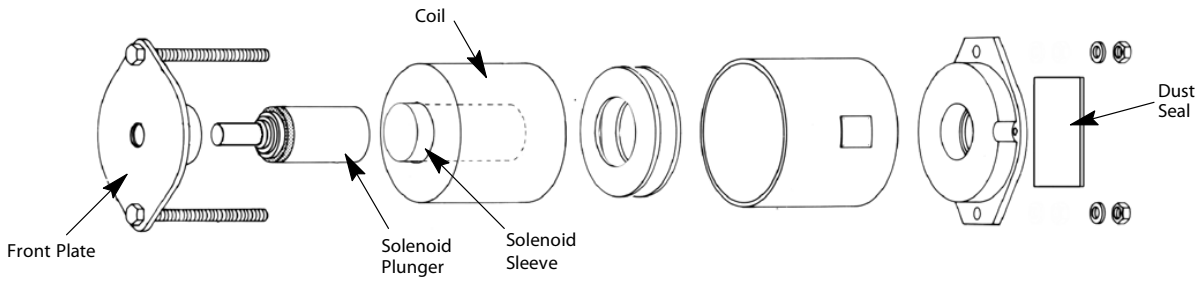


Figure 31 - Solenoid (exploded view)

Single Solenoid Brake Adjustment
(continued)

Reassembly and Preliminary Adjustments

1. Reassemble the brake solenoid, and be careful not to pinch the solenoid wiring.
   a. Assemble the brake solenoid to the brake arm that it was removed from.
   b. Verify that the brake solenoid armature moves freely in the solenoid assembly.

2. Install the brake arms, the pivot pins, the set screws, and the fulcrum pin retainer.
   a. Reconnect the flex conduit and the brake wiring.
   b. Verify that the brake arms will move freely.

3. Verify that the brake shoes are centered horizontally on the brake drum.

4. Use a .002" (.05 mm) feeler gauge, check for shoe-to-drum contact on both sides of the brake shoe at the top, the center, and the bottom of the drum.
   a. Place the feeler gauge on the edge of the brake drum, push one of the brake arms against the drum, and verify that the gauge cannot be pulled out at the top, the bottom, and the middle of shoe.
   b. Repeat Step a for the other brake arm.

5. If the brake shoe does not make 90% contact, sand in the shoes as follows:
   a. Remove the spring adjusting nut, the washer, the brake spring, and the bolt.
   b. Place adhesive-backed sandpaper (appx. 80 grit) around the entire surface of the brake drum.
   c. Hold one brake arm against the drum, and rotate the drum back and forth.
   d. If the shoe does not have 90% contact, repeat Step c.
   e. Repeat Steps b through d (if necessary) for the other brake arm until 90% contact is achieved.
   f. Remove the sandpaper and any adhesive from the brake drum.

6. Install the brake spring bolt, the brake spring locator, the spring washer, and the adjustment nut.
   a. Tighten the spring adjustment nut until the brake spring is compressed 1/2" (12.7 mm) from its uncompressed length (recorded earlier).
   b. Disconnect the brake wires from the controller.
   c. Turn ON the mainline disconnect.
   d. With the brake collapsed on the brake drum, run the car on Inspection Speed until the brake drum is at 212^0 F.

CAUTION **Do not let the brake drum exceed 212^0 F. Ensure that the unbalanced load on the platform (car) plus the collapsed brake does not present an overload to the motor or controller.**

   e. Land the counterweight of the empty car onto the buffers.
   f. Turn OFF, Lock, and Tag out the mainline disconnect.
   g. Remove the spring adjustment nut, the washer, the brake spring, and the spring bolt and verify that the shoes are slightly burnished.
   h. If the linings are not properly burnished, repeat Steps d through g of Step 6.

Reassembly and Preliminary Adjustments
(continued)

7. From the gear side, install the brake stop adjustment bolt.

8. From the sheave side, install the washer, the nut, and the locknut.

9. Tighten the adjustment nut and locknut to obtain the thread extension dimension recorded earlier in "Disassembly, Cleaning, and Lubrication".

Preliminary Shoe Adjustment

1. Ensure that the solenoid pin contacts the center of the stroke adjustment bolt.

2. Turn (by hand), the brake stop adjustment bolt assembly in the housing until the brake shoe on the sheave side is just pulled into contact with the brake drum.

3. Hold the brake stop adjustment bolt, and temporarily tighten the locknut to the housing.

4. On the gear side, pull the brake arm back against the flat washer, and turn the stop adjustment nut until the shoe-to-drum clearance is .020" (.51 mm).

5. Hold the stop adjustment nut, and tighten the locknut.

6. Loosen the brake stop adjustment bolt locknut from the housing.

7. Holding the brake arm against the stop washer, turn the brake stop adjustment bolt assembly clockwise until the brake shoe (on the gear side) clears the brake drum by .008" (.20 mm).

8. Hold the brake stop adjustment bolt, and retighten the locknut to the housing.

9. Install the brake spring bolt, the spring washer, and the adjustment nut. Tighten the spring adjustment nut until the brake spring is compressed 1/2" (12.7 mm) from its uncompressed length (recorded earlier).

10. Push the solenoid plunger completely back into the brake solenoid assembly.

    a. Adjust the stroke adjustment bolt to 1/4" (6 mm) between the solenoid plunger and the stroke adjustment bolt.

    b. Hold the stroke adjustment bolt, and tighten the adjustment bolt locknut.

    c. Verify that the solenoid pin retainer does not restrict the movement of the solenoid pin.

Final Shoe Adjustment

1. Turn ON the mainline disconnect.

2. With the controller on Inspection Operation, electrically energize the brake.

3. If the brake arms do not contact the stops, de-energize the brake and adjust the stroke adjustment bolt for a full pick.

Note: The arms should just lightly contact the stops. Do not allow excessive pressure.

Final Adjustments

Note: To make the final adjustments to the GD-2 Machine Brake, the controller must be able to run from the platform.

Brake Spring Tension Adjustment

For Construction Platforms

1. Verify the proper counterweight.
2. Position the platform at the bottom terminal landing.
3. Tighten the spring adjustment nut until the spring is fully compressed; then turn it counter-clockwise one (1) turn.
4. Place 50% of the capacity load on the platform.

WARNING

Do not load the platform beyond 50% of the contract capacity. To prevent accidental loss of traction, add weights 100 lbs. at a time.

5. Turn OFF, Lock, and Tag out the mainline disconnect.

Note: In order to prevent excessive movement in the following steps, be ready to quickly tighten the brake spring adjustment nut, or press on the brake arm assemblies.

6. Pry open the brake arms to allow the brake drum to rotate about an inch. Release the brake arms so that they close on a moving drum, and verify that the brake stops the car.
7. Slowly loosen the spring adjustment nut and repeat the previous step until the car no longer comes to a stop. Tighten the brake spring adjustment nut clockwise one (1) turn.
8. Measure and record the compressed brake spring length.
9. Subtract this compressed spring length from the uncompressed brake spring length (recorded earlier).
1. Increase the spring tension by the amount calculated in the previous step.

Note: This increase effectively doubles the spring tension recorded. This adjustment ensures that the brake will hold 50% of capacity, which is the maximum load for a construction platform (plus a safety factor).

For Use by Contractors (Temporary Car) or for Final Adjustment

1. Verify that the proper compensation is installed.
2. Verify the proper counterweight. Place a balanced load on the elevator with the car in the center of the hoistway. When the brake is manually opened, the car should not drift.
3. Turn ON the mainline disconnect.
4. Position the platform at the bottom terminal landing.
5. Tighten the spring adjustment nut until the spring is fully compressed, and then turn it counter-clockwise one (1) turn.

Final Adjustments
(continued)

WARNING **Do not load the platform beyond 50% of the contract capacity. To prevent accidental loss of traction, add weights 100 lbs. at a time**

6. Place 125% of the capacity load on the car.

7. Turn OFF, Lock, and Tag out the mainline disconnect.

Note: In order to prevent excessive movement in the following steps, be ready to quickly tighten the brake spring adjustment nut, or press on the brake arm assemblies.

8. Pry open the brake arms to allow the brake drum to rotate about an inch. Release the brake arms so that they close on a moving drum, and verify that the brake stops the car.

9. Slowly loosen the spring adjustment nut and repeat Step 6 until the car no longer comes to a stop. Tighten the brake spring adjustment nut clockwise one and one-half (1 1/2) turns.

CAUTION **The maximum brake spring length is exactly four (4) inches. Verify the length of the brake spring, and tighten to adjust it to exactly 4 inches.**

10. Turn ON the mainline disconnect.

11. Turn the doors OFF, and run the car to the top landing.

12. Verify that the brakes hold 125% at the top landing. If the brakes fail to hold the 125% load, increase the brake spring compression until it will.

13. Position the platform at the bottom terminal landing, and remove the load.

Brake Arm Adjustment

1. Run the platform up and down, and adjust the stroke adjustment bolt so that when the brake picks, the brake arms will gently contact the stop adjustment nuts.

2. If either of the brake shoes drags the drum while the car is running, adjust the shoe-to-drum clearance with the stroke adjustment bolt and the stop adjustment nuts.

3. Run the car up and down until the brake solenoid assembly reaches normal operating temperature.

4. Run the car to the top floor, and Turn OFF, Lock, and Tag out the mainline disconnect.

5. Drift the car up to land the counterweights.

6. Place the controller on Inspection Operation, and turn ON the mainline disconnect.

7. Electrically energize the brake, and verify with a feeler gauge that both brake shoes clear the brake drum by a minimum of .005" (.13 mm).

Note: If the clearance is less than .005"(.13 mm), adjust the stop adjustment nut to obtain a minimum of.005"(.13 mm), and then retighten all locknuts.

WARNING **The brake pick voltage is set in relationship to the spring pressure. If the spring pressure is increased, the pick voltage must be verified to ensure proper brake operation.**

Maintenance

Drive Sheave Retainer Bolt Verification

The GD-2 drive sheave retainer bolts and sheave bearing carrier bolts must be checked annually and after every impacted load event or test such as a safety and buffer test.

WARNING **Failure to check the bolt torque annually or after impacted loading may cause a crack in the drive sheave hub.**

Recommended Tools

- 175 ft/lbs torque wrench
- 70 ft/lbs beam torque wrench
- 15/16" and 3/4" sockets and ratchet
- Feeler gauges
- Scribe

1. Begin with an empty car at the top landing, with the doors closed and the door switch turned OFF, and set the controller to Inspection Operation.

2. Turn OFF, Lock, and Tag out the mainline disconnect.

3. Verify the existing sheave retainer bolt torque: Apply a slight tightening force with a beam torque wrench until the sheave retainer bolt turns or the appropriate value is reached. See Table 1.

Sheaves shipped prior to July 1, 2001		
Size	Print number	Torque
26”	750CE1-5	75 ft/lbs
32”	750CD1-5	75 ft/lbs
36”	750CH1-5	75 ft/lbs
Sheaves shipped July 1, 2001 or later		
Size	Print number	Torque
26”	750CW1-5	100 ft/lbs
32”	750CD6-10	100 ft/lbs
36”	750CH6-10	100 ft/lbs
Notes: • Always loosen the anti-rotator bolt when adjusting the retainer bolt torque. • Retighten the anti-rotator bolt to 175 ft/lbs when finished.		

Table 1 - Sheave Retainer Bolt Torque Values

4. If the torque is below the required value, loosen the non-rotator bolt and equally tighten the sheave retainer bolts. See Figure 32 on page 47.

WARNING **Do not remove non-rotator bolt.**

Drive Sheave Retainer Bolt Verification
(continued)

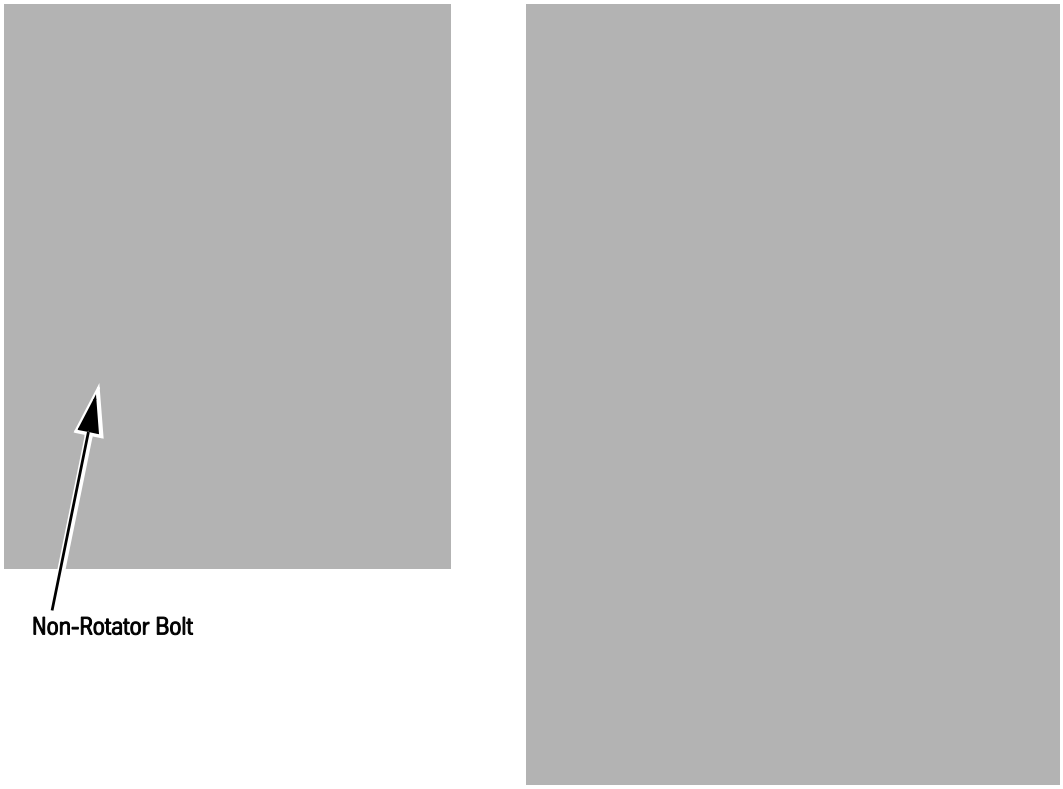


Figure 32 - Non-Rotator Bolt

5. Run the elevator on Inspection Operation Up and Down several times to verify proper operation.

6. Repeat Step 3 and Step 5 until the correct torque setting is maintained.

7. Cycle the elevator on Automatic Operation with the doors OFF for several complete hoistway runs, then return to the top landing and place the elevator on Inspection Operation.

8. Check the retainer bolt torque.
   - If correct: Return the elevator to service.
   - If not correct: Repeat Step 3 through Step 7 until the required torque value is maintained after Automatic Operation.

9. GD-2 Machines shipped July 1, 2001 or later: Inspect the hole located in the center of the retainer plate, and verify that the output shaft is not contacting the retainer plate.
   - If clearance cannot be visibly confirmed: Try to insert a small feeler gauge between the output shaft and the retainer plate.
   - If clearance is not present: Inspect the keyway location for a crack. Contact Field Engineering if there is no clearance present, whether or not a crack in the sheave is found.
   - If clearance is present: Place the elevator into service.

Drive Sheave Retainer Bolt Verification

(continued)

10. GD-2 Machines shipped prior to July 1, 2001: No inspection hole in the center of the retainer plate:

    a. Place the elevator on Inspection Operation at the top landing, and Turn OFF, Lock, and Tag out the mainline disconnect.

    b. Remove one of the retainer bolts and determine if there is clearance between the retainer plate and the output shaft.

    Helpful Tip: For improved future inspections, an inspection hole could be drilled in the center of the retainer plate while the plate is removed.

    - If clearance is present: Proceed to Step 11.
    - If clearance cannot be determined: Remove all retainer bolts and the retainer plate.

    c. Measure and record the distance between the end of the output shaft and the face of the drive sheave.

    d. Scribe a mark on the gear case at the non-rotator angle. This mark should extend approximately 1" above the non-rotator angle. See Figure 33.

    e. Reinstall the retainer plate, and torque to the appropriate value from Table 1 on page 46.

    f. Measure how far the mark (on the gear case at the non-rotator angle) has moved.

    - If the mark is less than the recorded distance from Step 10c: Perform Step 5 through Step 8.
    - If the mark is equal to the recorded distance: Inspect for a crack in the drive sheave hub above the keyway. If a crack is not present, contact Field Engineering.

