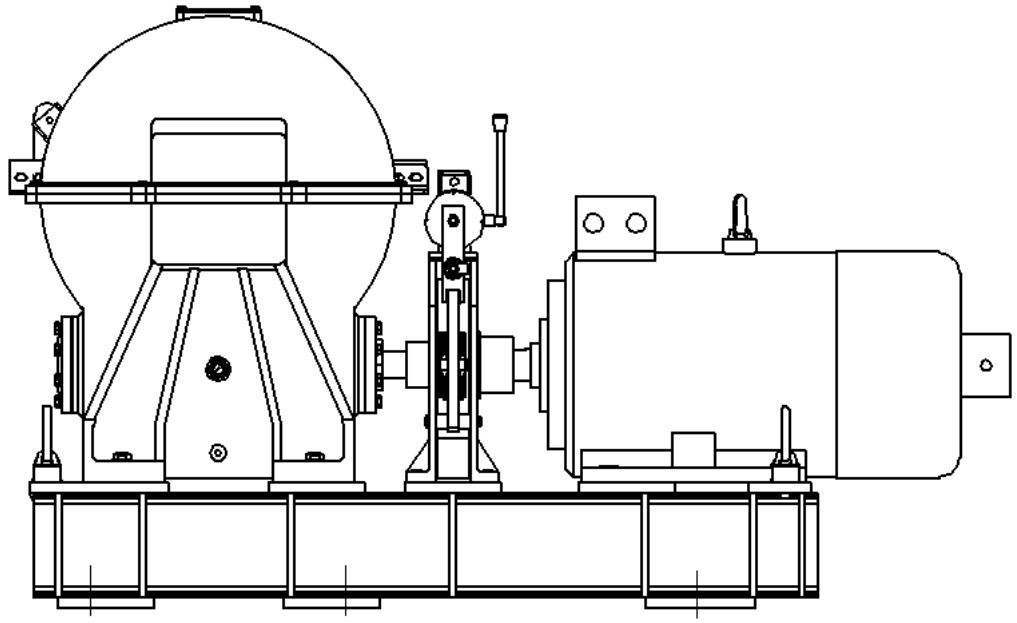
TGD4

Geared Machine

Complete Operation and Service Manual



SUZHOU TORIN DRIVE EQUIPMENT CO., LTD.

Manual No. TDI-001-TGD4 **Revision 04 / October 2014**

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(Revised Product Manual Version)

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1.0 Application

1.1 Overview

The TGD4 Machine is a geared machine designed for elevators. Its worm and gear configuration allows speeds up to 350 fpm (maximum), and an elevator capacity of up to 10000 lbs. 1:1, and 20000 lbs. 2:1 maximum.

The TGD4 machine used a drum brake with dual brake solenoids. The qualified elevator personnel can adjust the length of the spring to control the brake torque.

1.2 Codes and Standards

These machines are designed to comply with ASME A17.1-2005 code. The motors are designed with insulation class F minimum and have been approved and labeled by CSA.

1.3 Environmental Specifications

Operating ambient temperature: 0℃ to 50℃

Storage temperature: 0℃ to 60℃

Humidity: relative humidity of 10% to 95% non-condensing

Altitude: Up to 1000m above sea level without de-rating

1.4 Specifications

Induction motors: 480V / 60Hz / 4-poles / 3-phase

Brake coils: 110VDC/3.5A pick and 70VDC/2A hold

Maximum full load mass: 55000 lbs.

Demountable bronze gear

Sheave diameter: 32.28/35.28 inches

Up to 10 x0.75 in. Ropes

Designed for 180 starts per hour at 50% elevator duty cycle and 1:1 roping

Incremental encoder: 2048 pulse per revolution

Estimated weight: 6200 lbs.

Lubricating oil: 15L (3.9 Gal)

Recommended oil is Shell Omala S4WE460 synthetic gear oil or equivalent elevator gear oil.

Recommended grease is any quality EP2 grease.

Detailed Machine Specifications

Geared Machines For Single Wrap Applications				
Model Number		TGD4-12020-HV-R	TGD4-8035-HV-R	TGD4-20010-HV-R
Roping		1:1	1:1	2:1
Motor Rating	Hp	75	75	75
Elevator Capacity	lbs	12000	8000	20000
Elevator Speed	fpm	200	350	100
Sheave Diameter	inches	32.28	35.28	32.28
Gear Ratio		75:2	63:2	75:2
Motor Use Speed	Rpm	887	1175	887
Motor Rate Current	A	85A	78A	85A
Cwt	%	40	40	40

Table 1 Machine Duty Table

2.0 Machine Overview

2.1 Machine Assembly

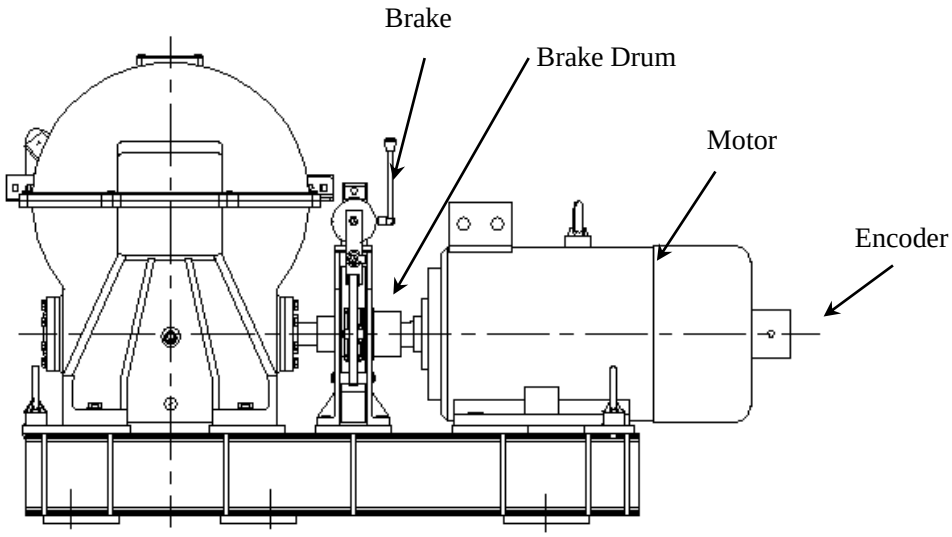


Figure 1 TGD4 Machine Assembly

2.2 Brake Assembly

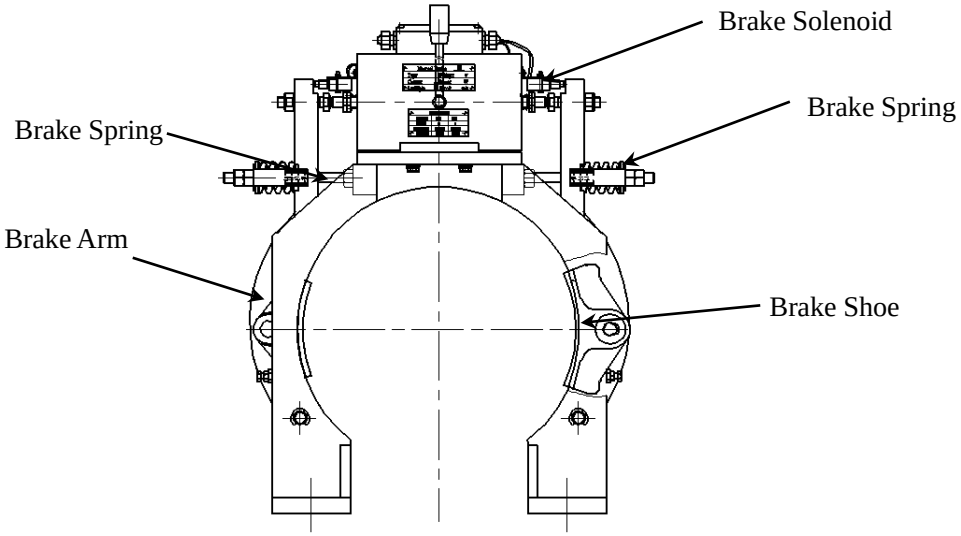


Figure 2 TGD4 brake Assembly

3.0 Safety Precautions

Read this page BEFORE any work is performed on Elevator Equipment.

Important!

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 done 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.

3.1 Terms in This Manual

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

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

3.2 General Safety

Specific warnings and cautions are found where they apply, and DO NOT appear in this summary.

3.3 Electrical Safety

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

3.4 Electrical Hazards

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.

3.5 Mainline Disconnect

Unless otherwise suggested, always turn OFF, Lock and Tag out the mainline disconnect to remove power from the equipment.

3.6 Test Equipment Safety

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

Meggering 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.

3.7 When Power Is On

Dangerous voltages exist at several points in some products. To avoid personal injury, do **NOT** touch exposed electrical connections or components while power is **ON**.

3.8 Product Specific Warnings

The TGD4 Machine MUST be balanced during hoisting. See Hoisting Methods in the Installation section for proper lifting procedures.

Hang the elevator car before removing ANY bolts. Failure to do so may result in severe injury and equipment damage.

4.0 Arrival of the Equipment

4.1 Receiving

Upon arrival of the machine, make a visual check for any external damage immediately upon their arrival on site. If any damage incurred in transit is found, make a notice of claim in the presence of the forwarder. If necessary, do not put these machines into operation.

4.2 Hoisting

TGD4 machines can be lifted by using a combination of hooks, chains & slings designed to safely carry the weight of the machine. There are 4 lifting points on the TGD4 machine. See Figure 3.