11. Before placing the elevator back into service, cycle the elevator and verify operation with the doors OFF.

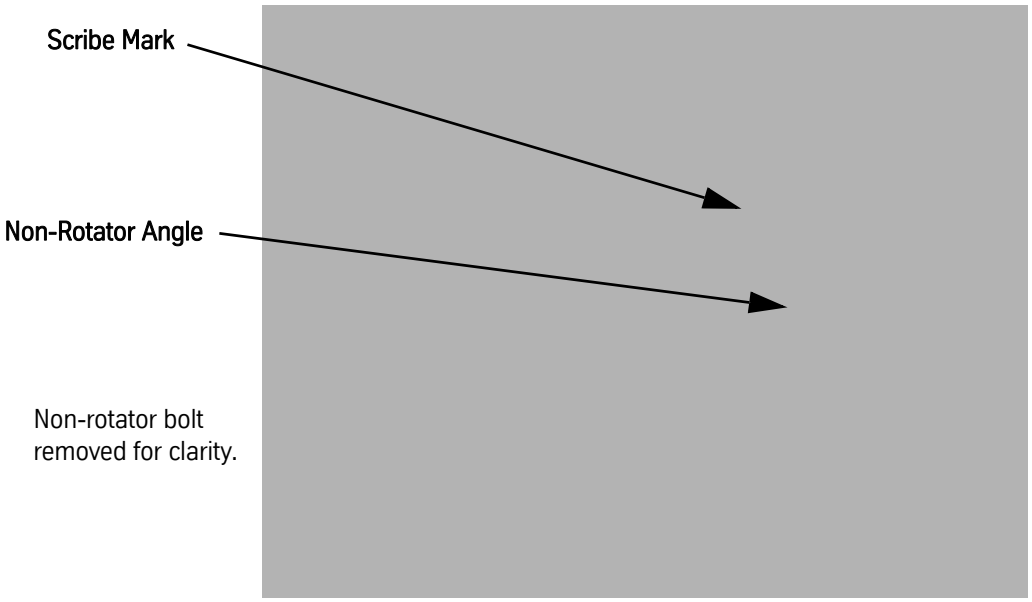


Figure 33 - Measure the Non-Rotator Angle Movement

Drive Sheave Carrier Bearing Bolt Torque Verification

Note: Before starting this procedure, verify that the Drive Sheave Retainer Bolt Verification has been completed.

1. Begin with an empty car at the top landing, with the doors closed and the door switch turned OFF, and set the controller to Inspection Operation.
2. Turn OFF, Lock, and Tag out the mainline disconnect.
3. Use a beam torque wrench, and slightly tighten the sheave retainer bolt until it turns or the torque reading reaches 70ft/lbs.

Note: If the torque does not reach 70ft/lbs, then tighten the drive sheave carrier bolts. If the sheave brake is present, the sheave brake must have the manual brake release installed and the sheave brake pads lifted from the drive sheave rim surface during adjustment. See the *GD-1 GD-2 Sheave Brake* component manual.

4. Use the torque wrench and tighten the carrier bolts in a "X" pattern until they are 50 ft/lbs. See “Measure and Adjust the Weave of the Drive Sheave” on page 61.
5. Continue tightening the carrier bolts, adding 5 ft/lbs each time, until 70 ft/lbs is achieved. Do not exceed 70ft/lbs.
6. Before placing the elevator back into service, cycle the elevator and verify operation with the doors OFF.

Sheave Carrier Bearing

Annually grease bearings with approximately 1 oz. of grease. Recommended grease is Part Number 70313.

Baldor Motors

Baldor Motors have seal bearings, which do not require lubricating.

Imperial DC Motors

Brushes

Brush maintenance includes inspection for proper seating, sparking, chattering, grooving, wear, and pressure. Spare brushes should be kept on hand and installed when required.

Install New Brushes (when required)

1. Rest the brush on the abrasive side of the paper.
2. Place 80-grit garnet commutator paper between the brush and the commutator.
3. Work the garnet paper back and forth until the curvature of the brush fits the commutator.

Note: On open loop equipment, never replace over half of the brushes at any one time.

Imperial DC Motors
(continued)

Commutators

Ensure that the commutators are smooth, highly polished, and free of dirt, oil, grease or moisture. If the surface of the commutator is dull and black (excessive sparking), clean it with a fine commutator stone or garnet commutator paper (do not use emery cloth).

If the commutator requires finishing in a lathe, ensure the center to the bearing journals is within .001 Total Indicator Reading (TIR) with a surface finish of 16 micro-inches or more. After undercutting mica, renew the finish with garnet commutator paper.

CAUTION

Failure to restore the undercut will result in sparking, excessive brush wear, and ultimate damage to the commutator.

When dirt, oil, grease, or moisture is found on the commutator, completely clean the commutator with a hard, lint-free cloth. Clean between the segments with a hardwood wedge or undercutting tool. Determine the source of dirt, oil, grease, or moisture, and take measures to prevent deposits on the commutator.

Windings

Keep foreign material off of the windings.

CAUTION

Failure to keep the windings clean may result in short circuits, grounding of insulated surfaces, and increased rising temperatures.

The operating conditions will determine the frequency of cleaning the windings. However, it is a good policy to clean the windings at least once a year. Wipe off any greasy or oily deposits with a lint-free cloth dipped in a suitable solvent. Follow cleaner instructions carefully regarding procedures, methods, cautions, and warnings.

Do not leave solvent deposits on the windings. Remove non-conductive dust using compressed air (not over 50 P.S.I.). Do not blow directly into the windings. If solvent deposits are heavy or highly conductive, use a vacuum cleaner with a plastic crevice tool attachment to clean the machine.

Ball Bearings

The speed and operating conditions determine the frequency of re-greasing the ball bearings.

Imperial DC Motors
(continued)

Greasing the Motor

Imperial motors are properly greased when they leave manufacturing and do not require lubrication when installed.

1. Clean the exterior of the motor.
2. Remove both the grease plug and the relief plug.
3. If grease has hardened, remove the hardened lubricant (which has accumulated in the area around the relief plug), with a wooden or plastic stick. In severe conditions, run the motor until the bearing chamber is warmed to a temperature which allows the grease to flow more easily.
4. Re-grease the motor with a low pressure grease gun.

Note: The motor must be stationary.

5. Run the motor until new grease flows from the drain plug. Ensure that the bearing chamber is two-thirds full of grease.
6. Replace grease and relief plugs.

Note: The motor must be stationary.

CAUTION **Lubricate the motor if it has been in storage for six months or longer. See Table 2 for lubrication guidelines.**

Duty	Motor RPM	
	Through 1800	3600
Normal - Eight hours per day, normal loading, clean environment, 104° F. max. ambient.	12 months	12 months
Severe - Twenty-four hours per day, or shock vibration loading, dirt or dust environment, 104° F to 150° F ambient.	6 months	6 months
Harsh - Heavy shock or vibration, harsh environment	3 months	3 months

Table 2 - Lubrication Guide for ambient temperature of 0° to 104° F.

Notes:

- For motors supplied with roller bearings, divide table values by 3. For operation in other than ambient temperature, contact the manufacturer.
- Unless otherwise shown on nameplate, the standard medium temperature grease (0° to 255° F.) is Shell Alvania #2.
- Do not use equivalent greases, they may not be chemically compatible.
- Do not use silicone grease in DC equipment.
- Lubrication should be done with the shaft stationary.

Lincoln AC Motors

- Periodically inspect the motor for excessive dirt, friction, or vibration.
- Use compressed air to remove dust from inaccessible locations.
- Keep the ventilation openings clear to allow free passage of air.
- Ensure the drain holes in the motors are kept open, and the shaft slinger is positioned against the end bracket.
- Use an approved solvent to remove excess grease or oil.

Bearing System Lubrication

The Lincoln AC Motor is equipped with double-shielded ball bearings. The ball bearings have sufficient grease to operate indefinitely under normal service. The bearing opposite the shaft extension on 143T and145T Lincoln TEFC Motors are double sealed. These maintenance-free bearings have no re-greasing provision, and require no additional lubrication throughout the life of the motor.

Where the motor is used constantly in dirty, wet, or corrosive atmospheres, it is advisable to add a quarter ounce (1/4 oz.) of grease per bearing every three months. Use a good quality rust inhibitor poly urea based grease, such as Chevron SR1. Lithium based greases are not compatible with poly urea based greases, and mixing may result in loss of lubrication.

Use replacement parts per Lincoln parts list P-90-A, P-99-A, and P-156-A to maintain the original Lincoln AC Motor quality.

Note: The following chart is provided for reference only.

* Bearings are single-row radial deep-groove ball bearings. The 318 size on 250 HP motors is a single row maximum capacity type ball bearing. ODR frames 284T/TS through 405T/TS double shaft extension motors have both bearings as listed under Shaft Extension End.

	Shaft Extension End			Opposite Shaft Extension End		
Frame	Size *	DDP	TEFC	Size*	DDP	TEFC
140T	205	FF on All Enclosures		203	-	ZZ
180T	207			205	-	FF
210T	208			206	FF	FF
250T	309			208	FF	FF
280T/TS	310			209	FF	FF
320T/TS	311			309	FF	FF
380T/TS	313			311	FF	FF
400T/TS	315			313	FF	FF
440T/TS	318			315	FF	FF
FF - Double shielded ZZ - Double sealed						

Lincoln AC Motor Bearing Chart

End Thrust Test and Adjustment

A verified, balanced load with the car and counterweight must be on the elevator via shackle-to-shackle, or with the hoist ropes removed from the drive sheave.

1. Install a dial indicator on the brake hub. See Figure 34.

Figure 34 - Dial Indicator on Brake Hub

2. Place the dial indicator on an area of the brake drum with the smallest variation of run-out.
3. Block open the brake arms so that the brake shoes are clear of the brake drum.
4. Pull the worm shaft, hold it in one direction, and zero the dial indicator.
5. Push the worm shaft to the end of travel (in the opposite direction), and read the amount of worm shaft travel.

Note: Pull or push the drive sheave to move the worm.

   a. If the total displacement is greater than .002" (.05 mm), remove the amount of shims from the end cap to obtain readings between .0005" (.01 mm) and.002" (.05 mm).

   b. If there is no movement at all, then add a .002" (.05 mm) shim to the thrust cap, and measure again.

CAUTION **Excessive pre-load will generate heat and premature wear. End thrust greater than .002" (.05 mm) will cause premature bearing failure.**

   c. If there is still no movement, or excessive movement, repeat Step 4 and Step 5 until the appropriate movement is obtained.

6. Remove the dial indicator, and remove the brake arm blocking.

Gear Pattern Test

1. Turn OFF, Lock, and Tag out the mainline disconnect.
2. Drain the oil.
3. Use solvent to remove the oil from three (3) gear teeth.
4. Spray or paint layout blueing on three (3) teeth in four (4) places (equally spaced around the sheave), and allow it to dry completely. See Figure 35 for all steps in this procedure.
5. Mark the sheave to identify the position of the blueing on the gear.
6. Place the car on Inspection Operation.
7. Turn ON the mainline disconnect.
8. Run the machine in one direction until the blueing is wiped off and the pattern can be seen.
9. Repeat Step 8, but run the machine in the opposite direction.
10. Compare the gear pattern to those shown below.

Note: If the gear pattern requires adjusting, continue with Gear Pattern Adjustment. If the gear pattern does not require adjusting, continue with Backlash Adjustment.

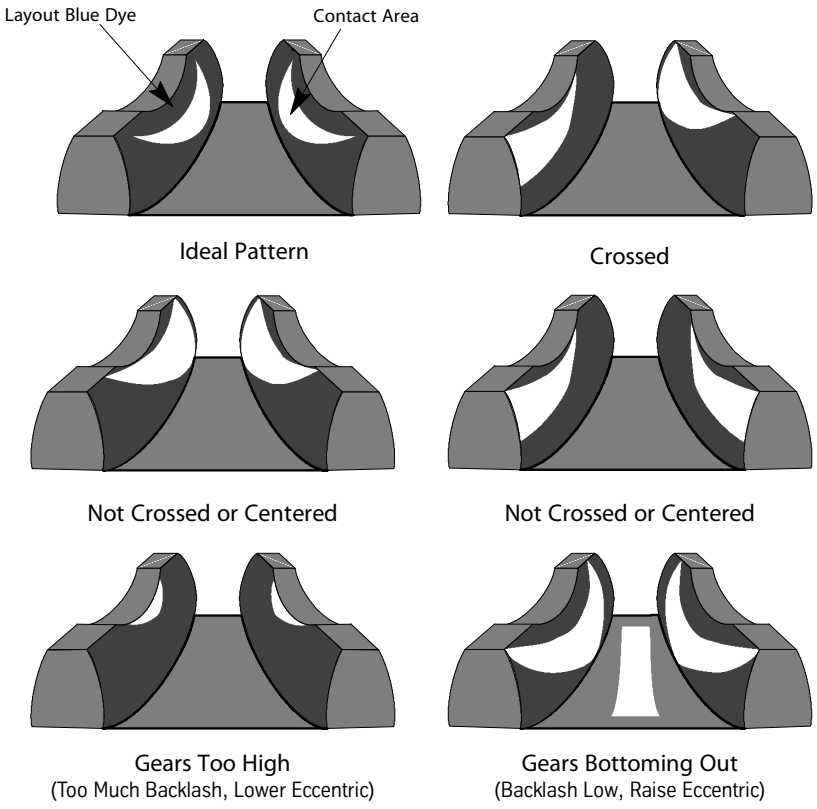


Figure 35 - Gear Patterns

Gear Pattern Adjustment

Note: The ring gear position is fixed. The gear case and worm are the moving adjustable components.

The Wear Pattern is in Line, But Shifted to One Side

1. Loosen the retaining clip bolts and the housing anti-torque bolt. See Figure 36.
   a. If the wear pattern is in line, but shifted toward the drive sheave:
      Move the wear pattern away from the sheave - Equally turn all hex set screws 1/8 to 1/4 counter-clockwise, and then tighten the retaining clip bolts.
   b. If the wear pattern is in line but shifted away from the drive sheave:
      Move the wear pattern toward the sheave - Loosen the retaining clip bolts and turn all hex set screws 1/8 to 1/4 turn clockwise equally, and then tighten the retaining clip bolts.
2. Tighten the anti-torque bolt to 120 ft. lb.
3. After each adjustment, repeat the Gear Pattern Test procedure and the Gear Pattern Adjustment procedure until the gear pattern is correct.
4. Once the gear pattern is correct, proceed to the Backlash Adjustment section.

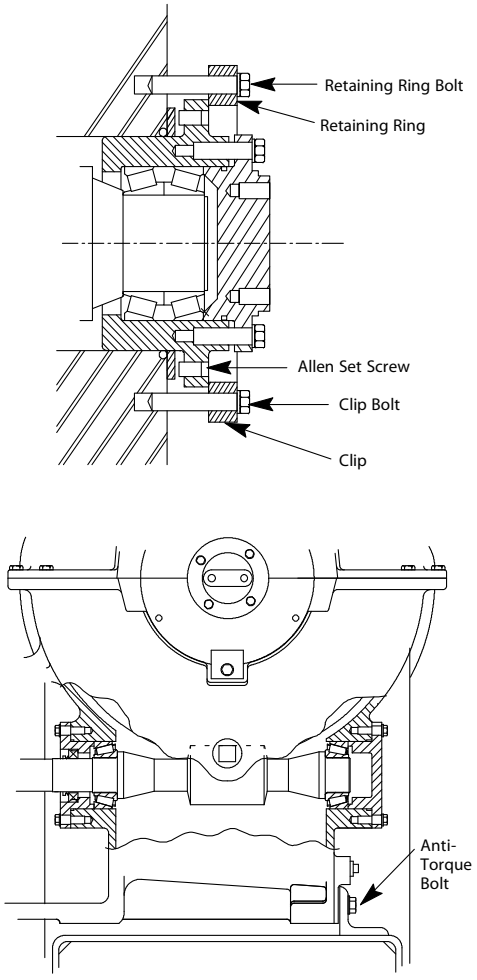


Figure 36 - Gear Pattern Adjustment Bolts

Gear Pattern Adjustment
(continued)

Wear Pattern is Crossed

1. Look down on the gear pattern to determine which wear pattern is shifted the farthest away from the center of the gear.

2. Loosen the retainer clip bolts and the housing anti-torque bolt.

3. Move the wear pattern. See Figure 37.
   - Move the wear pattern to the right:
     a. Move the outboard eccentric handle toward the motor, in the direction that the wear pattern is located on the tooth.
     b. Move the handle away from the face of the tooth.
   - Move the wear pattern to the left:
     a. Move the sheave side eccentric toward the motor, in the direction that the wear pattern is located on the tooth.
     b. Move the handle away from the face of the tooth.

4. After each adjustment, repeat the Gear Pattern Test procedure until the gear pattern is correct.

Note: Usually, once the wear patterns are in line with each other they will tend shift away from the center of the gear. See the "The Wear Pattern is in Line, But Shifted to One Side" on page 55, and complete the steps in this section.

5. Once the gear pattern is correct, proceed to the Backlash Adjustment section.

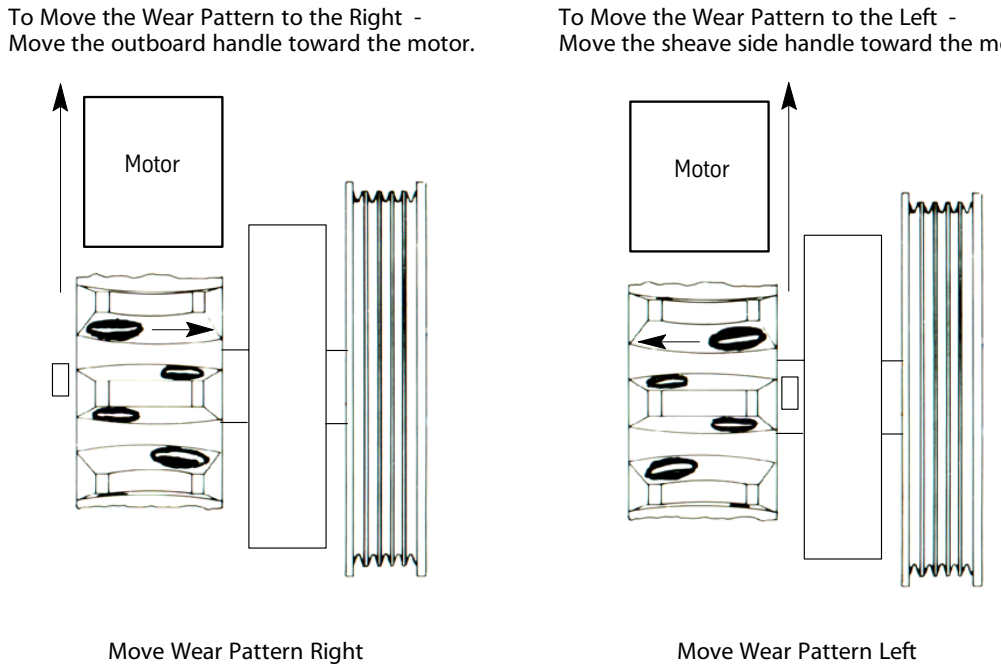


Figure 37 - Crossed Gear Wear Pattern

Backlash Adjustment

Requirements

- A verified, balanced load (with the car and counterweight) must be on the elevator via shackle-to-shackle, or with the hoist ropes removed from the drive sheave.
- The brakes must be installed and clamping the brake drum.
- There is a separate handle for each eccentric carrier. The handle on the sheave side eccentric carrier (attached to the bedplate), is also used for hoisting the machine. To attach the handle to the carrier, use the bolts and nuts that are attaching the handle to the bedplate.
- To raise or lower the worm, the two handles must be moved in the same direction and the same amount of distance.
- When the eccentric handles are between the 10 o'clock and the 11 o'clock position, the worm is at its lowest point (the maximum clearance between the ring and the worm gear).

1. Install one inspection cover bolt into the gear case, and attach a dial indicator to the cover bolt. See Figure 38.

Note: The brake shoes must be clamping the brake drum to prevent the worm shaft from moving. If the brake arms are not installed on the machine, the amount of end play must be subtracted from the TIP to determine the amount of backlash.

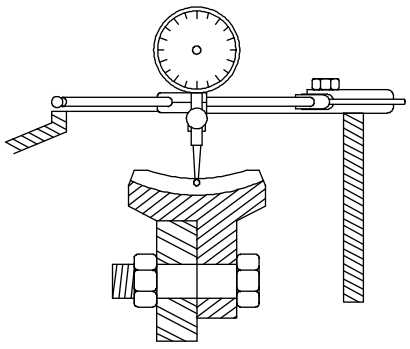


Figure 38 - Dial Indicator Measuring Backlash

2. Pull the drive sheave in one direction, and then zero the dial indicator.

3. Push the drive sheave in the opposite direction, and read the amount of gear movement.

Note: The displacement for a cold machine is .008"; a hot machine is .006".

4. Locate and note the stamped C's on the eccentric flange, and the position of the C's to each other.

Note: The position of the C's must be maintained (e.g., if the C on the sheave side is at the 2 o'clock position, and the C on the gear side is at the 1 o'clock position, any adjustments must maintain this one hour position difference). If not, the backlash cannot be adjusted.

5. Loosen the eccentric clips on the sheave side, the eccentric retaining ring on the gear side, and the anti-rotator bolt.

Note: The anti-rotator bolt must always be loosened when making gear adjustments (this allows the gear case/worm to move).

Backlash Adjustment
(continued)

6. Adjust the backlash:
   - To increase backlash, move the two C's up toward the12 o'clock position, no more than 1/2”.
   - To decrease backlash, move the C's away from the12 o'clock position, no more than 1/2”.
7. Tighten the eccentric clips on the sheave side.
8. Tighten the eccentric retaining ring and the anti-rotator bolt.
9. Check backlash with the dial indicator.
10. Repeat Steps 2 through 9 until the correct backlash is attained.
11. Check the Gear Pattern. See the “Gear Pattern Test” on page 54. If adjustment is required, see the “Gear Pattern Adjustment” on page 55.
12. Verify that the gear pattern wear matches the ideal gear pattern wear. See Figure 39.
    a. Remove the dial indicator.
    b. Install the inspection hole cover.
    c. Rope the machine.
    d. Test the car and machine for proper operation.
    e. Return the car to service.

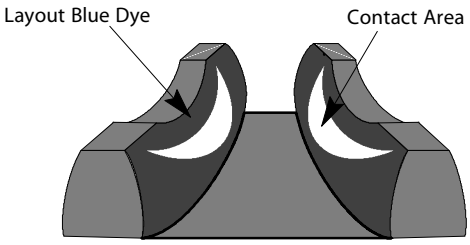


Figure 39 - Ideal Gear Pattern Wear

Sheave Replacement Procedure

Recommended Tools

- Necessary hoistway rigging to hang the car
- Necessary machine room rigging to lift the drive sheave
- Torque wrench
- 1/2”(24 mm) end wrench
- 1/2”(24 mm) drive socket
- 1/2”(24 mm) drive ratchet
- Breaker bar
- Spacer (1 3/4”section of 3“ pipe)
- Washer
- Hammer
- Heavy wall socket
- Starrett 196 or 196M dial indicator

Sheave Removal

1. Place the car on Inspection Operation.
2. Place the empty car at the top landing.
3. Turn OFF, Lock, and Tag out the mainline disconnect.
4. Trip the governor, and set the safety.
5. Tie the car off with chokers to secure the car at the top landing. Position the car to allow sufficient slack in the ropes for removal.
6. Remove the hoist ropes from the drive sheave.
7. Setup rigging in the machine room to support the drive sheave and use chokers to secure the sheave. See Figure 40.

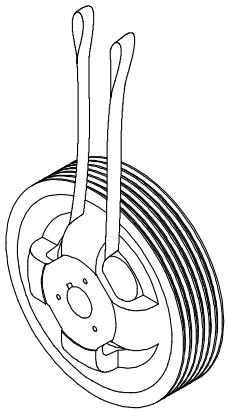


Figure 40 - Support the Drive Sheave

Sheave Removal
(continued)

CAUTION **Note the location of grease fittings to avoid breaking them when attaching the sling to the sheave.**

8. Remove the four (4) drive sheave carrier bolts. See Figure 41.

9. Remove the three (3) drive sheave retaining bolts, and remove the drive sheave retainer.

10. Place the spacer (1 3/4" section of 3" pipe or similar material) over the end of the output shaft.

11. Replace the drive sheave retainer - Use three (3) of the long drive sheave carrier bolts, and put these bolts through the outer set of holes that line up with the threaded holes in the sheave.

12. Equally tighten the three (3) bolts in the drive sheave retainer until all bolts are tight. Do not overtighten the bolts. Sharply strike the center of the retainer plate with a hammer. This action should produce slack in the bolts.

Note: The output shaft and sheave carrier are tapered. Once the sheave is moved a small amount, it can be removed by hand.

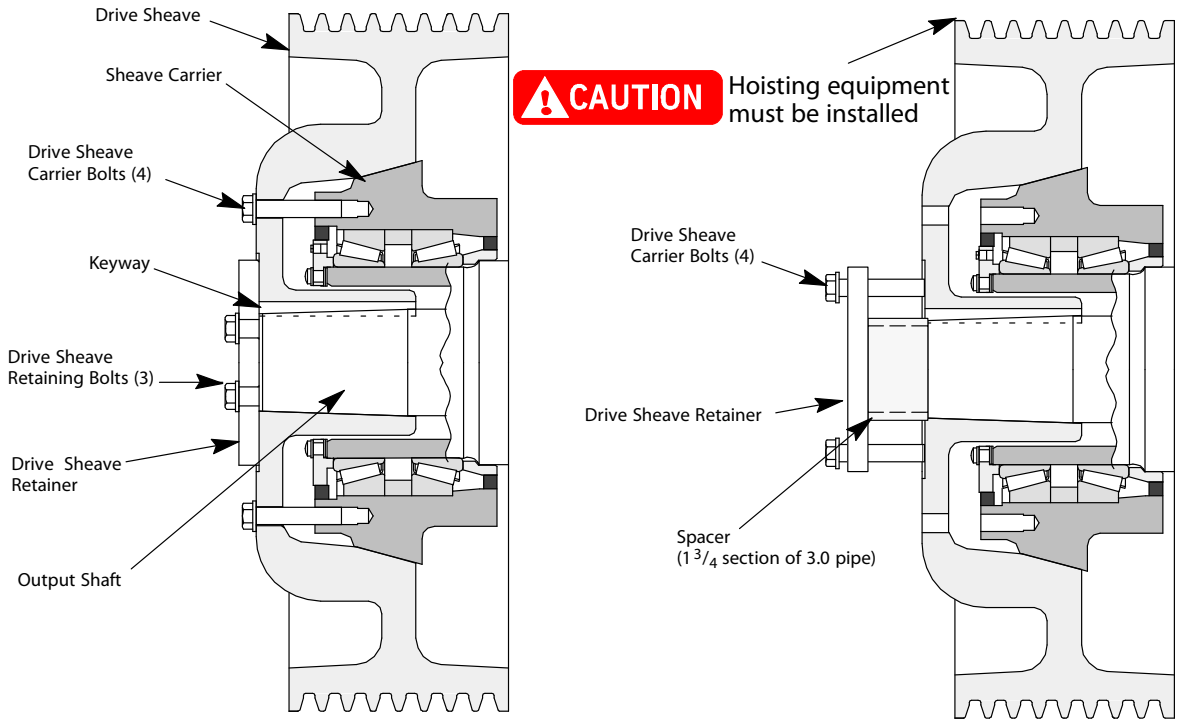


Figure 41 - Replace the Drive Sheave Retainer

Sheave Replacement Procedure
(continued)

Replacement Sheave Installation

1. Place the chokers on the replacement drive sheave in the same location as that of the removed drive sheave. Ensure that the replacement sheave keyway is also in the same position of the removed sheave. This will make it easier to line up the drive sheave and the output shaft keyways.

2. Hoist the replacement sheave into place.

3. Align the four (4) holes in the sheave carrier, and install the four (4) drive sheave carrier bolts until snug.

4. Align the drive sheave and output shaft keyways, and insert the key.

5. Replace the drive sheave retainer plate, aligning the three (3) inner holes with those in the output shaft.

6. Insert, thread, and hand tighten the three (3) drive sheave retaining bolts. Do not torque these bolts at this time.

Measure and Adjust the Weave of the Drive Sheave

1. Clean the rope groove of the drive sheave (this groove will be used as a indicator surface).

2. Attach a dial indicator to the bedplate, under the drive sheave, between the 5 o'clock and the 6 o'clock position. Set the indicator to measure the side of the cleaned rope groove. See Figure 42.

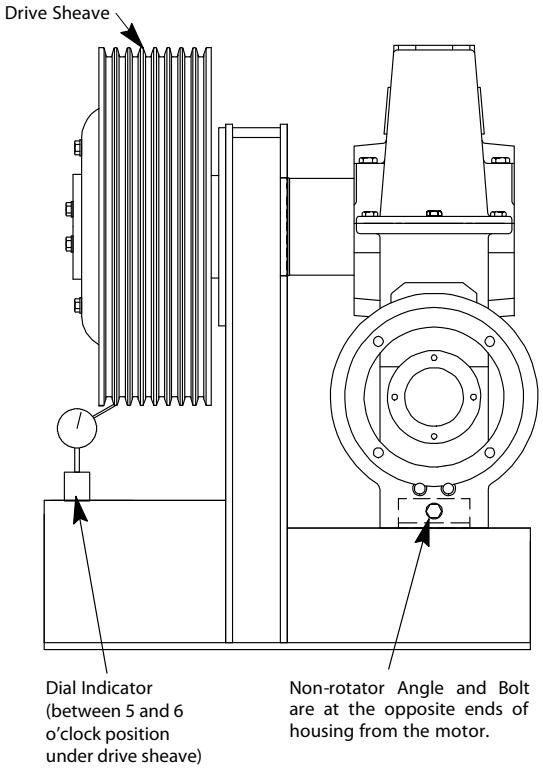


Figure 42 - Dial Indicator to the Bedplate

Measure and Adjust the Weave of the Drive Sheave

(continued)

3. Number the four (4) drive sheave carrier bolts, and make four (4) marks on the outer edge of the drive sheave corresponding to the bolts. See Figure 43.

4. Tighten the drive sheave carrier bolts.

   a. Use the torque wrench and an "X" pattern, and tighten the carrier bolts to 50 lb-ft (e.g., 1,3,4,2).

   b. Continue tightening the carrier bolts, adding 5 lb-ft each time, until 70 lb-ft is achieved. Do not exceed 70 lb-ft.

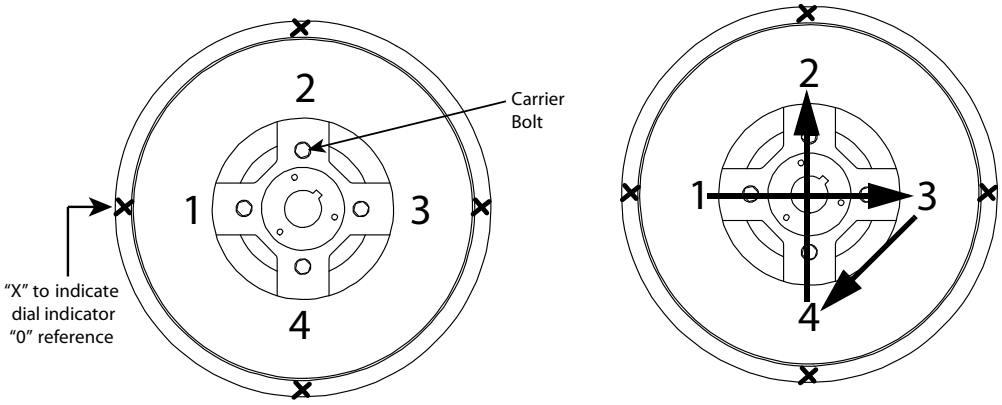


Figure 43 - Number and Tighten the Sheave Carrier Bolts

5. Rotate the drive sheave until the outer edge mark corresponding to the #1 carrier bolt is aligned to the probe of the dial indicator. Set the dial indicator to zero (0), and this will become the reference point for adjusting the weave of the drive sheave.

6. With the dial indicator, check for TIR of ±.005" by rotating the drive sheave clockwise one (1) complete revolution. Stop the rotation of the sheave.

7. Record each measurement of each number when the number on the sheave is even with the dial indicator. Use the table below to record your readings.

Sheave Readings									
Bolt Number	1								
	2								
	3								
	4								

8. For all readings with negative values, the weave must be drawn outward, away from the machine.

   a. Loosen the bolts with the negative values. The torque on the opposite bolts will fall off.

   b. Re-torque the positive number bolts to 70 lb-ft., and then re-torque the bolts that had negative readings.

   c. Repeat Step 3, 4, and 5 until TIR of ±.005" is obtained.

Sheave Replacement Procedure
(continued)

9. Reinstall the sheave retainer and bolts, and torque the bolts. See Table 3.

Note: Do not over torque the bolts.