Note: Tighten all eye bolts before hoisting machine, motor or gear box, and always use properly rated hoisting equipment with certified rigging personal on-site. Inspect all equipment/tools being used before every task.

Estimated weight: 6200 lbs.

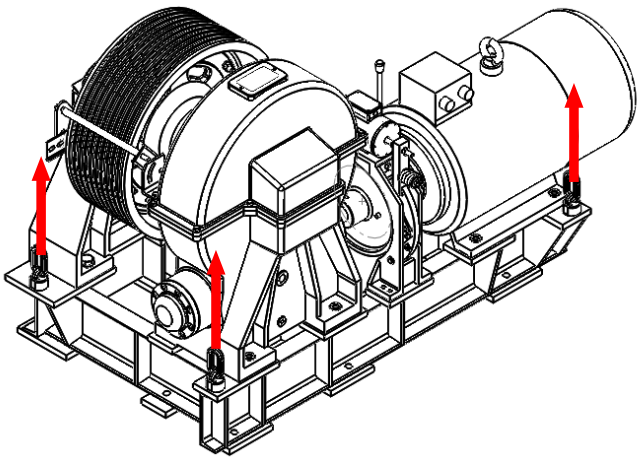


Figure 3 TGD4 Machine Recommended Hoisting Methods

4.3 Storing

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

5.0 Installation

5.1 Motor Connection

Use the job wiring diagrams with the motor configuration information to connect the motor to the controller.

Inverter drive output reactor: it is strongly recommended that a reactor to be installed between the inverter and motor to filter out high transient peak voltages that may damage the motor windings.

CAUTION! Before operating the machine, refer to the appropriate Product Manual and verify that the drive parameters for the job are set correctly.

Motor Connection

Connect the motor cable (U, V, W, and grounding) to three phase AC reactor then to frequency inverter output terminal, and check the short-circuiting between the windings and the ground before connection.

Note: Connections P1 and P2 are motor thermal overload connections if needed.

5.2 Brake Connection

The power terminal of brake is BK+ (positive pole), BK-(negative pole).

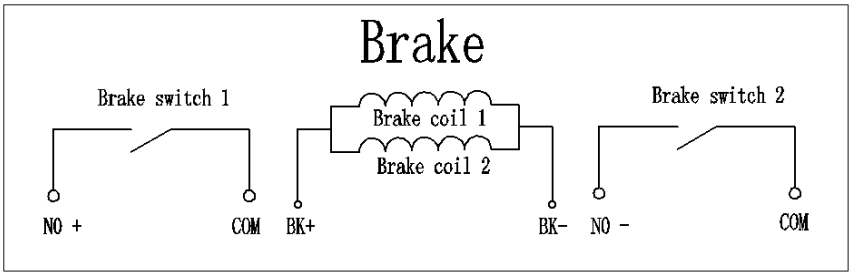


Figure 4 Brake Connection

There are two microswitches installed in the brake that are used to feed back the action of the brake. User can connect it according to your control system requests.

5.3 Absolute Encoder Connection

These machines are supplied with absolute encoder HS35 Incremental Optical Encoder. The incremental resolution is 2048 pulses per revolution. The absolute encoder is rear mounted for TGD4 machines. The operating personnel can connect the encoder and the inverter with special cable, and follow the below figure showing the signals.

Figure 5 Encoder Connection

6.0 Maintenance

Only qualified personnel are allowed to perform any maintenance work. The person who performs the maintenance work must be very careful because some work must be performed when the machine is running.

6.1 Brake Stroke Check

Please pay attention to the value of brake stroke during the course of routine maintenance. If the brake stroke is too short, the power of the solenoid cannot push the brake arm to obtain the enough gap, which will result in a disabled brake. Generally, the brake stroke has been adjusted in the factory and does not need to be adjusted in the field.

Suggest check cycle

- 3 months after initial install
- 6 months after initial install
- Annually for the remaining life of the product

Benchmark Criteria

The gap which is the bottom of the Brake Shoe and the drum should 0.1~0.5mm.

6.2 Brake Lining Wear Check

If the brake lining wears too much, the brake will be disabled.

Suggest check cycle

- Annually after initial install

Benchmark Criteria

The brake lining wear must be <2mm (0.08”). Use steel rule to measure the thickness of the brake shoe. The thickness must be >6mm (0.24”). Otherwise replace the brake lining or replace the whole brake assembly. See Figure 6.

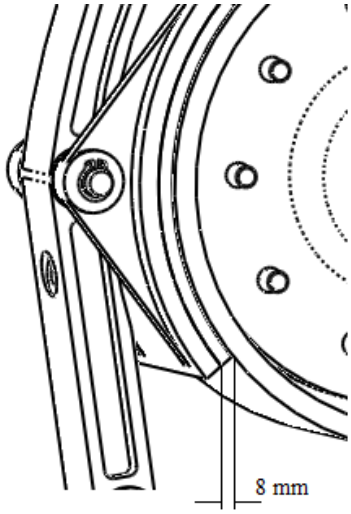


Figure 6 Brake lining check showing initial thickness

6.3 Lubricating Check and Oil Change

The oil type we recommend is Shell Omala S4WE460 synthetic gear oil or equivalent elevator gear oil.

CAUTION! W**hether the oil needs to be changed depends on the cleanliness and age. Check the oil color, smell and degree of cleanliness to determine whether the oil needs to be changed. If oil turns black and smells foul, it should be changed. Use filter paper to check hot oil and watch for metal shavings to confirm whether oil needs changing. The oil volume of the TGD4 machine is about 15L. The oil level should be at scale mark. If too little, the lubrication will be not enough. If too much, the oil will be leak out.**

If the machine storage more than 1 years, the oil should be changed before use.

Suggested check cycle

When using synthetic oil, the first time oil change should be done after the new machine runs **700 hours**. After that, depending on the machine running condition, change synthetic oil each 3000-4000 hours (at most than 24-36 months).

For oil change it is not necessary to hang the car and remove the ropes.

Required Tools & Materials:

Open end Wrench: 16mm & 22mm

Funnel & Oil pan (Capacity at least 15L (3.9 gal))

Oil change procedure

1. Remove elevator from service and verify the elevator is under your control.
2. Take off top cover with 16mm wrench for air flow.
3. Place funnel and oil pan right next to the oil drain. The oil pan should be able to hold at least 15L (3.9 gal).
4. Remove oil plug, drain the old oil away.
5. When the oil has ceased running out of the geared box, hand tighten oil plug to make sure it is not being cross-threaded; tighten the rest of the way with the 22mm wrench.
6. Pour in 15 L (3.9 gal) synthetic oil into the gear box top.
7. Run the car floor to floor for 10 minutes and check the machine running situation. Also check the gear box for any signs of heat or smoke, while verifying the proper disbursement of oil over the ring gear.

7.0 Adjustments

7.1 Brake Torque Adjustment

WARNING! Generally, the brake stroke has been adjusted in the factory and does not need to be re-adjusted any more.

Adjustment of the brake MUST be complete before anyone is allowed to ride on the platform.

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.

Required Tools & Materials:

Open end wrench: 24mm

Crane scale (more than 500lbs)

Scale arm

Connecting shaft

Loctite 243

Adjust Procedure Steps

1. Remove the elevator from service.
2. Check the length of the spring's decrement, which is shown on the surveyor's rod. The surveyor's rod should show the value A in Table 2 and Figure 7, otherwise the length must be readjusted. The number of motor poles is on the motor nameplate.

Motor Power	Motor pole	A
75Hp	8	19~20mm
75Hp	6	15~16mm

Table 2 Spring decrement

3. Go to Step 4 only if the length is out of the range. Otherwise the brake torque is good.
4. Loosen nuts M16 by open end wrench (24mm), then adjust the spring slowly to ensure the length is in range. See Figure 8.