Sheaves shipped prior to July 1, 2001		
Size	**Print number**	**Torque**
26”	750CE1-5	75 ft/lbs
32”	750CD1-5	75 ft/lbs
36”	750CH1-5	75 ft/lbs
Sheaves shipped July 1, 2001 or later		
Size	**Print number**	**Torque**
26”	750CW1-5	100 ft/lbs
32”	750CD6-10	100 ft/lbs
36”	750CH6-10	100 ft/lbs
Notes: • Always loosen the anti-rotator bolt when adjusting the retainer bolt torque. • Retighten the anti-rotator bolt to 175 ft/lbs when finished.		

Table 3 - Brake Torque

Final Adjustments

1. Replace the sheave retainer, and torque the drive sheave retainer bolts to 100 lb-ft.
2. Replace the ropes.
3. Once the drive sheave has been properly aligned, check the ropes for proper tension.
4. Remove the chokers securing the car.
5. Release the safety and the governor.
6. Turn ON the mainline disconnect
7. Place the car on Inspection Operation.
8. With the weight now on the drive sheave, run the car down a few landings and then back up.
9. Repeat the original weave measurements to ensure the weave of the drive sheave has not changed.

Note: If the weave of the drive sheave has drifted out of TIR of ±.005”, continue the adjustments until TIR of ±.003” is achieved.

10. Lightly pry at the 5 o'clock position and the 8 o'clock positions of the drive sheave, and re-torque the bolts.

Note: With the weight now on the drive sheave, adjustments to the drive sheave will be easier. Prior to loosening the torque, rotate the negative values of the drive sheave to the 12 o'clock position. The counterweight and the car weight will assist in the movement and adjustment of the drive sheave.

WARNING **Do not loosen or remove the sheave retainer bolts during this adjustment.**

11. Cycle the elevator with the doors disconnected to ensure proper operation.
12. Return the car to service.

Service Information

Gear Replacement

Required Tools	
Qty.	**Description**
	Layout blueing
	Starrett 196 or 196M dial indicator (or equivalent with single tree)
	Test weights
	Hoisting equipment
	Frame with a top beam (to have 21" of gear case travel)
	Rigging equipment
	Set of feeler gauges
	Welding gloves
	Bearing heater (optional) for a 4 1/2" (114.3 mm) diameter shaft
1	1/2” section 3" OD pipe
2	24" tall or greater stands
1	5 lb. hammer
1	2-ton beam trolley
1	1/2-ton hoist
1	Tape measure
2	Drift pins
1	Scribe
1	1/4” or 3/8” torque wrench in/lbs up to 200 ft/lbs
1	1/2" drive torque wrench
1	1/2"drive ratchet
1	1/2" drive breaker bar
1 ea.	1/2" drive point socket 30 mm, 24 mm, 19 mm, 14 mm
1	1/2" drive 1 1/8” point socket
1 ea.	20 mm, 10 mm wrench
1	19 mm open end wrench
1 ea.	30 mm, 24 mm, 13 mm box end wrench
1	1" combination wrench
1	3/4" hand reamer
3	4" x 4" x 20" blocks of wood
1	Oxyacetylene rig
1	Putty knife
1 ea.	M22, M20, M12 die
1	Single-edge razor blade
1	Fire extinguisher
1 ea.	8 mm, 6 mm hex wrench
1	1" (25.4 mm) pipe, 5' (1524 mm) long
1	3/4" chisel
	Grinder with 4" wheel

Secure the Car

1. Run the empty car to the top floor.
2. Place the car on Inspection Operation.
3. Turn OFF, Lock, and Tag out the mainline disconnect.
4. Land the counterweight on their buffers by slowly drifting the empty car in the up direction.

Brake Removal

1. Install hoisting and rigging over the brakes.
2. Measure and record the brake spring length, from between the spring's flat to flat. See Figure 44 on page 66 for the remaining steps in this procedure.
3. Disconnect and label the brake coil and brake switch leads.
4. Remove the flex conduit from the junction box.
5. Install (in a choker configuration) a nylon sling around the brake coil.
6. Remove the brake spring adjustment's M16 nut, washer, spring, and bolt.
7. Measure and record, for each brake arm, the length of the brake stop adjustment bolt that extends past the stop adjustment locknut.
8. Remove all of the M16 brake stop adjustment nuts and locking nuts from the brake stop adjustment bolt.
9. Hoist the brake arm with the coil until slight pressure is applied to the rigging.

CAUTION **If the brake fulcrum pin retainer is not present, order one from the Warranty Department.**

10. From the brake fulcrum pin retainer, remove two (2) M6 flange screws and two (2) set screws, and then remove the retainer.
11. Install an M6 bolt into the end of the brake arm pivot pin.
12. Remove the brake arm pivot pin's retaining screw, and pry on the M6 bolt (installed in the previous step) to remove the pivot pin.
13. Hoist and remove the brake arm, and move it away from the machine.
14. Remove the M6 bolt from the brake arm pivot pin, and install it into the other brake arm pivot pin on the machine.
15. Use the M6 bolt, and pry out the pivot pin.

Note: This brake arm is not heavy enough to require rigging, and can be removed by hand.

16. Hoist and remove the brake arm, and move it away from the machine.

Brake Removal
(continued)

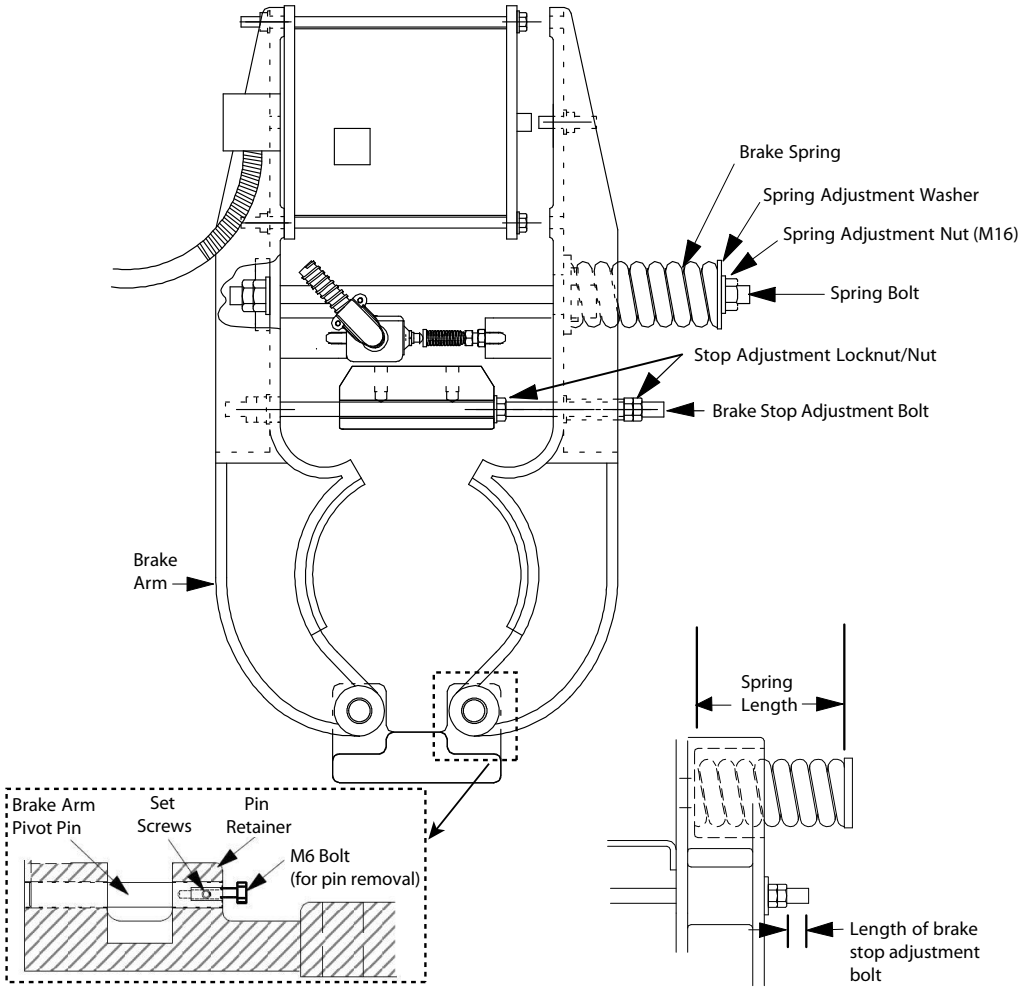


Figure 44 - Brake Assembly

Motor Removal

1. Install a 1/2-ton hoist and rigging over the motor.

Note: The motor and encoder wiring may not have to be removed if there is enough slack to allow the motor to rest on the bedplate.

2. Loosen the flex conduit for the motor and encoder wiring.

3. Hoist the motor until pressure is applied to the rigging.

4. Remove the eight (8) 5/8” nuts and washers from the brake pulley shoulder bolts. See Figure 45 on page 67.

5. Remove the brake pulley shoulder bolts and the rubber cushions.

6. Remove the four (4) 5/8” bolts, lockwashers, and flat washers that secure the motor to the gear case.

Motor Removal
(continued)

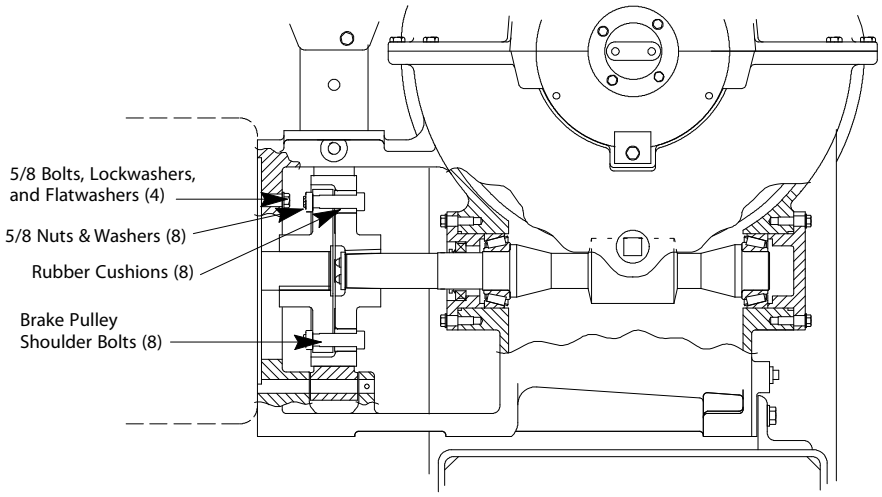


Figure 45 - Brake Coupling to Motor

7. Slide the motor away from the gear case.

8. Place two (2) 4" x 4" x 20" blocks on the bedplate, below the motor.

9. Lower the motor onto the two (2) 4"x 4"x 20" blocks until the motor is resting on the bedplate. See Figure 46.

Note: Leave the rigging secured to the motor until reinstalling the motor on the machine.

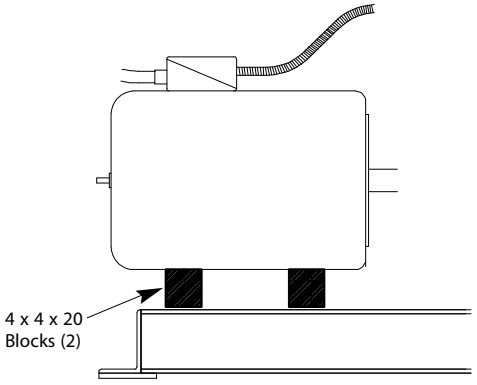


Figure 46 - Motor on Bedplate (resting on blocks)

Output Shaft Removal

WARNING

The car does not have to be hung to remove the gear case. Do not loosen the four (4) outer bolts of the drive sheave. If these bolts are removed, the sheave could fall from the sheave bearing carrier.

Note: When installing new gears, the car should be hoisted, and the ropes removed. Setting the gear pattern and gear clearances will be easier with the hoist ropes removed from the drive sheave.

1. Use approved rigging of adequate strength to secure the car to the overhead beams. See the strength charts in the *Elevator Employees' Safety Handbook*.

2. Activate the back-up system.

   a. Manually trip the overspeed governor jaws.

   b. Before the hoist ropes are removed from the drive sheave, set the car on the safeties.

3. Drain the gear case oil into a clean bucket, and cover the bucket.

4. Mark a matching line from the single bearing eccentric to the gear case. See Figure 47.

5. Mark a matching line along the top of the dual bearing eccentric, across the gland ring, and onto the gear case. See Figure 47.

Note: These lines will provide a good starting point to adjust a new gear, or to place the original gear back into the original position.

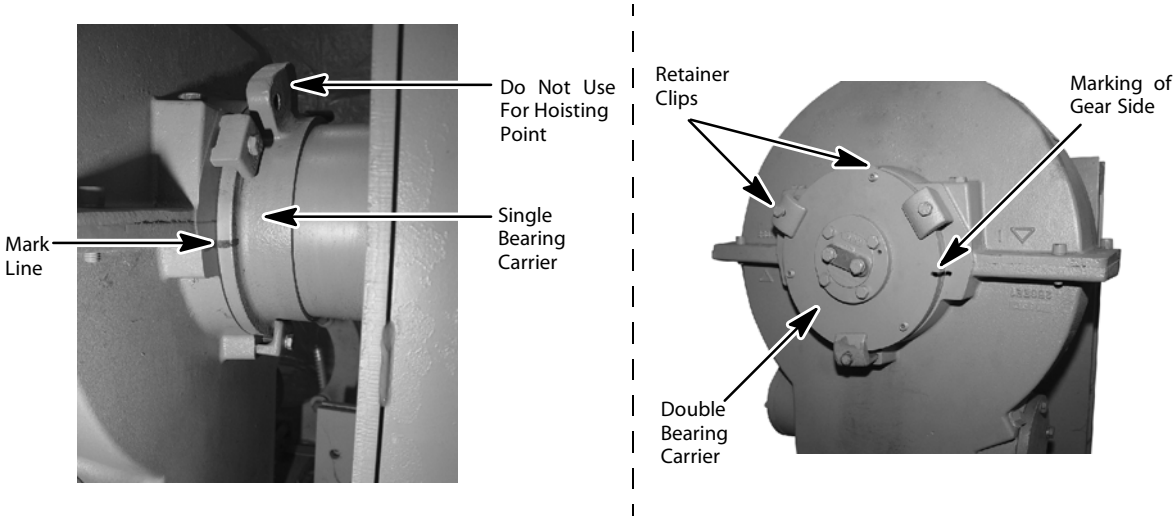


Figure 47 - Single (left) and Dual (right) Bearing Eccentric Marking

Output Shaft Removal
(continued)

6. Install hoisting and rigging over the gear case. SeeFigure 48.

Note: The gear case must be able to move 21" away from the drive sheave in order to clear the bedplate.

Figure 48 - Gear Case with Hoisting and Rigging

7. Remove the three (3) center M16 screws, and then remove the sheave retainer plate. See Figure 49.

WARNING **Do not loosen the four (4) outer bolts of the drive sheave. The sheave could fall from the sheave-bearing carrier if these bolts are removed.**

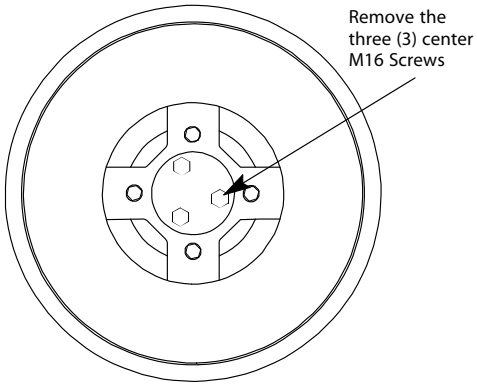


Figure 49 - M16 Screws

8. Install a 2-ton hoist over the machine.

9. Install a large nut, a stack of washers, or a 1/2” section of 3" OD pipe (as a spacer) on the end of the output shaft.

Output Shaft Removal
(continued)

Reinstall the Sheave Retainer Plate

1. Use the M16 screws to reinstall the sheave retainer plate in the outer hole locations.
2. Tighten the screws until the retainer plate holds the spacer in the center of the output shaft.
3. Hoist the gear case until pressure is applied to the rigging.
4. Remove the non-rotator bolt that connects the gear case to the bedplate.
5. Equally tighten the three-sheave retainer plate screws until all are tight.
6. Strike the center of the sheave retainer plate with a 5 lb. hammer.
7. Repeat Steps 3 and 4 until the output shaft is free from the drive sheave.
8. Place a pry bar under the bottom of the gear case, and gently rock the machine up and down.
9. Move the gear case away from the drive sheave.

Note: To aid in removing the gear case, a 2" x 4" wood block can be used to pry against the bedplate pedestal and the single bearing eccentric.

WARNING **To prevent dropping the machine, the rigging must be secure to the gear case so that the rigging will not move during machine removal.**

10. When the output shaft is clear of the torque tube and bedplate, lower the output shaft to the floor.

Lift the Gear Case Top

1. Remove the rigging from the gear case, and clear a working space around the machine.
2. Remove the M12 screws, washers, and clips from both eccentrics.
3. Remove the six (6) M12 and four (4) M16 bolts from the top of the gear case. See Figure 50.

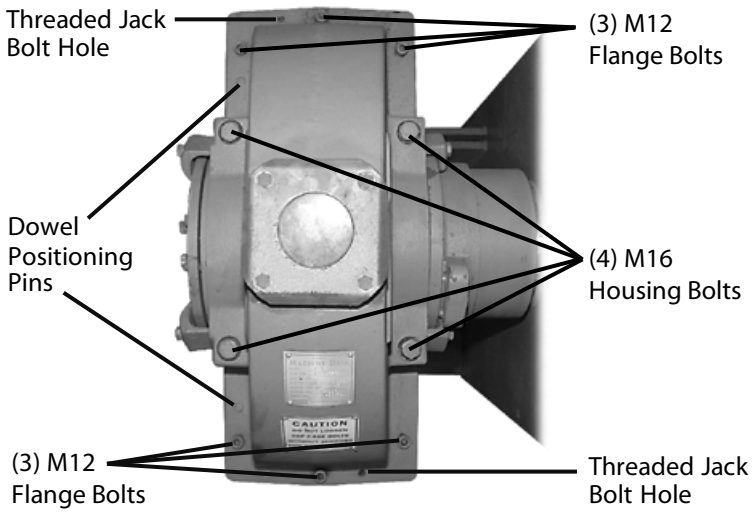


Figure 50 - Top View of Gear Case

Lift the Gear Case Top
(continued)

4. Remove two (2) screws located diagonally across the top of the gear case, and replace them with two (2) eye bolts. See Figure 51.

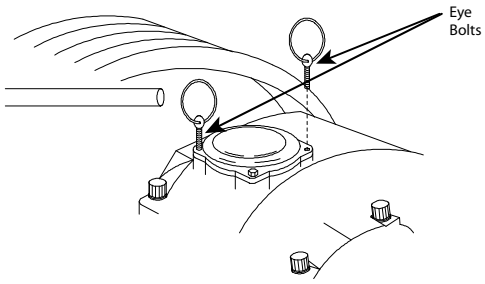


Figure 51 - Eye Bolts in Top Gear Housing

5. Alternately tighten the two (2) M12 bolts until the top gear case is free of the two dowel positioning pins.
6. Remove the top housing.
7. Remove the single bearing carrier eccentric.
8. Place hoisting and rigging material over the bottom housing.
9. Install one nylon sling (in a choke or basket configuration) around the output shaft, between the dual bearing eccentric and the spider assembly.
10. Install another sling on the output shaft side of the spider assembly.

Ring Gear Replacement

1. Place two stands approximately 12" apart in an area of the machine room with enough clearance to work with the output shaft and ring gear.
2. Hoist the output shaft assembly from the bottom housing, and then lower onto 24" stands.
3. Place some protective material between the bronze ring gear and the stands.
4. With the assembly resting on the stands, remove the output shaft sling, and set the sheave side of the output shaft pointing down. See Figure 52.

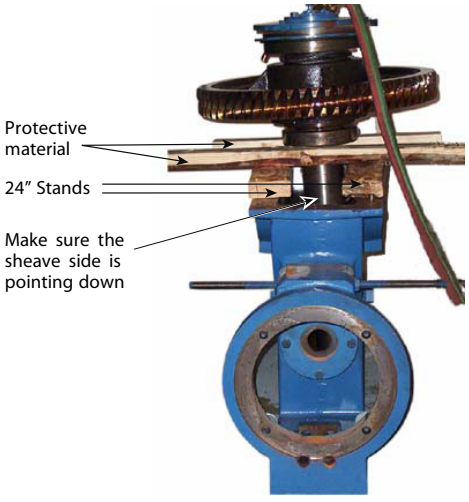


Figure 52 - Output Shaft on Work Stands

Ring Gear Replacement

(continued)

5. Remove the six (6) 3/4" nuts, washers, and bolts that secure the ring gear to the gear flange. Note the position of the ring gear bolts, washers, and nuts because the new material is to be installed in the same position.

6. Contact the building engineer to turn off the machine room smoke detectors.

7. With a gloved hand, gently warm the gear with a torch until the gear can be lifted off the gear flange.

8. Check the mating surfaces of the new gear and the gear flange for any debris that may hinder a flush fit.

9. With a gloved hand, set the new gear with the mating side down on the gear flange. Gently warm the new gear until it drops onto the gear flange.

10. Once the gear is sitting flush, align the holes to match the gear flange (drift pins or an existing bolt can be used for alignment).

11. Allow the gear to cool completely. While the gear is cooling, remove all the old silicone and Loctite from all of the machine bolts and sealing surfaces.

12. When the gear has cooled completely, hand-ream the holes from the flange side up.

13. Insert and tighten the bolts, washers, and nylon insert lock nuts.

Note: It may be necessary to use the lock nut to pull the bolt through; turn the lock nut until the bolt head is flat on the gear surface. Do not hammer the bolts.

14. Torque the lock nuts to 80 ft/lb.

O-rings and Seal Replacement

1. Remove the old O-ring from behind the dual bearing eccentric. Use sandpaper or emery cloth to clean the dual bearing eccentric and gland ring of any sharp edges or burrs that may damage the new O-ring.

2. Add a light coating of grease to the O-ring groove in the housing. Submerge the new O-ring in oil, and stretch it over and around the dual bearing eccentric and gland ring.

3. Remove the O-ring from the single bearing eccentric carrier. Use sandpaper or emery cloth to clean the single bearing eccentric carrier of any sharp edges or burrs that may damage the new O-ring.

4. Add a light coating of grease to the O-ring groove in the housing. Submerge the new O-ring in oil, and install it on the carrier.

5. The GD-2 Machine has two styles of single bearing eccentric seals. If the machine was shipped prior to 02/01/03, and if there has been an excessive oil leak around the pedestal or sheave area, verify that Field Bulletin 04_04_02 Spider Leak.doc has been performed.

O-rings and Seal Replacement
(continued)

6. Determine the machine manufacturing date, and perform the following applicable procedure.

- Machines Manufactured Before 02/01/03 - A V-ring was mounted on the gear flange assembly. See Figure 53, and complete the following steps:

  a. Remove the V-ring seal from the gear flange assembly (the V-ring is located just behind the output shaft ball bearing).

  b. Remove any burrs or debris from the gear flange where the V-ring will be located. Remove debris from inside the surface of the single bearing eccentric carrier where the V-ring lip will be located.

  c. Apply a light film of grease on the lip of the V-ring and install the new V-ring (stretch the seal over the output shaft ball bearing and seat it on the gear flange).

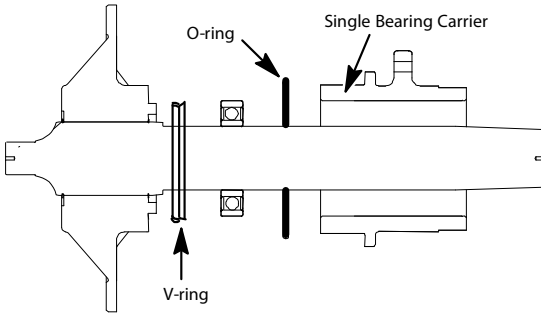


Figure 53 - Output Shaft with O-ring and Seal (machines manufactured before 02/01/03)

- Machines Manufactured After 02/01/03: An output shaft seal is mounted inside the eccentric. See Figure 54, and complete the following steps:

  a. Set the eccentric carrier assembly, with the flange that sits against the machine housing, down on two (2) 2"x 4" blocks.

  b. Place a 6" OD PVC pipe (approximately 10" long) into the eccentric carrier.

  c. Place a 2" x 4" x 8" block across the top of the PVC pipe, and strike it with a hammer to remove the old output shaft seal.

  d. Measure with a caliper, and scribe two marks 6.226"on the OD of the PVC pipe from the square end, 180° apart.

  e. Lubricate the edge of the seal with a light coating of grease, and place the seal with the sealing lip down.

  f. Lightly tap the new seal until it is 6.226" from the edge of the eccentric carrier.

  Note: The two marks on the PVC pipe should be flush with the top of the eccentric carrier.

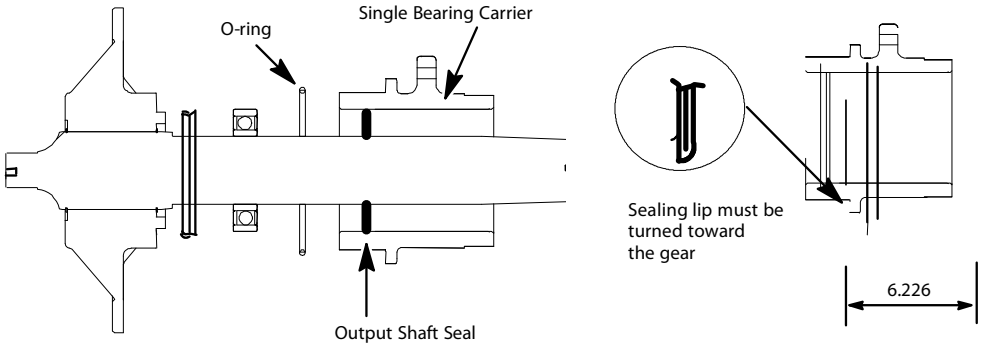


Figure 54 - Output Shaft with O-ring and Seal (machines manufactured after 02/01/03)

Bearing Replacement

Output Shaft Bearing, Sheave Side

1. Replace the single ball bearing on the sheave side of the output shaft.
2. Cover the dual bearing eccentric.
3. Cut the existing ball bearing, cup, and cage, with a grinder.

CAUTION **Do not touch the gear flange, ring gear, or output shaft with the grinding wheel.**

4. Cut into the cone until 1/16” of material remains before contact with the output shaft.
5. Place the blade of a chisel into the cut, strike it with a hammer, and repeat until the cone splits at the cut.
6. Remove the cone, and clean the output shaft of any debris or burrs.
7. Place the bearing in or on the bearing heater, and heat the bearing to about 250° F (121° C), but no greater than 300° F (150° C).
8. With a gloved hand, quickly slide the heated bearing fully onto the output shaft.
9. Hold the bearing against the shoulder of the output shaft until it seizes to the shaft.

Dual Bearing Eccentric

For bearing replacement, manufacturing recommends that the output shaft assembly be taken to a machine shop that has the necessary equipment to remove and replace the bearings.

Removing the Dual Bearing Eccentric in the Machine Room

1. Remove the four (4) M10 screws from the dual bearing gland ring.
2. Remove the gland ring and the outer bearing cup.
3. Remove the dual bearing eccentric with the 3-arm gear puller or a port-a-power. See Figure 55.
   a. Gently heat the outboard bearing to no greater than 250° F to help remove two (2) of the bearings.
   b. Apply force to the puller or port-a-power until the dual bearing eccentric is free of the output shaft.

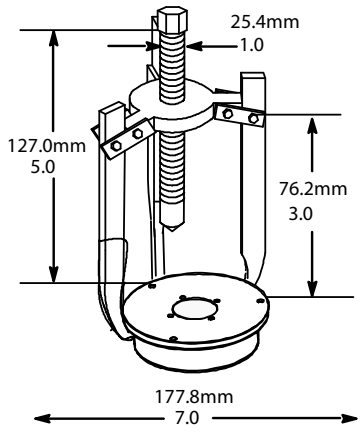


Figure 55 - 3-Arm Puller Dimensions

Dual Bearing Eccentric
(continued)

4. With the new O-ring and the interior bearing race installed, set the dual bearing eccentric back into place.

5. Insert the interior dual bearing cup into the dual bearing eccentric carrier in the correct order.

CAUTION

Before placing the heated bearing case on the shaft, the interior bearing cup must be in the dual bearing eccentric carrier.

6. Position the dual bearing eccentric as far down as possible to provide clearance for mounting the bearing cones onto the output shaft.

7. Place both dual bearing cones in or on the bearing heater, and heat the bearing to about 250° F (121° C), but no greater than 300°F (150°C).

8. With a gloved hand, quickly slide the heated dual bearings fully onto the output shaft. Ensure that the bearing is installed correctly. See Figure 56.

CAUTION

To avoid unnecessary labor, recheck the installation of the bearings. The bearings can be installed backwards.

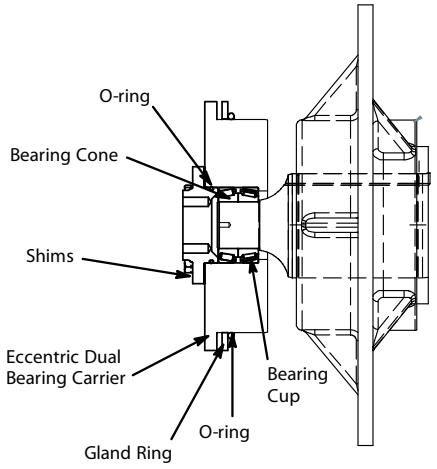


Figure 56 - Dual Bearing Eccentric

9. Hold the cones against the shoulder of the output shaft until they seize to the shaft.

10. Allow the bearings to cool completely.

11. Install the outboard cup into the dual bearing eccentric carrier.

12. Insert the bearing gland (without its O-ring or shims), and install the four (4) bolts finger-tight.

13. While rotating the dual bearing eccentric on the output shaft, torque each bolt to 30 in/lbs.

Dual Bearing Eccentric
(continued)

14. With a feeler gauge, measure the gap adjacent to each bolt and average the readings. See Figure 57.

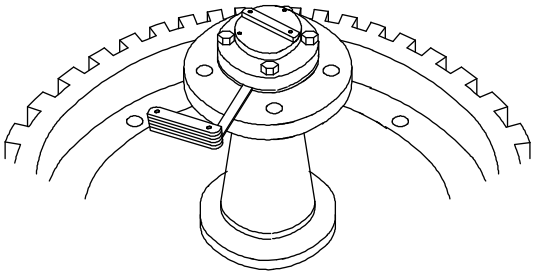


Figure 57 - Feeler Gauge on Dual Bearing Gland

15. Remove the bearing gland, put on a shim pack (the thickness of the average gap plus .007" .18mm), and install the new O-ring on the bearing gland.

16. While turning the bearing gland, place it back into position and evenly torque the bolts to 13 ft/lbs.

Worm Gear Bearing Replacement

1. Run the empty car to the top floor.

2. Place the car on Inspection Operation.

3. Turn OFF, Lock, and Tag out the mainline disconnect.

4. Land the counterweight on their buffers by slowly drifting the empty car upward.

Notes:

- The car does not have to be hung to remove the gear case.
- The worm shaft bearings can be replaced in a GD-2 Machine without removing the output shaft assembly.
- The motor must be removed in order to access the brake pulley retainer.