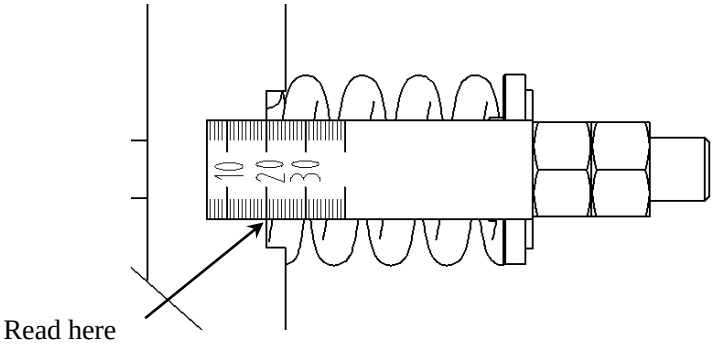


Figure 7 Spring decrement

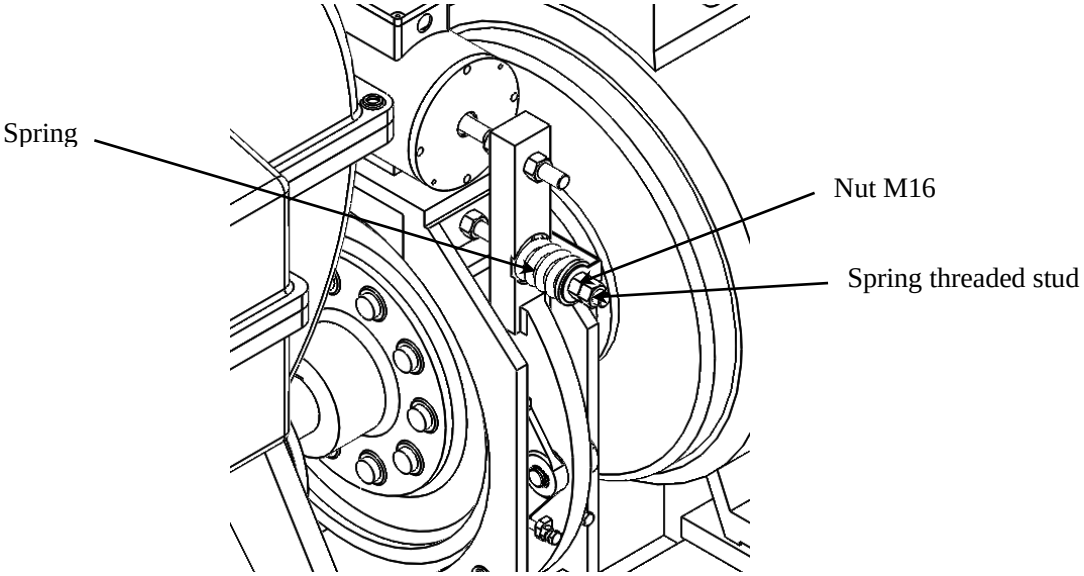


Figure 8 Brake torque adjustment

5. If the length is too long, tighten the nut M16 clockwise to reduce it. If the length is too short, loosen the nut counter-clockwise to increase the length.
6. Remeasure and confirm that the value on the surveyor's rod is good.
7. Also measure the brake torque by crane scale and scale arm. First of all, tighten the connecting shafts onto the brake drum. See Figure 9.
8. Remove the Butterfly screw M6X20 by hand, and remove the screw M5X12 (if so equipped) using a screw driver, take off the hand wheel cover.

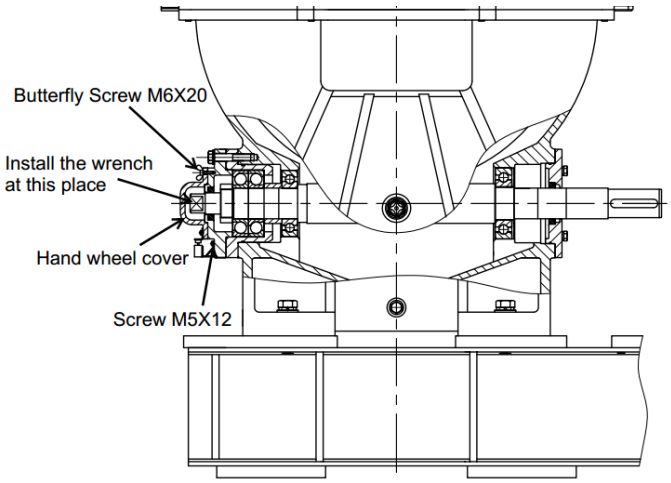


Figure 9 -Brake torque adjustment

9. Install the wrench (scale arm and connecting shaft) on the worm shaft, Use the crane scale to measure the torque, make sure the torque is B as shown in Table 3.

Motor Power	Motor Pole	B
75HP	8	≥935Nm (690 ft-lb)
75HP	6	≥715Nm (527 ft-lb)

Table 3 Brake torque

10. Then apply Loctite 243 between the spring threaded stud and nut M16 for anti-vibration purpose.

7.2 Brake Stroke Adjustment

WARNING! Generally, the brake stroke has been adjusted in the factory and does not need to be re-adjusted any more.

Required Tools & Materials:

Open end wrench: 24mm (x2)

Feeler gauges

Loctite 243

Adjust Procedure Steps

If the brake stroke is too small, the brake drum and brake shoe will rub and the machine will make abnormal noise when it runs. Generally, brake stroke has been adjusted at the factory and there is no need for more adjustment.

1. Loosen the Stroke adjustment locknut M16, verify that the hit pin and the stroke adjustment bolt just make contact when the brake's power is on, and screw the stroke adjustment bolt into the direction of the brake to 2.0~2.5mm (0.078"~0.098"). See Figure 10.
2. Measure the gap which is the bottom of the Brake Lining and the drum, check it is 0.1-0.5 mm (0.004"~0.02") with feeler gauges. Make sure the gap is about uniform from top to bottom by adjusting the bolt M8. If the gap of the top is too big, tighten the bolt clockwise to reduce it. If the gap is too small, loose the bolt counter-clockwise to increase the gap. See Figure 11.
3. Tighten the Locknut M16 up then apply Loctite 243 between the locknut and the bolt.

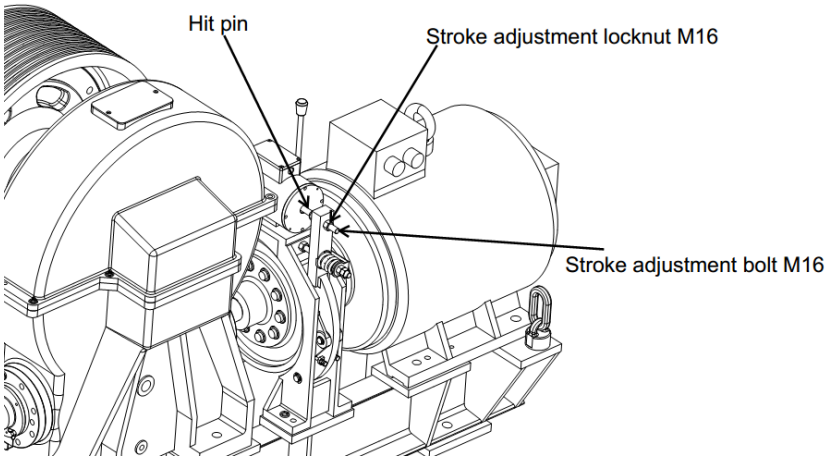


Figure 10 -Brake Stroke adjustment

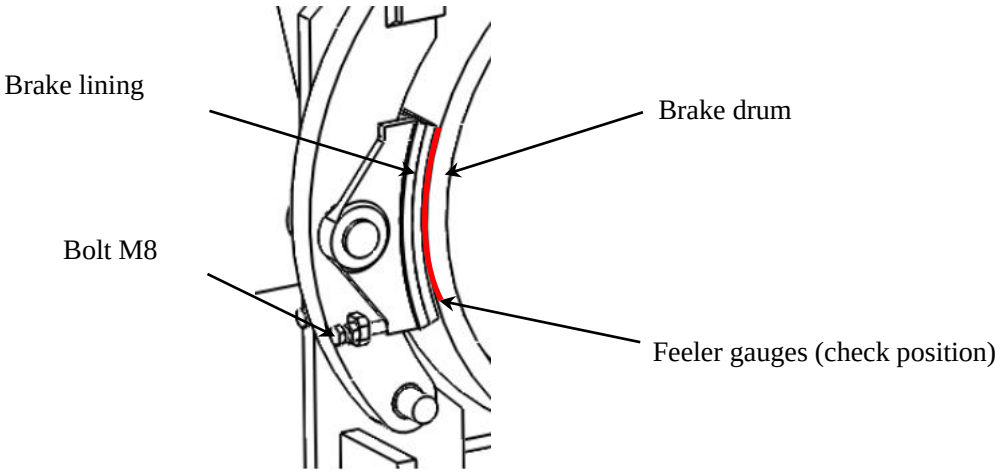


Figure 11 -Brake Stroke adjustment

7.3 Brake Synchronous Adjustment

This step should be done after the brake torque meets the specified value (See Table 3 above).

Adjust Procedure Steps

1. If a Brake Arm is open slower than the other arm, slacken the Spring Adjustment Nut and locknut.
2. Otherwise, tighten the Nut when the Brake Arm opens faster.
3. After adjusting, verify the brake torque according to **section 7.1 Brake torque adjustment.**

8.0 Replacement

WARNING! The user who does the replacement must make sure that the machine is powered off and the elevator is secure and will not be moved unexpectedly. Only qualified personnel are allowed to perform the replacement work.

WARNING! Please refer to the troubleshooting procedure first and make sure that the component is actually bad before performing this replacement procedure.

8.1 Encoder Replacement

Required Tools & Materials:

Hex wrench: 9/64”, 6mm, 8mm

Clean cloth

Straight head screw driver

8.1.1 Encoder removal

1. Remove the encoder cover using a hex wrench (8mm)
2. Remove the encoder cable using a straight head screw driver.
3. Loosen the locking bolt of the encoder using a hex wrench (9/64”), remove the bolt which connects the motor and the encoder bracket (hex wrench 6mm), then remove the broken encoder. See Figure 12.

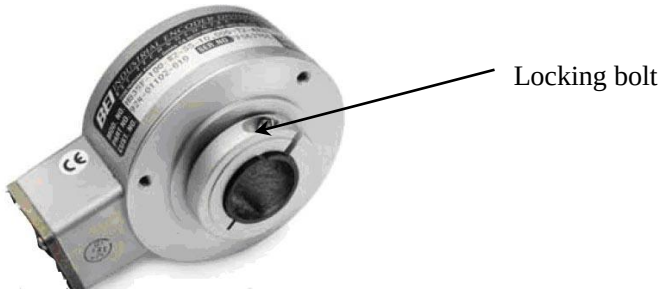


Figure 12- Encoder replacement

8.1.2 Encoder installation

1. Attach the encoder bracket to the encoder so that the cable connection is near the opening in the encoder cover.

Note: Check new encoder by slowly spinning it to check for smooth operation before installing.

2. Clean the motor shaft with clean colth, then slip the encoder on to the shaft.
3. Tighten the bolt into the motor through the encoder bracket with a 8mm hex wrench and tighten the locking bolt with the 9/64” hex wrench.
4. Connect the encoder and the transducer cable, and install the encoder cover.