WARNING **Do not loosen the four (4) outer bolts of the drive sheave. If these bolts are removed, the sheave could fall from the sheave-bearing carrier.**

5. Remove the following items:
    - The brake pulley retainer
    - The brake pulley
    - The seal
    - The thrust carriers

6. Take the worm out of the rear of the machine.

Worm Gear Bearing Replacement
(continued)

7. Remove the three (3) M10 hex button head screws and the brake retainer plate. See Figure 58.

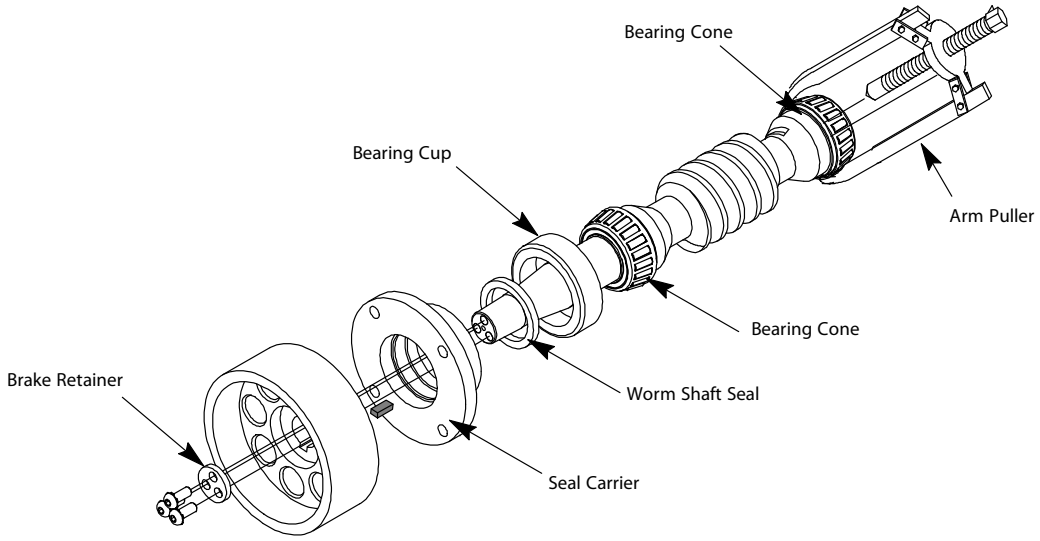


Figure 58 - Arm Puller on Worm Shaft

8. Place a block of wood on the machine side of the brake pulley, and hit the wood with a hammer.
9. Slightly rotate the worm shaft after each strike of the hammer, until the brake pulley is free from the worm shaft.
10. To prevent cutting of the worm shaft seal, place tape over the worm shaft keyway.
11. Remove the M12 bolts from the shaft seal carrier and the worm shaft-bearing carrier.
12. Remove the worm shaft-bearing carrier from the machine housing.
13. To force the cup out of the housing, place a hand over the thrust bearing cup and rotate the worm shaft.
14. Remove the worm shaft seal carrier.
15. Remove the worm shaft from the machine.
16. Install a bearing puller on the thrust bearing, and remove the bearing.
17. Cut the front worm shaft bearing cage with a small grinder, and remove the cage and the roller from the bearing cone.
18. Cut into the cone until 1/16” of material remains before contact with the shaft.
19. Place a 3/4” chisel into the cut, and strike the chisel with a hammer until the cone splits.

CAUTION **Do not let the chisel contact the worm shaft.**

20. Place new bearings in the heater, and heat the bearings to 250° F (121° C), but no greater than 300° F (150°).

Worm Gear Bearing Replacement

(continued)

21. Verify the correct installation order, and with a gloved hand, quickly slide the heat bearings onto the worm shaft. Hold the bearings against the shoulder of the worm shaft until they seize to the shaft.

CAUTION **To avoid unnecessary labor, recheck the installation of the bearings. The bearings can be installed backwards.**

22. Install a new seal (if required) into the worm shaft seal carrier, and install the carrier on the machine.

23. When reinstalling the worm shaft, lightly lubricate it to prevent damage to the seal, and then place tape over the worm shaft keyway.

24. Place the interior-bearing cup on the bearing, and place the worm shaft into the machine.

25. Remove the tape that was placed over the worm shaft keyway.

26. Place the thrust bearing cup onto the thrust bearing, and reinstall the bearing cap.

27. Tighten the thrust bearing carrier bolts to 15 ft/lbs.

28. Measure the clearance in three (3) locations between the inside of the carrier and the casing.
    a. Make a note of each clearance.
    b. Average the three (3) clearance measurements, and add .002" to the averaged clearance.
    c. Remove the thrust bearing cap, and install the amount of calculated shims.

    Example:

    Average Clearance + .002” = Total shims required

    .030” + .002” = .032” (Total shims required)

29. While turning the worm shaft back and forth, replace the thrust bearing cap, and tighten the bolts to 30 ft/lb.

30. Place the brake drum on the worm shaft, and install the brake pulley retainer, the external tooth lock washers, and the M10 button head screws.

31. Torque the button head screws in a circular pattern to175 in. lb., until all screws maintain this torque.

32. Install a dial indicator on the brake hub. See Figure 59.

Note: To measure the end play, a verified, balance load must be on the elevator with the car and counterweight shackle to shackle, or the hoist ropes removed from the drive sheave.

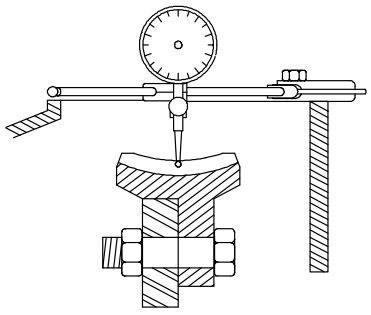


Figure 59 - Dial Indicator to Measure Backlash

Replace the Output Shaft

1. From the dual bearing eccentric flange, turn the hex set screws counterclockwise. Count and record the number of turns (to be used later) until the screws are flush with the flange.

2. Slide the O-ring and gland ring to the dual bearing eccentric flange.

3. Set the output shaft back down into the housing.

Note: While turning the worm shaft back and forth, the O-ring should be slightly out of the O-ring groove in the machine housing.

4. Remove the lifting choker used to lift the shaft.

5. Ensure that grease has been added to the O-ring groove in the machine housing, and that the O-rings have been oiled.

6. Smooth silicone sealer on the flange surface of the gear case.

Note: Do not put silicone sealer on any surface that will come in contact with either bearing eccentric.

7. Set the C stamp (in the flange of the eccentric) to the 12 o'clock position, with the handles between the 10 o'clock and the 11 o'clock position.

Note: The top of the gear case (toward the motor) is clockwise. The top of the case will be the 12 o'clock position.

8. To ensure backlash is present, rock the gear.

9. Carefully set the gear case cover on top of the gear case (do not damage the O-rings), and align the dowel pins back into place.

Notes:

- If the original ring gear and spider shaft are being reinstalled in the machine, set the eccentrics marks to match the machine marks.
- Before tightening the mounting bolts, make sure that there is some space between the worm shaft and the ring gear. The worm gear is at its lowest point (maximum gear clearance), when the eccentric handles are between the 10 o'clock and the 11 o'clock position.

10. Inspect the position of both O-rings, and move them away from the machine housing.

11. Tighten the top case mounting bolts until both case flanges just touch.

12. Push both eccentric O-rings into their grooves on the gear case.

13. Push the single and dual bearing eccentric carriers until their flanges are against the gear case.

14. Install and lightly tighten the sheave side single bearing eccentric cast clips and bolts as well as the dual bearing eccentric bolts.

15. Turn the hex set screws clockwise the number of turns recorded in Step 1.

Replace the Output Shaft
(continued)

16. Turn the worm shaft to ensure that the worm and ring gears are not restrained.

    a. If the worm gear does not turn easily, loosen the gear case flange bolts and retainer clips. Repeat this action until the worm turns easily.

    b. Retighten the flange bolts, and ensure that the worm turns easily.

    c. If the worm gear is still restrained, remove the gear case top and check the clearance.

    d. If the worm gear is still connected with the worm shaft, move the eccentrics.

17. Tighten the top case mounting bolts to the specified torques. See Figure 60.

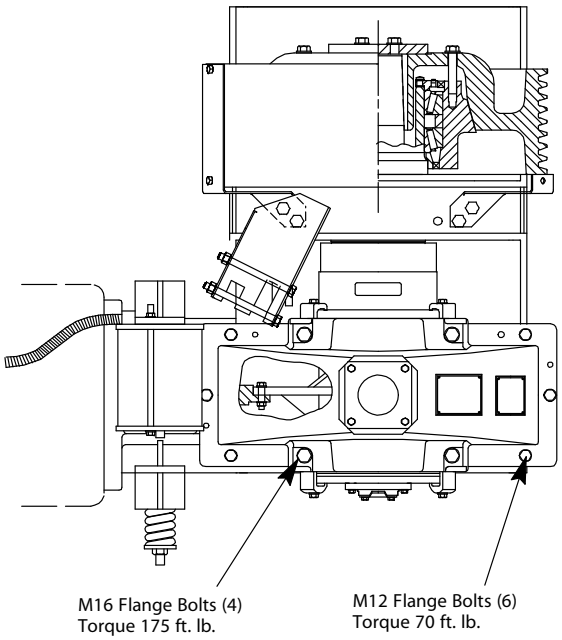


Figure 60 - Torques for Top Case Mounting Bolts

18. Adjust both eccentric handles until the marks on the eccentric and the marks on the gear case are aligned.

19. Rotate the worm shaft to ensure there is no binding. Adjust the handles if the worm does not move easily.

20. Tighten the retainer clips.

Installing the Gear Case on the Bedplate

1. Install hoisting and rigging materials over the gear case and bedplate.
2. Attach rigging to the machine so that it will sit almost level.
3. Hoist the machine, and slide toward the pedestal until the output shaft is in the torque tube (but not engaging the drive sheave).
4. Align the drive sheave and the output keyways.
5. Slide the gear case until the output shaft is stopped by the drive sheave.
6. Install the key in the keyway. See Figure 61.

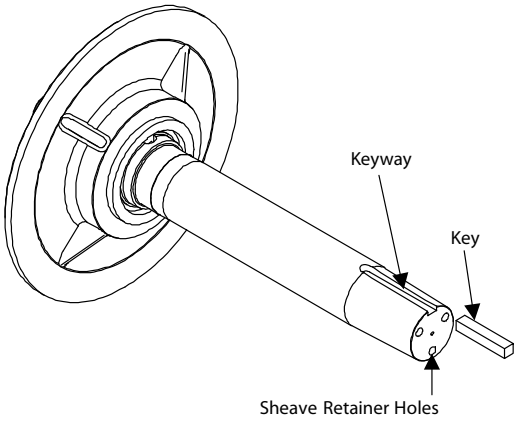


Figure 61 - Output Shaft Keyway

7. Install the drive sheave retainer and the three drive sheave retainer bolts, in the center three holes.
8. Alternately tighten the drive sheave retainer bolts until 100 ft/lb. is maintained.
9. Install the non-rotator bolt (to anchor the machine to the bedplate), and torque to 120 ft/lb.
10. Remove the rigging from the machine.

Brake Installation

1. Remove the worm shaft seal protective tape from the brake pulley keyway.
2. Install the key into the keyway.
3. Place the brake pulley retainer, locking washers, and button head screws onto the end of the worm shaft, and torque the button screws to 175 in/lbs.
4. Continue to torque the button screws until they maintain 175 in/lbs.
5. Reinstall the brake components in the reverse order of the installation.

CAUTION **The brake spring must be compressed to the previous used value.**

Motor Installation

1. Hoist the motor, reinstall, and tighten the four (4) 5/8" flat, lock washers, and screws.
2. Rotate the armature coupling until the keyway is approximately 180° from the brake pulley keyway.
3. Rewire the motor and encoder (if removed).
4. Use cushions, eternal tooth lock washers, and nuts to install the eight (8) brake pulley shoulder bolts.
5. Adjust the gears. See “End Thrust Test and Adjustment” on page 53.
6. Verify the motor parameters. See the *TAC50-xx Controller* manual (or other mfg. for all non-Vertical Express Controllers).

- MFC
- MSF or RSF
- KVI
- KFP
- MTP or number of motor poles
- LPF
- NCF
- Auto Tune TAC 50-xx

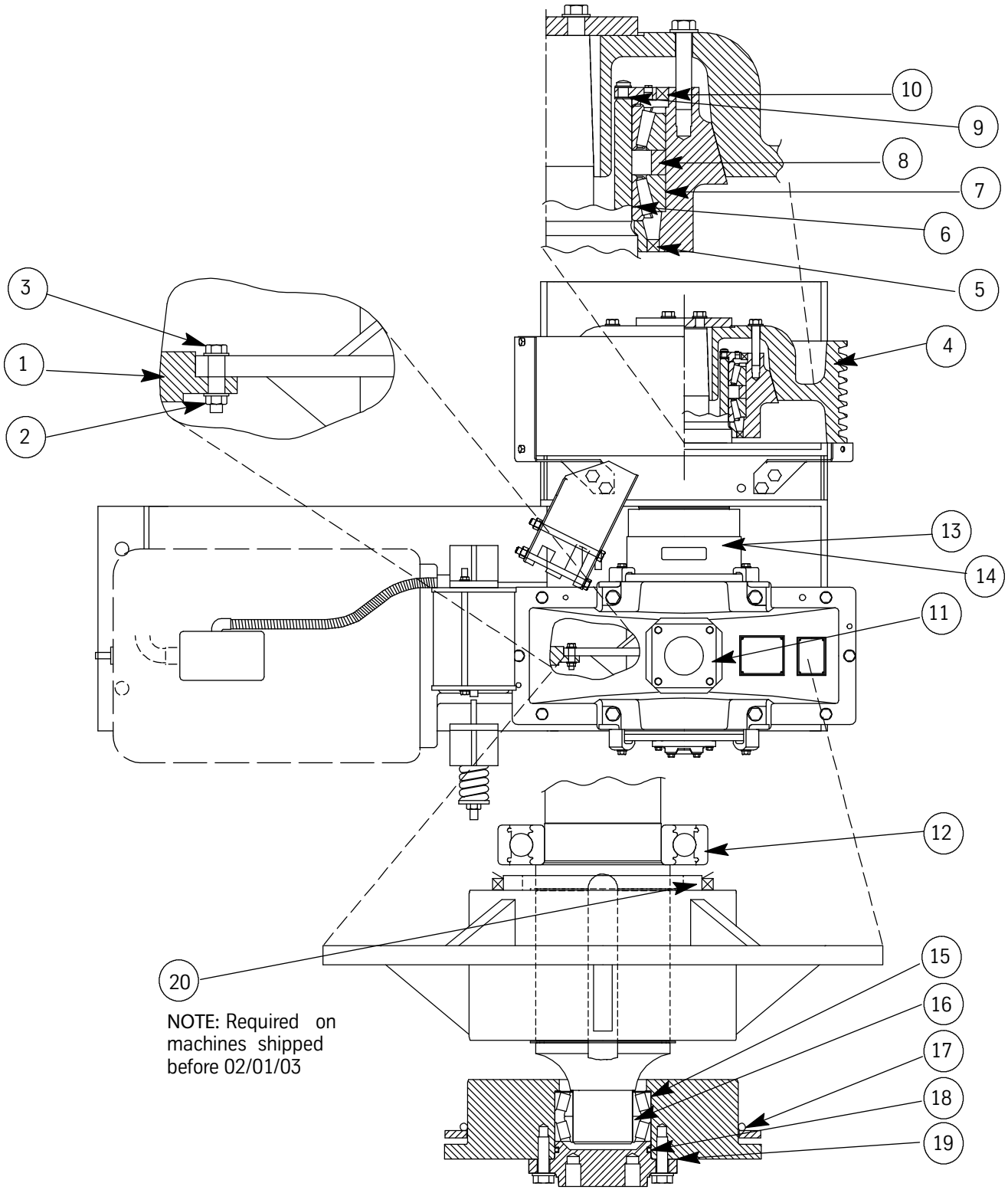
7. Verify that all field bulletins for the GD-2 Machine have been completed.