8.2 Brake Switch Replacement

Please refer to the troubleshooting procedure first and make sure that the switch is actually bad before performing this replacement procedure.

Required Tools & Materials:

Brake switch

Philips screwdriver

Multimeter

Small flat head screwdriver

Open end wrench 7mm (x2)

Feeler gauges: 1.5mm

Loctite 290

8.2.1 Brake switch removal

1. Loosen the screws in the brake terminal box by the Philips screwdriver, and remove the terminal box cover.
2. Remove the brake switch cable which needs to be replaced from the brake terminal using a small flat head screwdriver.
3. Remove the screws M4 busing a Philips screwdriver, then remove the broken switch and bracket. See Figure 13.
4. Remove the bolts M4 and nut M4 using open end wrench (7mm), then remove the broken switch.

8.2.2 Brake switch installation

1. Clean the switch bracket mounting surface if it is not clean.
2. Install the new brake switch on the switch bracket using the bolts M4 and nuts M4, then install the switch and bracket on the brake surface using screws M4x10.
3. Reconnect the new brake switch cable.

8.2.3 Brake switch adjustment

1. Loosen the bolts M4 and nuts M4 by open end wrench (7mm) and adjust the position of the brake switch on the switch bracket.
2. Place a 1.5mm feeler gauge between the brake arm and the brake switch (position A), and adjust the switch slowly. When the switch operates, tighten the bolts M4 and nuts M4, and remove the feeler gauges. **Note: A multimeter may be used to determine when the switch operates.**
3. Apply Loctite 290 between the screw heads and the switch body.

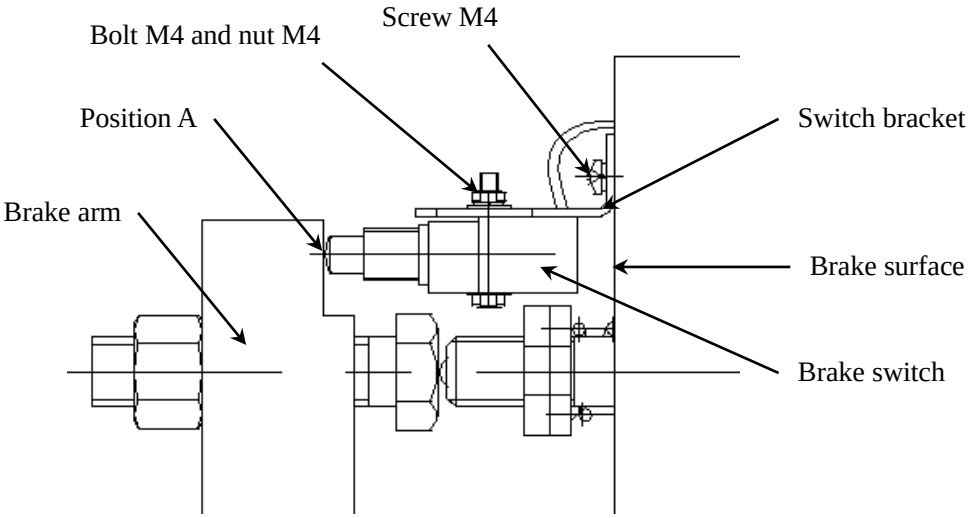


Figure 13 Brake switch replacement

8.3 Motor Replacement

WARNING! Please refer to the troubleshooting procedure first and make sure that the switch is actually bad before performing this replacement procedure.

Required Tools & Materials:

Hoisting equipment

Open end wrench (30mm)

Clean cloth

Torque Wrench (30mm)

Hex Wrench (4mm)

Hydraulic Puller

Pin puller

Pressing machine

Indicator

Loctite 243

8.3.1 Motor removal

1. Remove the elevator from service.
2. Remove the encoder from the motor. See Section 8.1.1 Encoder Removal.
3. Remove the power cable from the terminal box.
4. Install a hoist and rigging over the motor, and hoist the motor until pressure is applied to the rigging.
5. Remove the Bolts M20x90 and washers by open end wrench .Remove the pins 12 using the pin puller. See Figure 14.
6. Mark the motor shims and motor leg so the shims can go back in the same locations. Also mark the motor coupling and brake drum for reference if the motor coupling will be reused. See Figure 15.
7. Remove the motor away from the traction machine.
8. If reusing the motor coupling, loosen the hex socket set screw M10 by hex wrench (4mm). Remove the motor coupling using a hydraulic puller; remove the key 20.

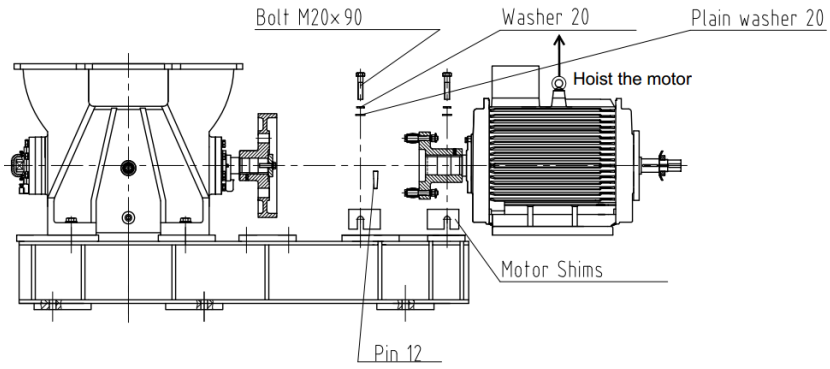


Figure 14 Motor replacement

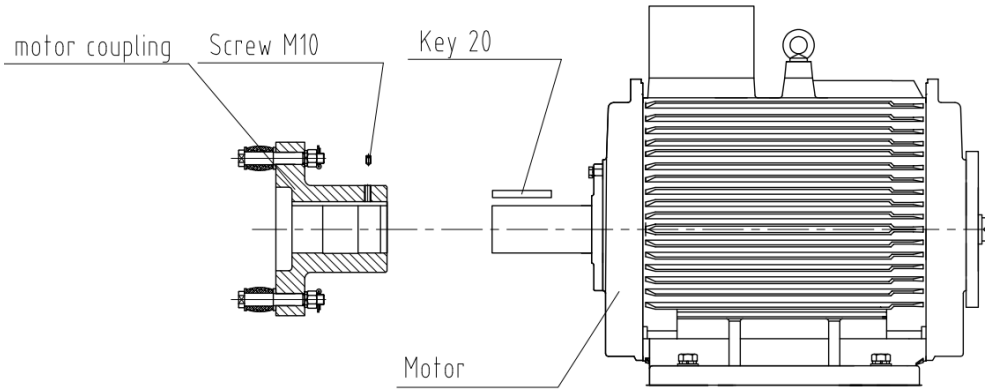


Figure 15 Motor coupling removal

8.3.2 Motor installation

1. Clean the motor shaft with clean cloth, install the key on the shaft and apply some lubricating oil.
2. Press the motor coupling into the motor shaft with pressing machine, then apply Loctite 243 on the hex socket set screw M10, and tighten it into motor coupling. See Figure 16.

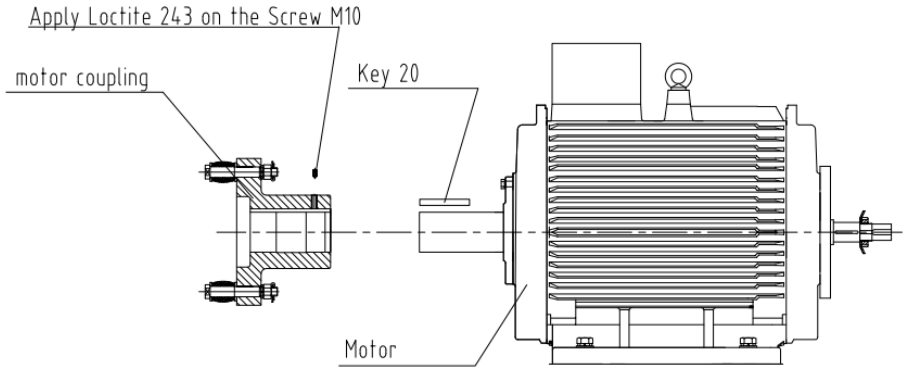


Figure 16 Motor coupling assembly

3. Loosen the brake springs, unbolt the brake arms, and make sure the brake shoes are clear of the brake drum.
3. Align the mark of motor coupling and brake drum, install the motor coupling into the brake drum.
4. Install the motor shims according to the mark, install the pins 12 into the motor. Then tighten the bolts M20x90 and washers. See Figure 12 (above).
5. The motor now must be 'trammed'. Put indicator on motor coupling with one against the face of brake drum, turn the indicator vertically with the drum until a "0" reading is obtained, turn the drum 180°to the indicator in an upright position on the bottom of the drum, it will tell you whether the back of motor is high or low. The reading should be within 0.3mm (0.012"). If not, adjust the motor shims under the motor leg and recheck. See Figure 17.

6. Put indicator on motor coupling with one against the O.D. of brake drum, turn the indicator vertically with the drum until a “0” reading is obtained, turn the drum 180°to the indicator in an upright position on the bottom of the drum, it will tell you the height of motor. The reading should be within 0.15mm (0.006"). If not, adjust the motor shims under the motor leg and recheck.
7. Put indicator on motor coupling with one against the face of brake drum, turn the indicator horizontally with the drum until a “0” reading is obtained, turn the drum 180°, it will tell you whether the back of motor is left or right. The reading should be within 0.3mm (0.012"). If not, hit the back of motor lightly and recheck.
8. Tighten the bolts M20x90 and washes to 300~375Nm (200 ft-lbs~276ft-lbs).
9. Reinstall the encoder. See Section 8.1.2 Encoder installation.
10. Reconnect the power cable and test the machine.

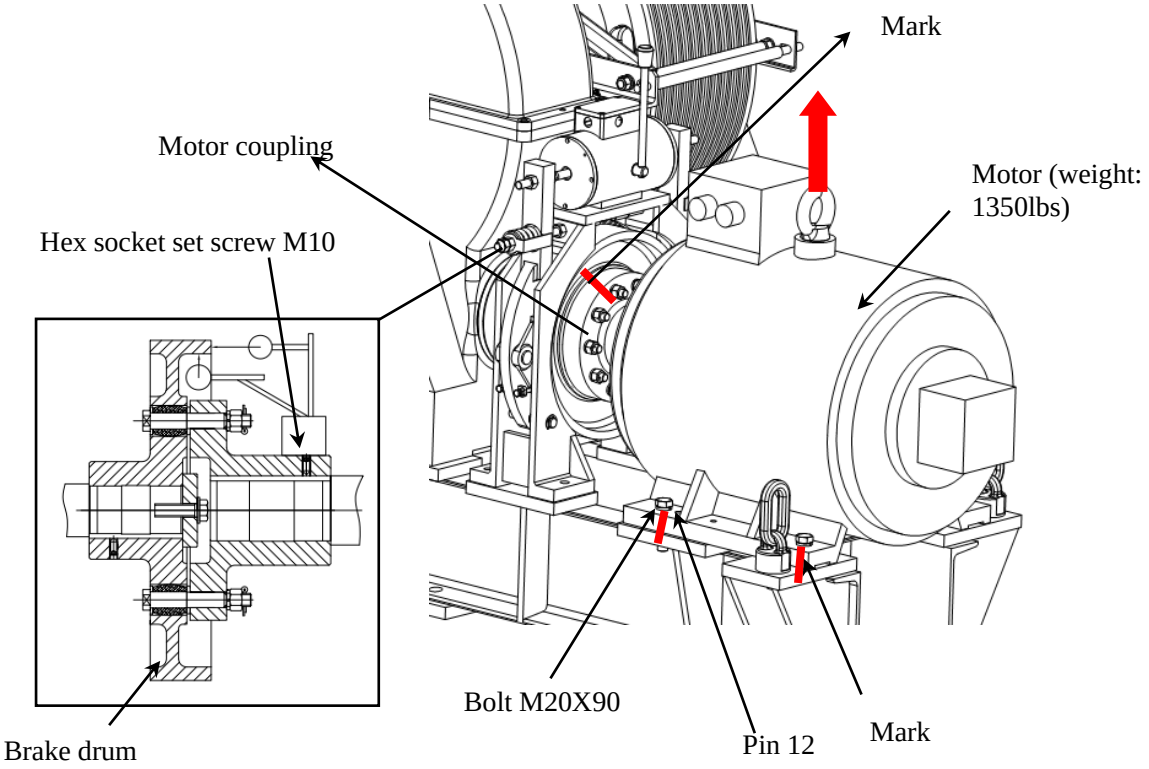


Figure 17 Motor replacement

8.4 Brake Replacement

WARNING! Please refer to the troubleshooting procedure first and make sure that the switch is actually bad before performing this replacement procedure.

Required Tools & Materials:

Open end wrench (16mm)

Phillips screwdriver

Small flat head screwdriver

8.4.1 Brake removal

1. Remove the elevator from the service.
2. Remove the brake cable and the brake switch cable from the brake terminal box.
3. Loosen the bolts M10x35 and washers, and remove the broken brake from the brake bracket. See Figure 18.

8.4.2 Brake installation

1. Install the new brake onto the brake bracket, and secure it with the bolts M10x35 and washers, but not to tighten.
2. Adjust the position of the brake, making sure that the axis of the solenoid, the Spring Threaded Stud and the Stroke Adjustment Bolt are aligned in the same plane, and tighten the bolts M10x35, securing the position of the brake.
3. For brake adjustment refer to this manual Section 7.0 Brake Adjustment and Section 8.2.3 Brake Switch Adjustment.

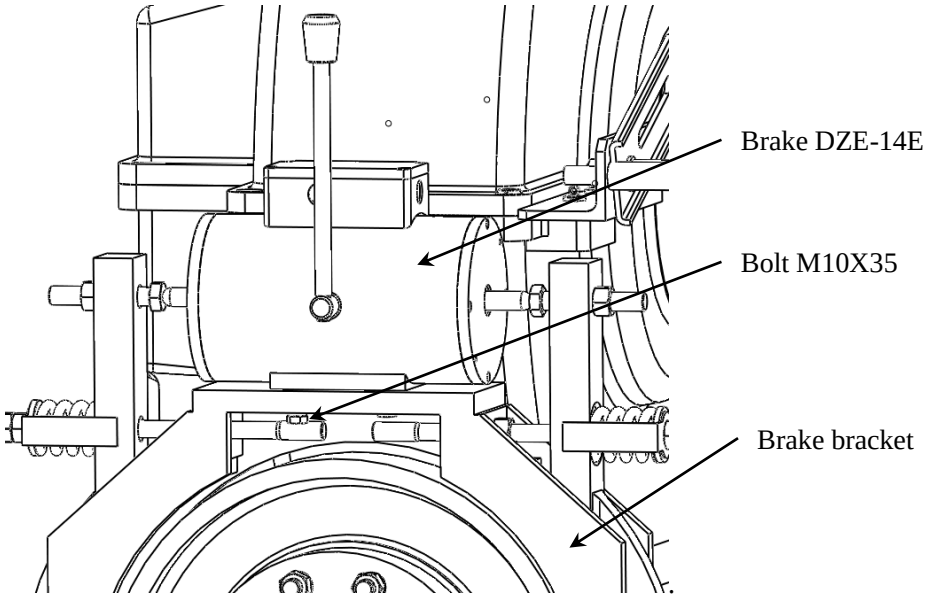


Figure 18 Brake replacement

8.5 Brake Lining Replacement

WARNING! **Please refer to the troubleshooting procedure first and make sure that the brake lining is actually bad before performing this replacement procedure.**

If the brake lining wears more than 2mm, must replace the brake lining or replace the whole brake arm assembly.

Required Tools & Materials:

Open end wrench: 13mm，24mm

Hammer

Snap ring pliers

8.5.1 Brake lining removal

1. Remove the elevator from service.
2. Remove the nuts M16, brake spring, and spring threaded stud. See Figure 19.
3. Open the brake arm, and remove the snap ring of brake shoe by snap ring pliers.
4. Remove the brake shoe pin using a hammer.
5. Remove the brake shoe (worn brake lining) and pressure spring.

8.5.2 Brake lining installation

1. Clean the brake arm and new brake shoe with clean cloth.
2. Install in pressure spring into the hole of the brake arm, and secure the new brake shoe with the pin and the snap ring.
3. Adjust the bolt M8x35 and the nut M8 in order to the brake lining good contact with the brake drum.
4. Install the spring threaded stud, brake spring, nuts M16.
5. For brake adjustment refer to this manual Section 7.0 Brake Adjustment and Section 8.2.3 Brake Switch Adjustment.

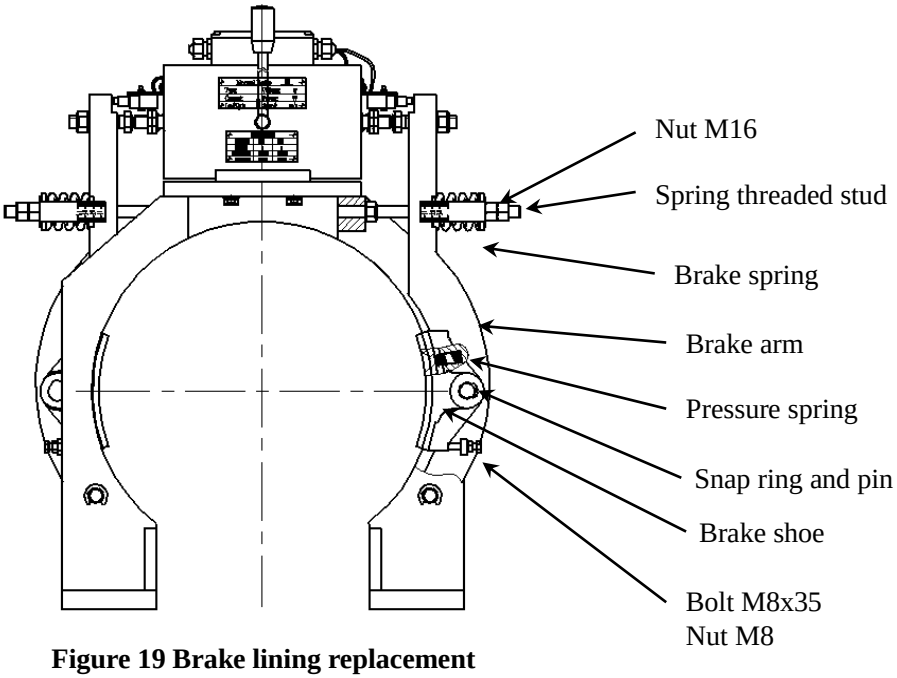


Figure 19 Brake lining replacement

8.6 Sheave replacement

WARNING! **Please refer to the troubleshooting procedure first and make sure that the sheave is actually bad before performing this replacement procedure**

Required Tools & Materials:

Hoisting equipment

Torque wrench

Sockets: 36mm, 30 mm, 18mm, 16mm

Dial indicator

Open end wrench: 36mm, 30mm, 18mm, 16mm

Pliers

M20 eyebolts (x2)

M20x100 bolts (x2)

Rigging (over 2000lbs)

The spacer

Clean cloth

8.6.1 Sheave removal

1. Remove the elevator from service.
2. Remove the Nuts M24, bolts M12X45 and washers 12 on the rope guard using the open end wrench 36mm, and remove the rope guard. Then remove the ropes. See Figure 20.
3. Remove Bolts M10X20 and then remove the cover plate.
4. Remove Bolts M12X45 and then use two of the bolts M12×45 turned into the bolt holes M12 to loosen the gear case cover. Remove the gear case cover. See Figure 21.
5. Remove Bolts M20X200 and Nut M24, Remove the pin 16x60.
6. Install hoisting and rigging over the worm gear and shaft as Figure 22 shows.
7. Slinging the sheave (with the gear), clean the oil from the gear.
8. Place two stands (about 10” tall) approximately 250mm (10”) apart under the gear surface. See Figure 23.
9. Remove the Cotter pin 4x45 using pliers, remove the hexagon fit bolts M20X1.5 and hex slotted nuts M20x1.5 using an end wrench 30mm.
10. Install two eye screws M20 into the threaded holes locations opposite each other on the sheave.
11. Turn two bolts M20×100 into bolt holes to push the sheave out of carrier. Remove the two bolts M20×100.