Troubleshooting Chart

Problem	Cause
Brake is not properly picking or dropping	Worn parts
	Improper adjustment
	Improper maintenance
	Bad power supply
Excessive gear box heat	Not enough backlash
	Low or contaminated oil
	Not enough worm end play
	High-duty cycle
Brush noise or sparking	Incorrect or wrong length brushes
	Commutator damaged
	Excessive current
Sheave noise	Improper rope tension
	Sheave wear
	Rope wear
	Machine misaligned
Motor noise	Improper motor parameters
	Misaligned motor
	Bent brake coupling shoulder bolts
	Brake coupling cushion pinched
	Worn motor bearing or damaged
Oil leaking	Damaged O-ring
	Damaged seal
	Loose screws
Ride quality	Gear alignment
	Lack of backlash
	Excessive backlash
	Incorrect end play
	Isolation pads installed incorrectly or missing
	Rope tension
	Incorrect drive parameters
	Poor car or counterweight rail alignment
	Improper roller guide set-up
	Isolation broken between the cab/platform and car sling
	Defective encoder
	Machine bearings worn
	Motor bearings worn

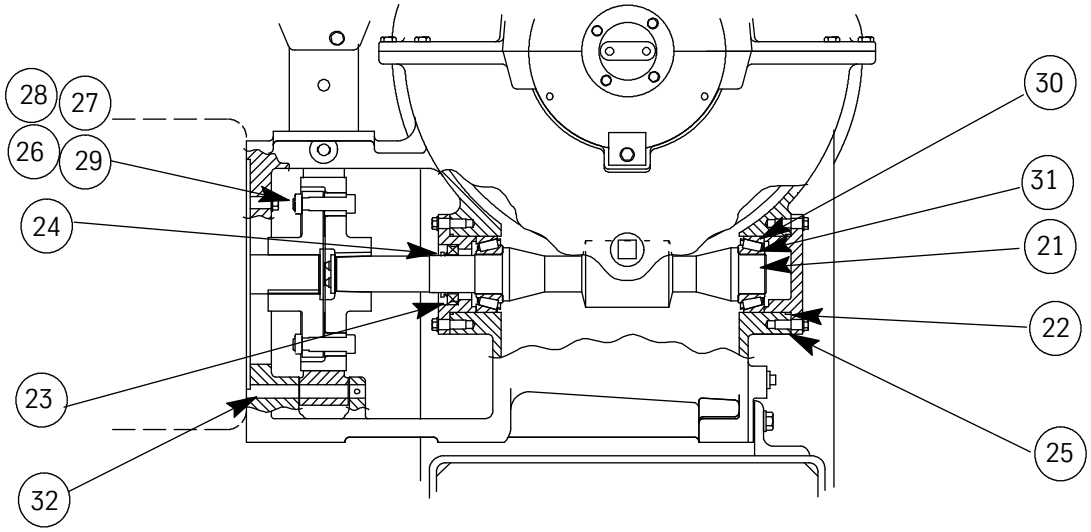
Replacement Parts

GD-2 Machine (4501AM)



GD-2 Machine (4501AM)

(continued)

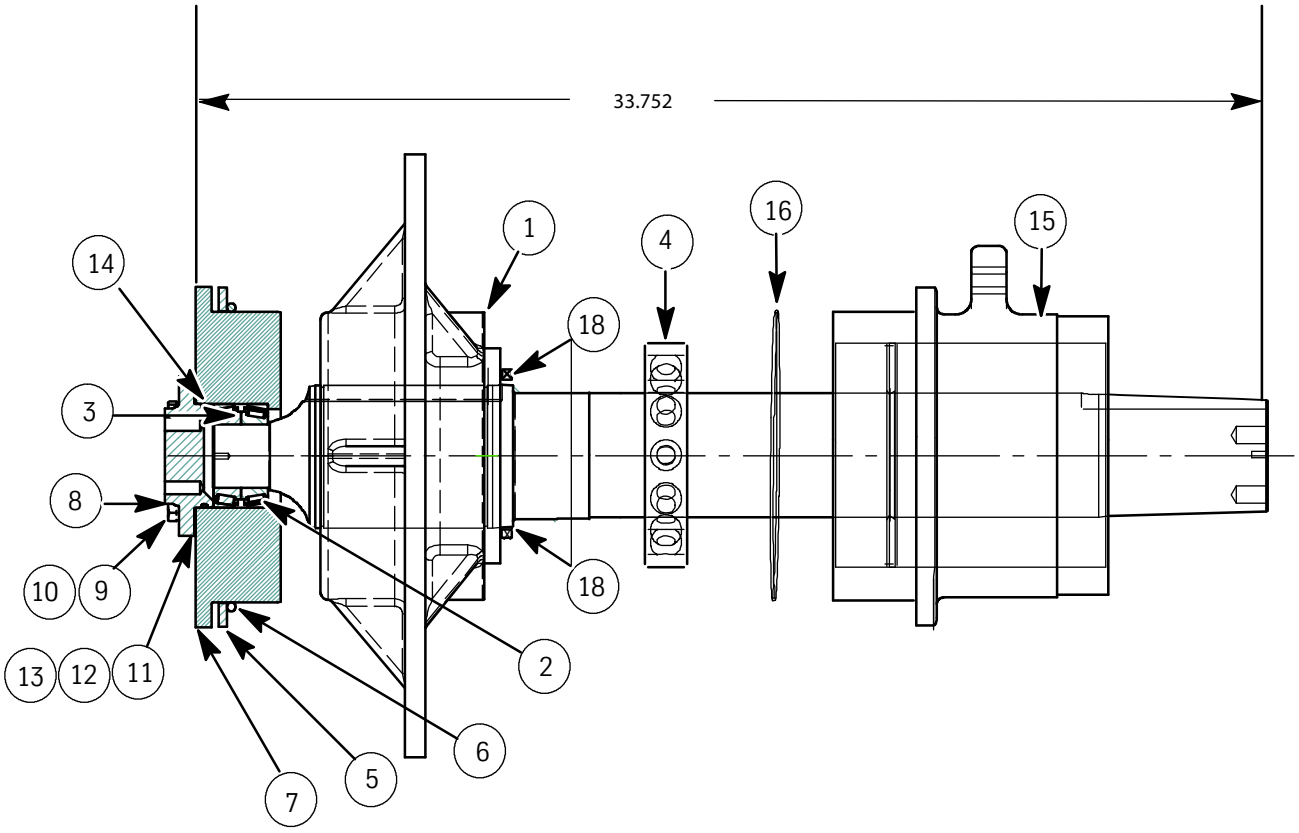


ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		436AG1	Gear, D-65
2		436AG2	Gear, S-57
3		436AG3	Gear, D-83
4		70378	Gear Locknut, NHL, .75 U
5		100508	Screw, CSH, .75 x 2.5 UE, Gear Retaining
6		110910	Drive Sheave
7		732AN1	Seal, Sheave Carrier
8		142BB1	Bearing, Cone, Sheave Carrier
9		142BC1	Bearing, Cup, Sheave Carrier
10		781BA1	Bearing, Spacer, Sheave Carrier
11		760AR1	Sheave Bearing Shims, .005
12		760AR2	Sheave Bearing Shims, .007
13		760AR3	Sheave Bearing Shims, .020
14		760AR4	Sheave Bearing Shims, .060
15		732AN2	Seal, Sheave Bearing Retainer
16	9833511	320AJ1	Gear Inspection Cover
17		142BE1	Bearing, Ball, Output Shaft
18		254AV2	Carrier, Single Bearing Eccentric
19		732BM1	Seal, Output Shaft
20		142AE1	Bearing, Cup, Dual Bearing, Output Shaft

21		142AF1	Bearing, Cone, Dual Bearing, Output Shaft
22	9817049	717AR2	O-ring, Eccentric, Adjustment Side
23	9871720	717AG1	O-ring, Dual Bearing Carrier
24	9876017	760AA1	Shim, .002, Dual Bearing Carrier
25		760AA2	Shim, .005, Dual Bearing Carrier
26		760AA3	Shim, .020, Dual Bearing Carrier
27		732AF2*	Seal, Oil Shaft (V-Ring)
28		744DE1	Worm Shaft Assembly, D-65
29		744DE2	Worm Shaft Assembly, S-57
30		744DE3	Worm Shaft Assembly, D-83
31		717AB1	O-ring, Worm Shaft Cap & Seal Carrier
32	9871731	732AB1	Worm Shaft Seal
33		732AF1	Worm Shaft Face Seal (V-ring)
34	9876005	760AC1	Worm Shaft Bearing Cap Shim Set: Blue, .005; Silver, .007; Yellow, .020
35		391AB1	Shoulder Bolt
36		71890	.625" Nut
37		74506	.625" Washer
38	9871718	208AC1	Coupling Bushing
39	9744745	142AB1	Bearing Cup, Worm Shaft
40		142AC1	Bearing Cone, Worm Shaft
41		638AN1	Fulcrum Pin, Brake Arm

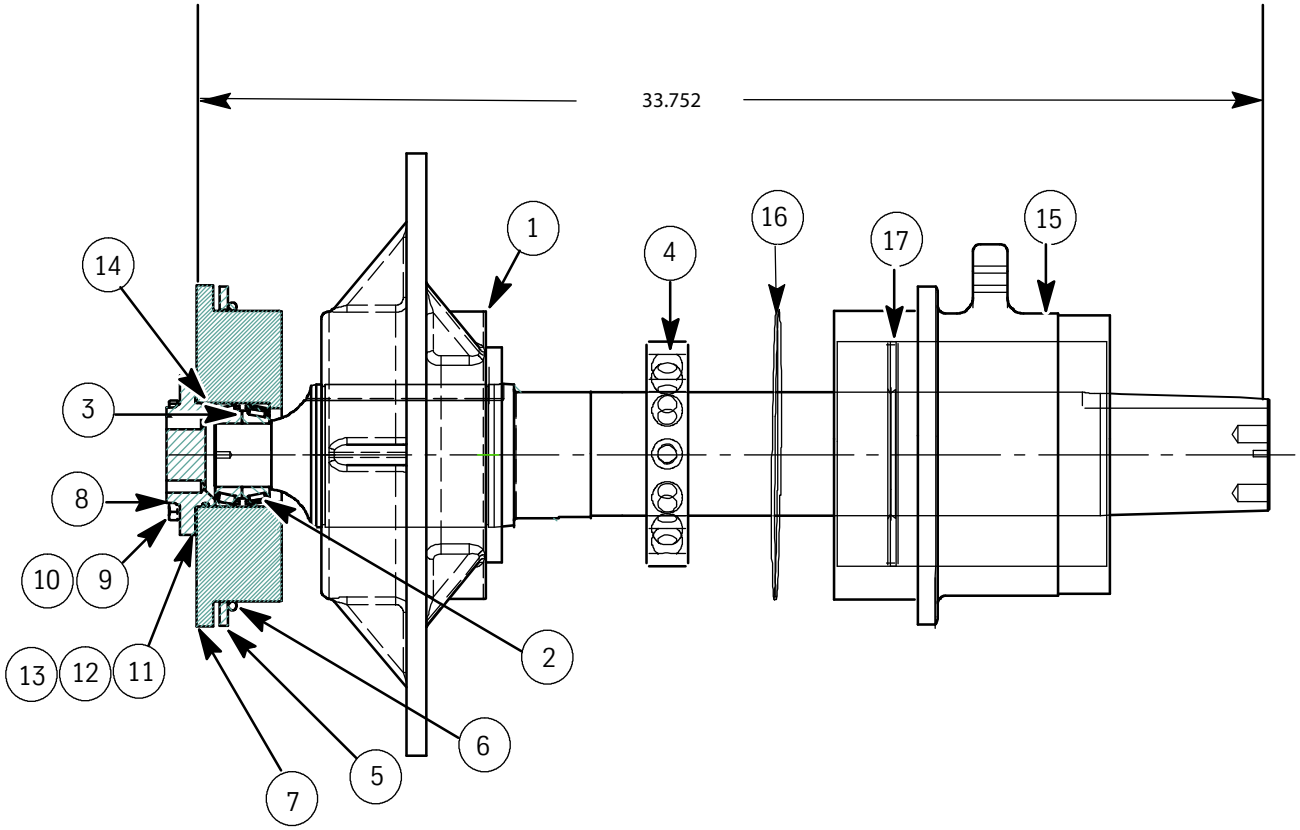
Note: See the Hollister-Whitney Rope Gripper component manual for a list of the rope gripper parts.

Output Shaft Assembly (744DH1)
Shipped before 02/01/03



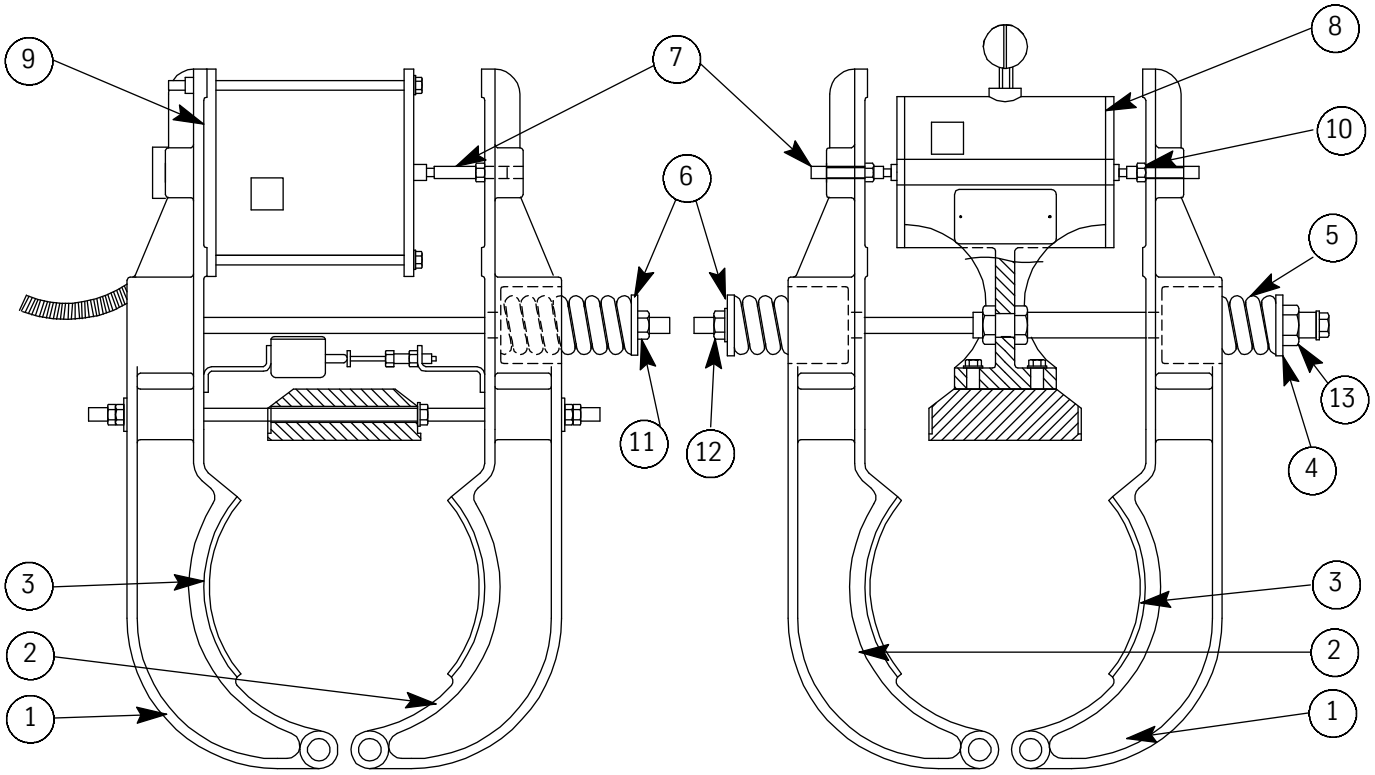
ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		744CF1	Shaft, Sub-Assembly, Output, 744DG1
2		142AE1	Bearing, Cup
3		142AF1	Bearing, Cone
4		142BE1	Bearing, Ball
5		717CH1	Ring, Gland
6	9817049	717AR2	O-ring
7		254AT1	Carrier, Dual Bearing, Eccentric (GD-2)
8		438AB1	Bearing, Gland (GD-0/GD-1)
9		405AG2	Screw, FS, CSH, M10 x 35mm
10		408AG2	Washer, FS, LWH, M10 Z
11	9876017	760AA1	Shim, .002
12		760AA2	Shim, .005
13		760AA3	Shim, .020
14	9871720	717AG1	O-ring
15		254AV1	Carrier, Single Bearing, Eccentric
16	9817049	717AR2	O-ring
17		732AF2	V-ring

Output Shaft Assembly (744DH2)
Shipped after 02/01/03



ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		744CF1	Shaft, Sub-Assembly, Output, 744DG2
2		142AE1	Bearing, Cup
3		142AF1	Bearing, Cone
4		142BE2	Bearing, Ball, Sgl Row, 100mm ID x 180mm OD, No Seal
5		717CH1	Ring, Gland
6	9817049	717AR2	O-ring
7		254AT1	Carrier, Dual Bearing, Eccentric (GD-2)
8		438AB1	Bearing, Gland (GD-0/GD-1)
9		405AG2	Screw, FS, CSH, M10 x 35mm
10		408AG2	Washer, FS, LWH, M10 Z
11	9876017	760AA1	Shim, .002
12		760AA2	Shim, .005
13		760AA3	Shim, .020
14	9871720	717AG1	O-ring
15		254BB1	Carrier, Single Bearing, Eccentric
16	9817049	717AR2	O-ring
17		732BM1	Seal, Output Shaft