NOTE: When the two bolts M20×100 contact the carrier, turn each evenly. Gasket of each side shouldn’t be replaced.

12. Remove the sheave.

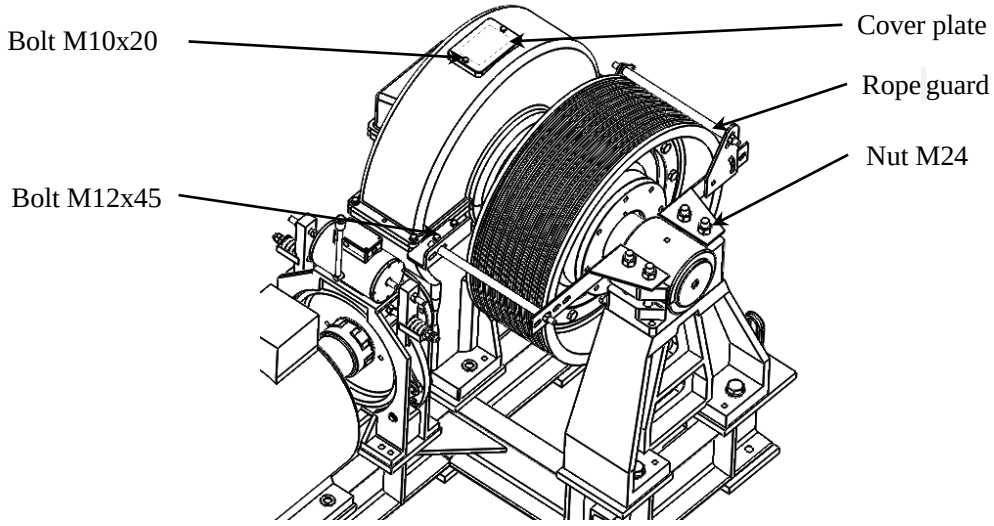


Figure 20 Remove Guard and Cover plate

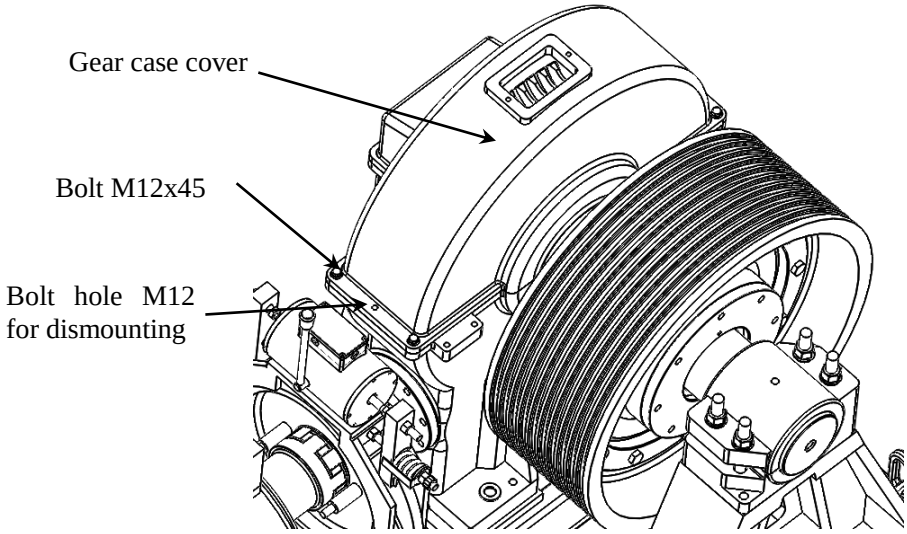


Figure 21 Remove Gear case cover

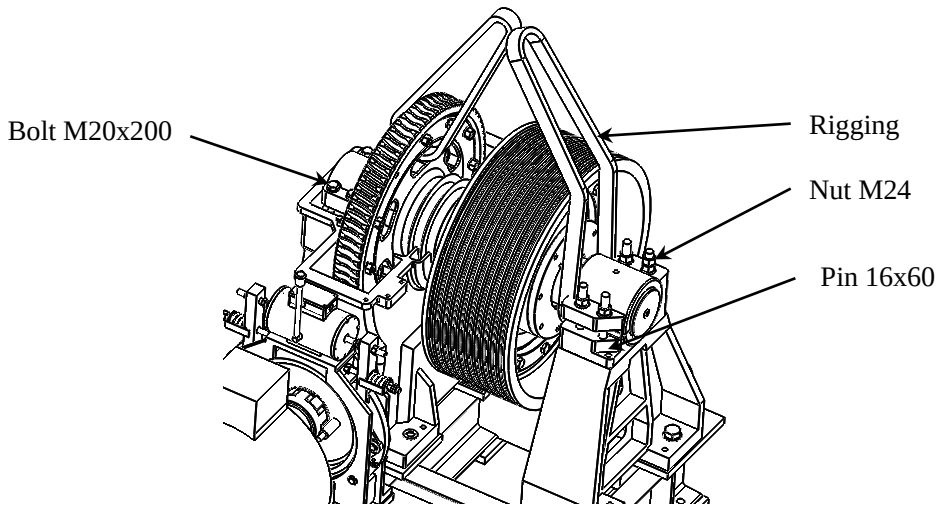


Figure 22 sheave shaft assembly hoisting

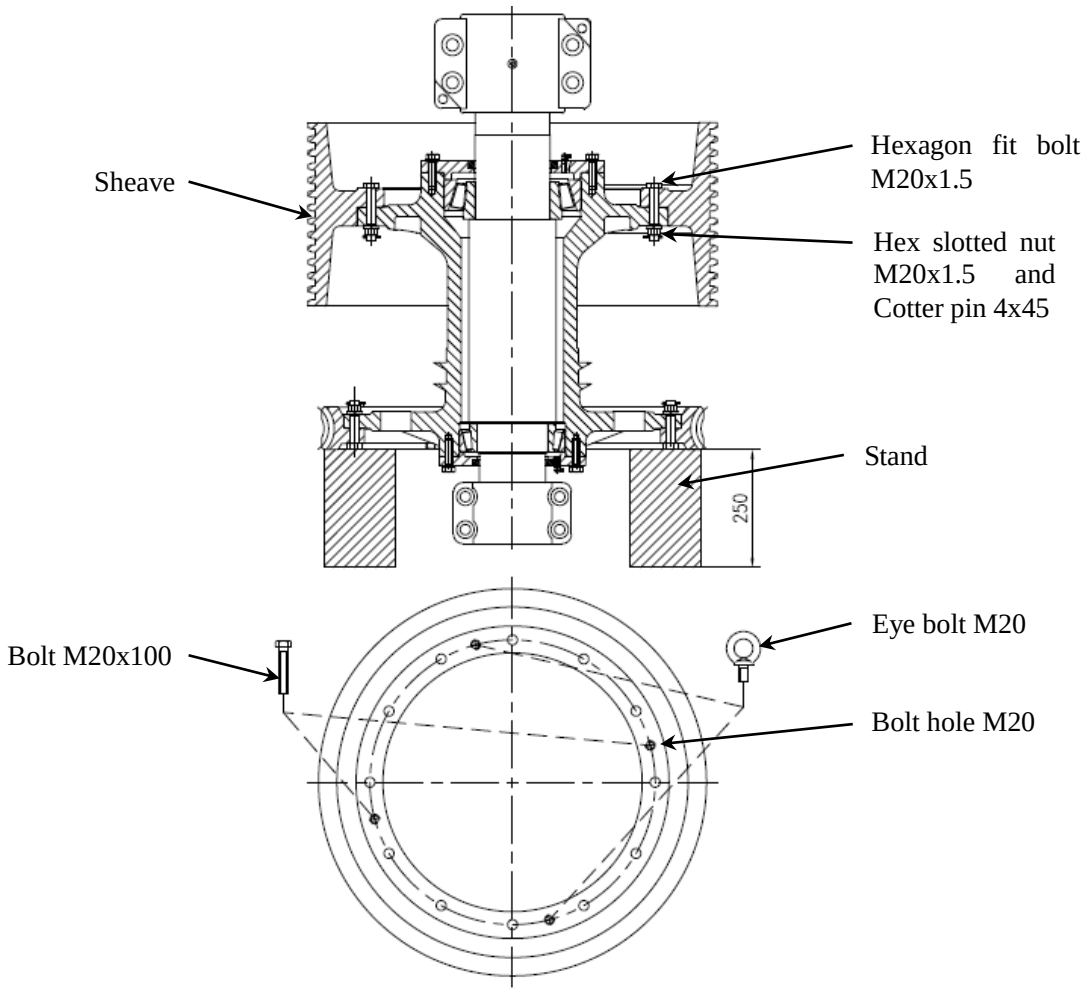


Figure 23 sheave disassembly

8.6.2 Sheave installation

1. Clean the carrier's mating surface with the sheave. Make sure there is no rust or greasy dirt.
2. Install two Eye Screws (M20) into the threaded holes locations at each 180°of the new sheave.
3. Place the sheave onto the heating equipment, then gently heat the sheave to about 160±20℃ (320±68°F)
4. Quickly slide the heated sheave fully onto the carrier. With a gloved hand ensure that the sheave is installed correctly and aligned with the holes in the carrier. A drift pin or bolt may be used.

5. Allow the sheave to cool completely.
6. Install bolts M20X1.5 tapping into place with a hammer. Tighten nuts M20X1.5 to 300~375Nm (220~275 ft-lb.) and install split (Cotter) pin in the end of the nuts. See Figure 24.

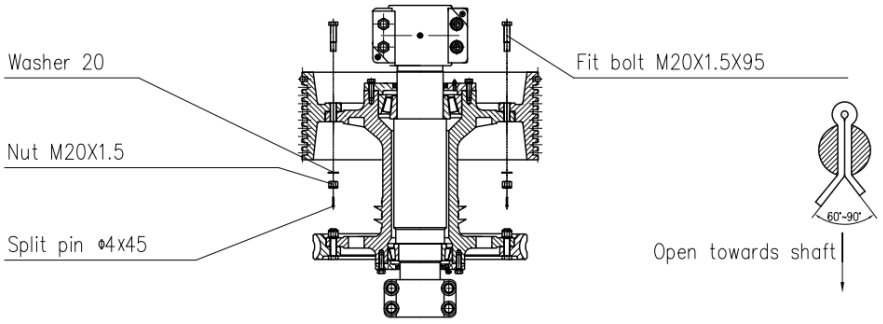


Figure 24 Install sheave on carrier

7. Place the sheave (with the gear) into the gear case.
8. Install the pin 16x60. See Figure 25.
9. Insert, thread, and hand tighten the Bolts M20X200 and Nut 24.

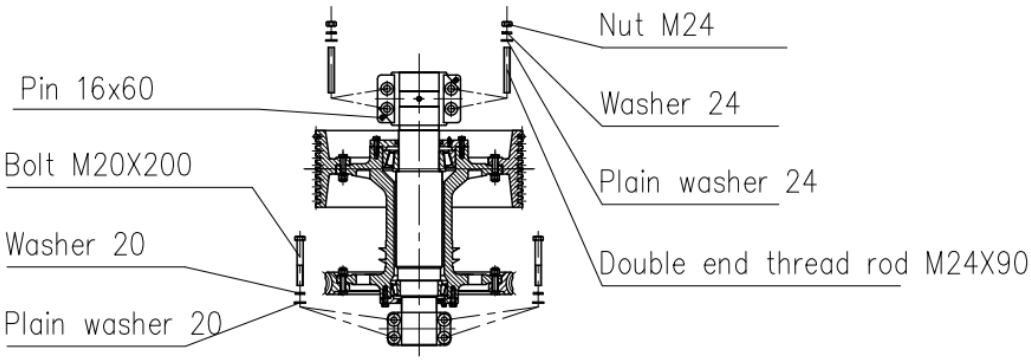


Figure 25 (top view) Install Pin, M20, and M24 fasteners

10. Using the torque wrench, tighten the bolts (M20×200) to 330Nm (343 ft-lb), tighten the nut M24 to 580NM (428 ft-lb.).
11. Clean the top gear case's mating surface and the gear case's mating surface. Make sure there is no rust or greasy dirt.
12. Apply sealant on gear case's fitting surface with the top gear case. See Figure 26.

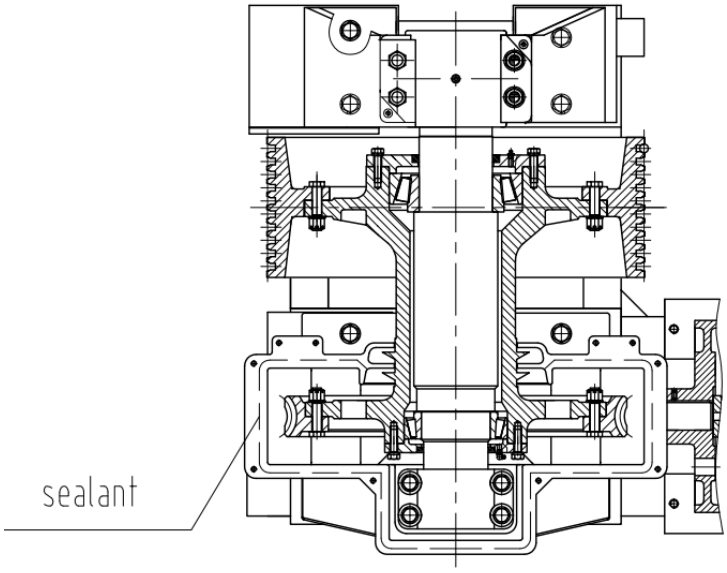


Figure 26 Apply sealant

13. Install the top gear case onto the gear case.
14. Insert, thread, and hand tighten the Bolts (M12×45) and Washer 12.
15. Clean the rope groove of the drive sheave-this will be used as an indicator surface.
16. Attach a dial indicator to the machine, over 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.
17. Rotate the drive sheave until the least reading of the dial indicator. Set the dial indicator to "0". This will become the reference point for adjusting the weave of the drive sheave.
18. With the dial indicator, check for TIR of ≤0.3mm by rotating the drive sheave clockwise one complete revolution. See Figure 27.

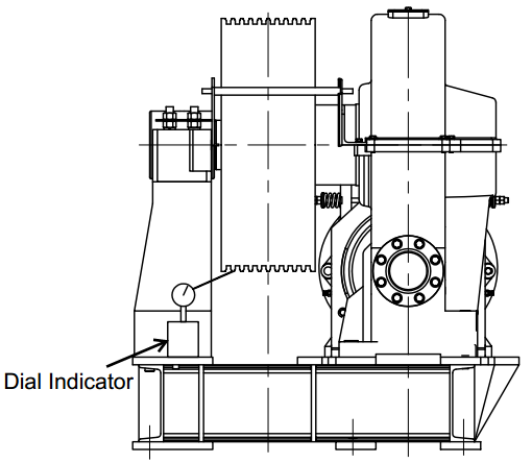


Figure 27 Check sheave with dial indicator

19. Reinstall the ropes and rope guard. See figure 18 (above).

8.7 Ring Gear Replacement

WARNING! **Please refer to the troubleshooting procedure first and make sure that the component is actually bad before performing this replacement procedure.**

Required Tools & Materials:

Box end wrench (24mm)

Reamer (16X230)

Hammer

Pressing machine

Dial indicator

Color ink

Hoisting equipment

Clean cloth

8.7.1 Ring Gear removal

1. Hoist the Sheave/Ring Gear assembly. See Section 8.6.1 Sheave removal, steps 1-7.
2. Drain the oil. Make sure the container can hold >15L (3.9 Gal). **Reinstall the drain plug.**
3. Place two stands approximately 250mm apart under the gear surface. See Figure 28.
4. Remove the Bolts M20X1.5X95 and the Nuts M20X1.5 which secure carrier and the gear.

   Note: there are the split (Cotter) pins in the bolts and the nuts.

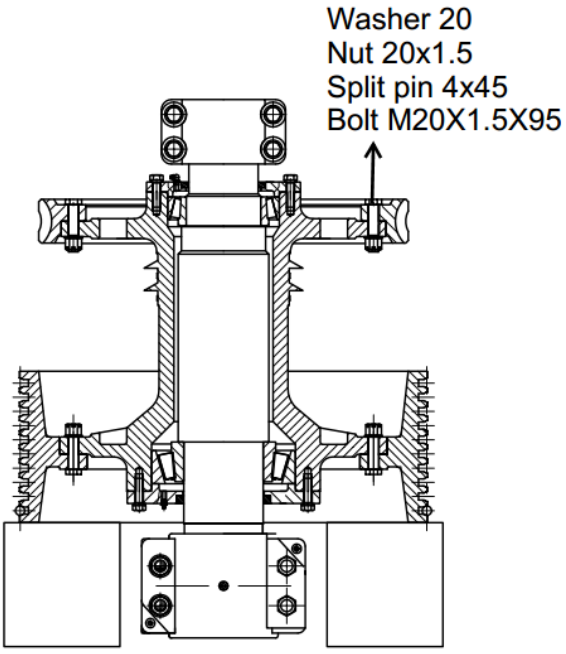


Figure 28 Remove the worm gear

8.7.2 Ring Gear installation

1. Check the mating surface of the new gear and the carrier for any debris that may hinder a flush fit.
2. With a gloved hand, set the new gear (with the mating side down on the carrier), and gently warm the new gear to about 70℃(158°F) and drop onto the carrier.
3. Once the gear is sitting flush, align the holes to match the carrier (drift pins or an existing bolt can be used for alignment). See Figure 29.
4. Allow the gear to cool completely, then hand ream the hole from the carrier side up.