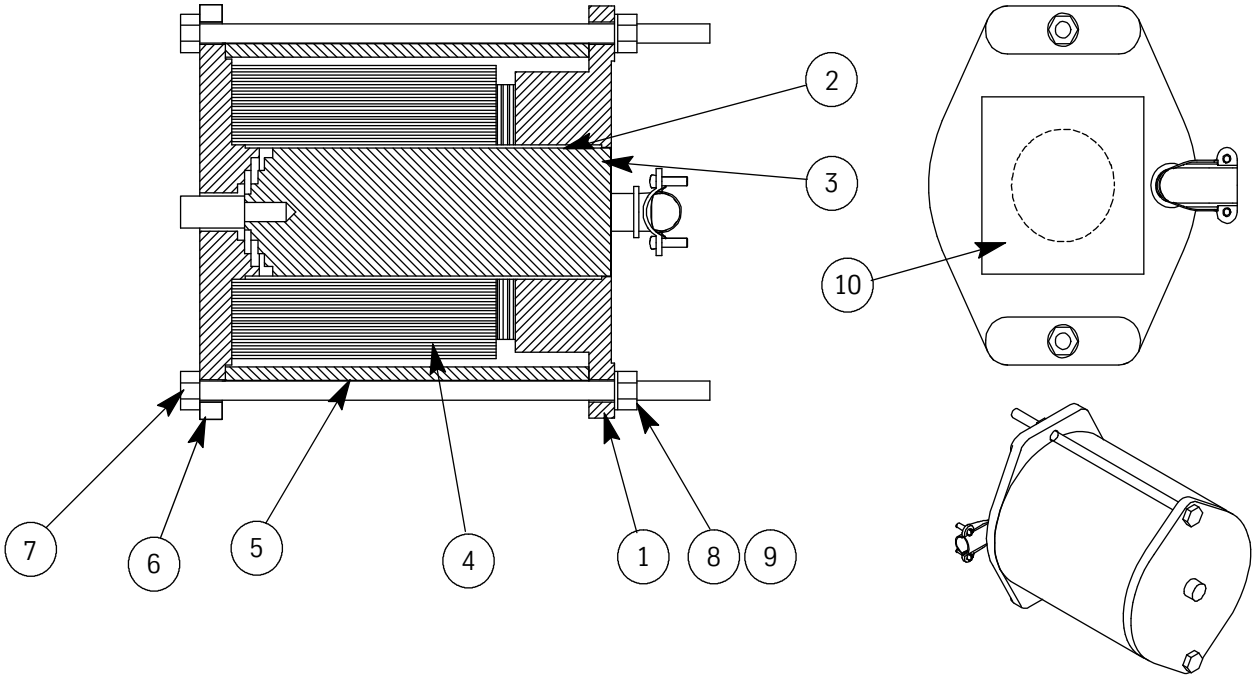
Brake Assemblies



Single Solenoid 4503AD1 Dual Solenoid 4503AD2

ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		205BN1	Brake Arm Assembly, Sheave Side
2		205BN2	Brake Arm Assembly, Adjustment Side
3		559AA3	Brake Lining
4		711CF1	Brake Spring Washer (tube end)
5	9875827	75826	Brake Spring
6	9800311	100014	Brake Spring Washer
7		405AT2	Stroke Adjustment Screw
8		779AB5	Solenoid Assembly
9		779AG3	Solenoid Assembly
10		402AB2	Stroke Adjustment Locknut, NHJ, M12 U
11		402AF1	Spring Adjustment Locknut, NHL, M16 Z
12		402AC1	Spring Adjustment Locknut, Sheave Side, NHL, M12
13		402AC2	Spring Adjustment Locknut, Adjustment Side, NHL, M24

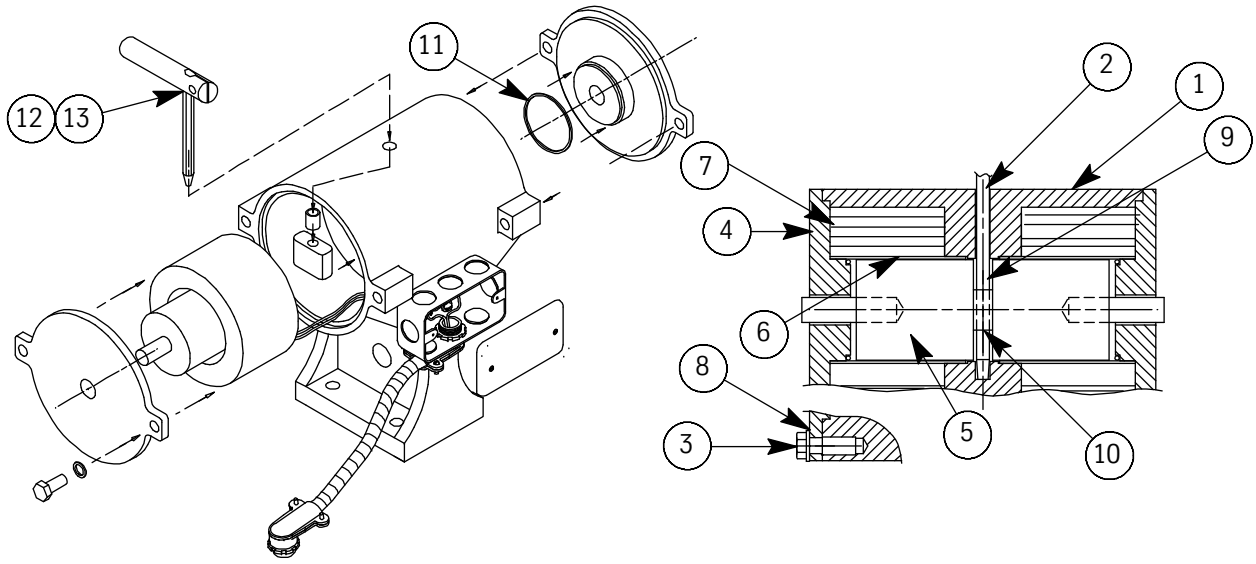
Single Solenoid Assembly (140V) 799AG3



Isometric View

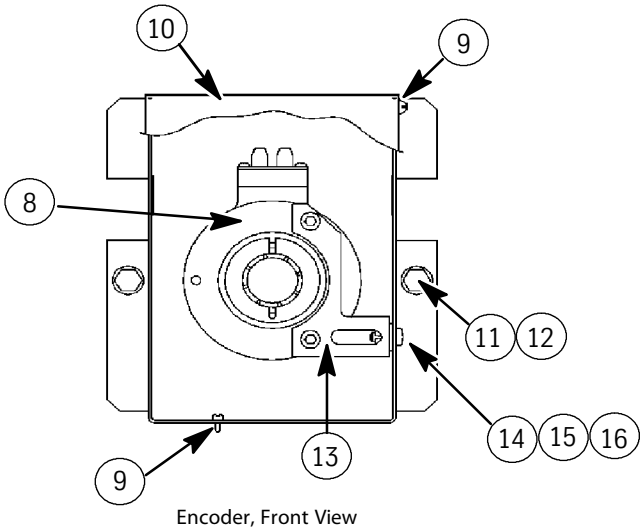
ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		778AL1	Plate, Rear
2	9815867	765AC3	Sleeve, Solenoid
3	9815879	181AH1	Armature Assembly
4		28327	Coil, 140V
		28326	Coil, 220V
5		26329	Shell
6		778AJ1	Plate, Front
7		110464	Screw
8		700407	Washer
9	9700407	700564	Nut
10		72816	Dust Seal

Dual Solenoid Assembly (140V) 799AB5

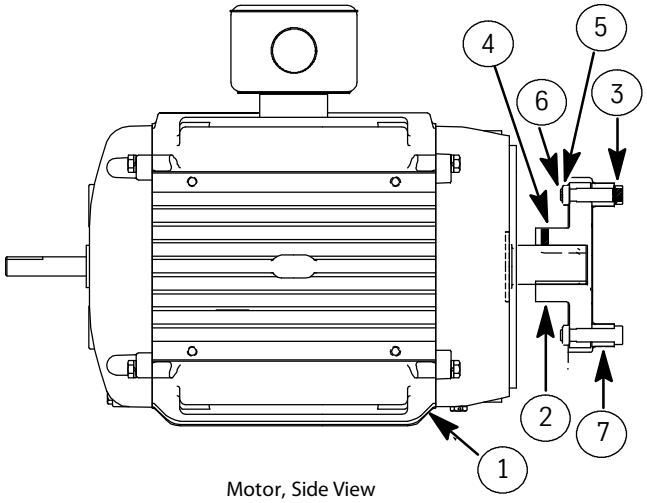


ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		196FL2	Bracket, Solenoid Housing
2		459AC2	Handle, Emergency Extension
3		405AG1	Screw, FS, CSH, M10 x 25mm Lg. Z
4		165DP1	Plate, Front Machined, GD-1
5		779AD1	Solenoid Armature Assembly, GD-1
6		765AC2	Sleeve, Solenoid
7		280AA1	Coil 140V DC
8		408AG2	Washer, FS, LWHR, M10 Z
9		781AG1	Spacer, Nylon
10		459AC2	Handle, Emergency Cam
11		717AY1	O-ring 2.250 x .500
12		408AE1	Washer, FS LWET M10
13		459AJ1	Handle, Brake, Removable

Encoder/Motor Coupling (AC Motor Shown)



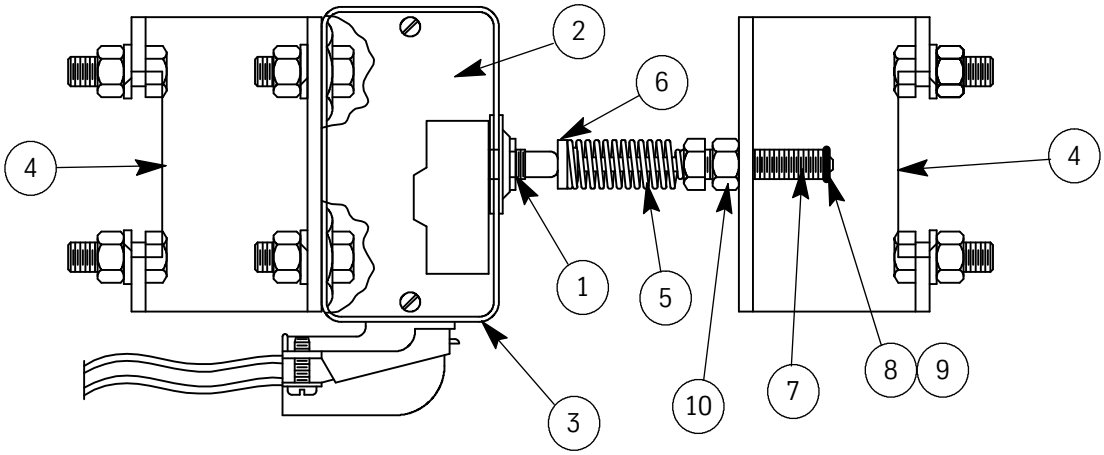
Encoder, Front View



Motor, Side View

ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		590CC15	Motor, 460VAC, 1180RPM, 50HP
		590CC14	Motor, 460VAC, 1180RPM, 40HP
2		309AR1	Armature Coupling
3		391AB1	FS, Shoulder Bolt
4		405BE1	Set Screw, SSHS (MX10 x 10)
5		74506	LWET Washer .625"
6		71890	Nut, .625"
7	9871718	208AC1	Coupling Bushing
8	9817610	373AX1	Encoder, 2048 CPR w/hardware
9		396AV1	Screw, SPABS #6, 138 x .500Z
10		482BP2	Encoder Housing
11		70395	Screw, CSH .250-20 UNC x .750Z
12		74599	Washer, LWET.250Z
13		802BT2	Support, Encoder, Non-Rotator
14		700682	Screw, STPFP #10, .190 x .500Z
15		700393	Washer, FWA #10, .190
16		392CB1	Square Head Grommet Nut, nylon

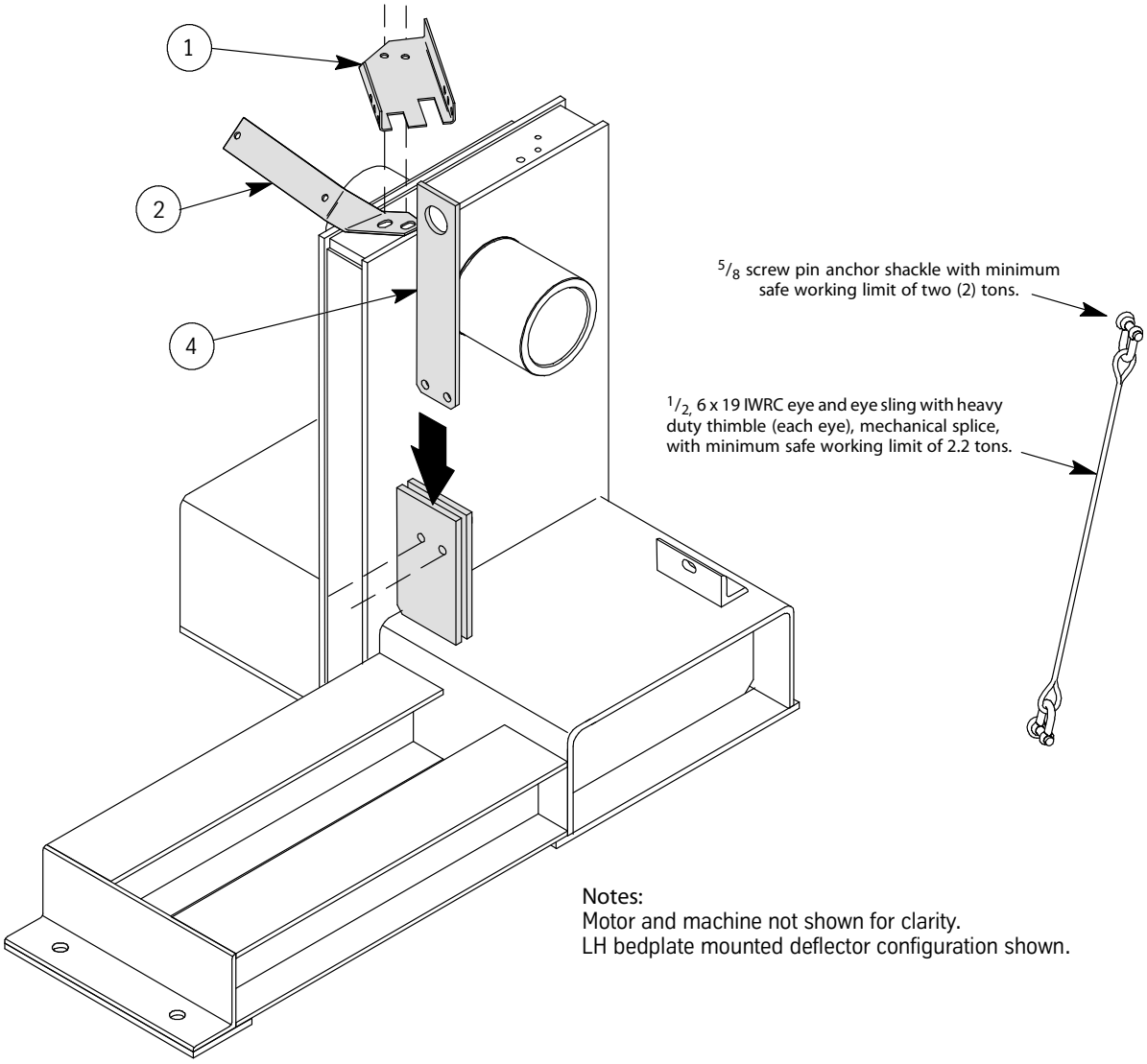
Brake Switch



ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		68415	Switch, Micro BZ2RG1-A2
2		77551	Cover, Junction Box
3		546AG1	Junction Box, 4.0 x 2.125 x 1.5
4		196JL1	Bracket, "Z" Switch/Actuator
5		45241	Spring
6		45239	Plunger
7		26739	Screw, Adjusting
8		45240	Retainer, Plunger
9		392BA1	Washer, FS. ENG., Cupped, 500 SE
10	9700407	700564	Nut, FS, NH, .375 Z

Hoisting Parts

WARNING **Ensure that the Hoisting Bar, the Center-of-Gravity Deflection Bracket, and the Screw Pin Anchor Shackle are securely fastened, and that the sling is in the proper position for the machine configuration.**



ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		196PJ1	Lift Bracket Assembly, (LH)
		196PJ2	Lift Bracket Assembly, (RH)
2		196NT7	Sheave Guard Bracket Assembly, 26” Sheave (LH)
		196PK5	Sheave Guard Bracket Assembly, 32” Sheave (LH)
		196PK6	Sheave Guard Bracket Assembly, 36” Sheave (LH)
3		196NT8	Sheave Guard Bracket Assembly, 26” (RH - not shown)
		196PK7	Sheave Guard Bracket Assembly, 32” (RH - not shown)
		196PK8	Sheave Guard Bracket Assembly, 36” (RH - not shown)
4		459AG1	Adjustment Handle, Hoisting Bar

Vertical Express

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