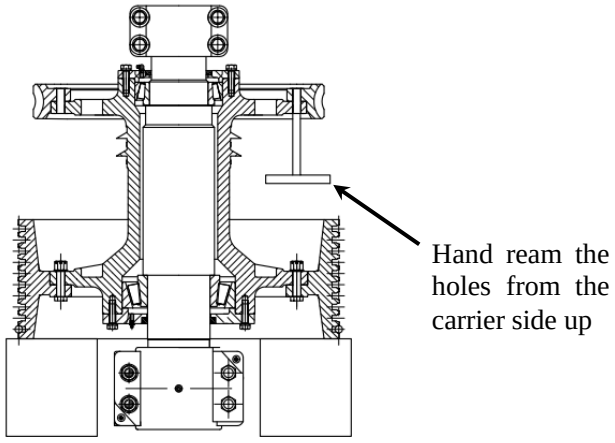


Figure 29 Install the worm gear

5. Clean the shavings and install the bolts M20X1.5X95 tapping into place with a hammer. Tighten M20x1.5 nuts to 260Nm (162 ft-lb) and install the split (Cotter) pins 4x45.
6. Hoist the carrier assembly into the bottom housing.

8.7.3 Backlash Adjustment

1. Insert, thread, and hand tighten the four bolts (M20×200). Using the torque wrench tighten the bolts M20x200 to 330Nm (343 ft-lb.). See Figure 30.

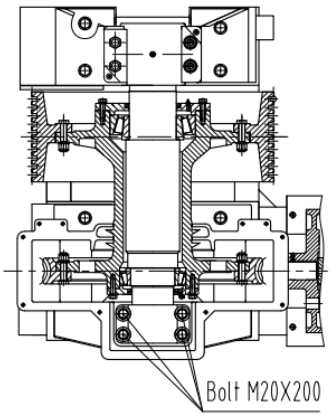


Figure 30 Backlash Adjustment

2. Spray or paint layout color on teeth, rotating the worm shaft in order to rotate Ring Gear clockwise and counter clockwise one complete revolution.
3. Make sure that the Contact Area account for 30% of the direction of the gear's width, and for 55% of the direction of the gear's height. See Figure 31.

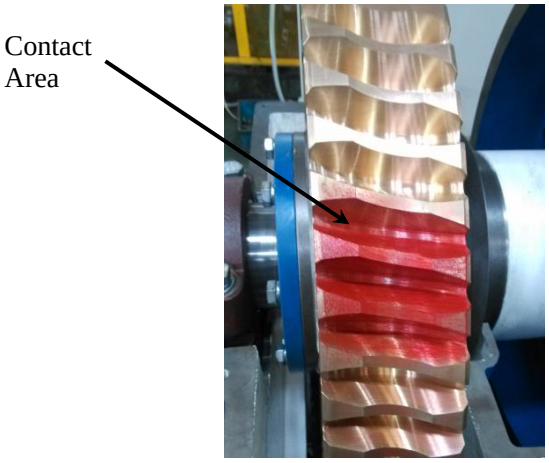


Figure 31 Worm gear contact area

4. If the Contact Area is to left, loosen the two bolts (M20×200) where the support bodies have a gap; install a bolt (M10) into the pin (A16X60) and pull out the pin; knock the shaft from right in order to the Contact Area move right. If the Contact Area is to right knock the shaft the opposite way. See Figure 30.
5. Tighten the four Nuts 24 to 580Nm (428 ft-lb.) and recheck the Contact Area. If it not correct, repeat steps 3-4. See Figure 32.

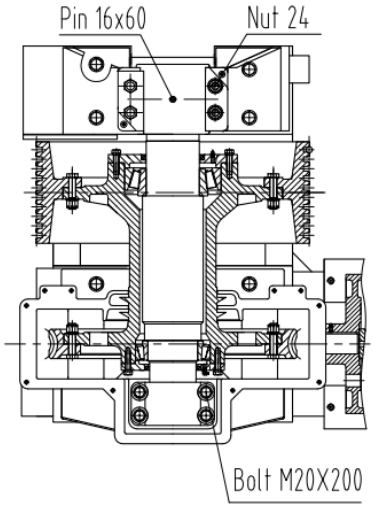


Figure 32 Backlash Adjustment (top view)

6. Put the magnetic base of the dial indicator to the gear case. See Figure 33.

7. With the dial indicator, Check for backlash between 0.2mm and 0.3mm by rotating the Ring gear (The gap is from the worm with the ring gear out of mesh to the worm go into mesh with the ring gear).
8. Record the backlash of 3 places evenly spaced (120° apart) around the ring gear.

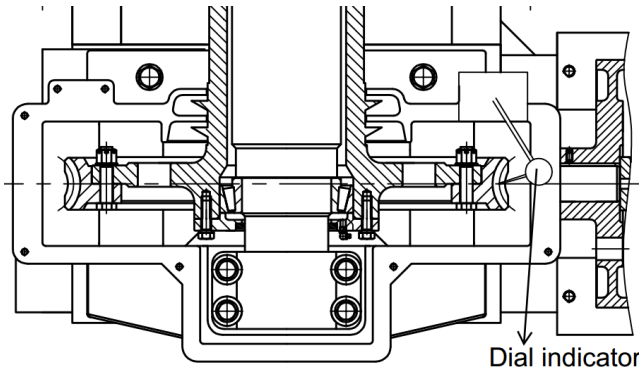


Figure 33 Measure the backlash

9. If the backlash is not in the range (0.2mm～0.3mm), loosen the four bolts M20×200 and four nuts M24 and add or subtract shims under both support bodies (A and B). See Figure 34.
10. Tighten the four bolts (M20×200) to 330Nm (343 ft-lb.) and four nuts M24 to 580Nm (428 ft-lb.). Recheck the backlash. If it is not within specified range, repeat step 9.
11. If the relative position of shaft and support body changed, through the hole in the support body drill a Φ16mm hole (60mm (2.75”) deep) into the shaft; ream the hole with the reamer.
12. Remove the iron filings from the hole.
13. Knock the pin (A16X60) into the support body.

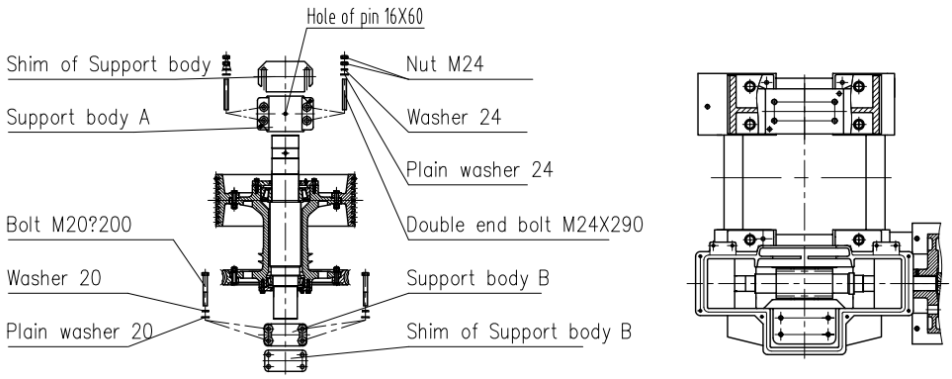


Figure 34 Install pin 16x60

14. Reinstall the gear case top. See Section 8.6.2 Sheave installation from step 11 to step 14.

15. Loosen the bolt M10x20 to turn the oil windows hood, then add about 15L of synthetic elevator oil.
16. Connect the mainline and test the machine.
17. Reinstall the ropes and rope guards. See Figure 20.

8.8 Bearing Replacement

WARNING! Please refer to the troubleshooting procedure first and make sure that the component is actually bad before performing this replacement procedure.

Required Tools & Materials:

Hoisting equipment

Bearing heater

Hex wrench: 4mm

Open end wrench: 18mm 24mm

M16 Eye bolt

Arm puller

3# General purpose lithium lubricating grease

8.8.1 Shaft bearing Replacement

8.8.1.1 Shaft Bearing removal instructions

1. Sling the sheave/carrier/worm gear assembly. Refer to section 8.6.1 Sheave removal, steps 1-8.
2. Remove the Pin 16X60 then remove the Support body A and B. See Figure 35.

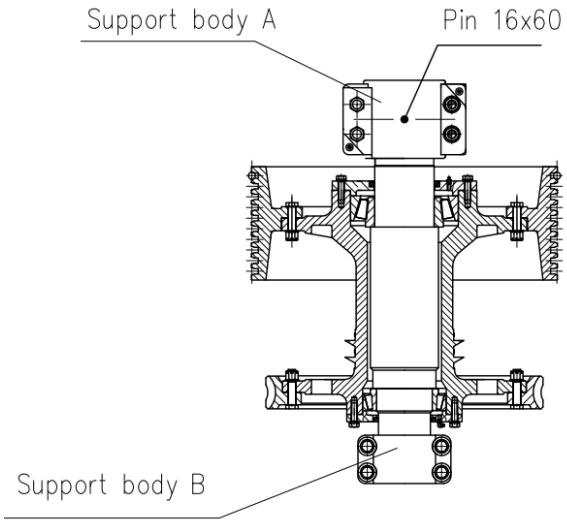


Figure 35 Remove support bodies

3. Remove the six Bolts (M16X55) and Washers (16) from the shaft through cover and the shaft back cover using an open end wrench (24mm). See Figure 36.
4. Remove the shaft through cover and shaft back cover using two bolts (M12x50) to push the covers free.

NOTE: When the two bolts (M12×50) contact the carrier, turn each one evenly to back the covers loose. Do not damage the seal.

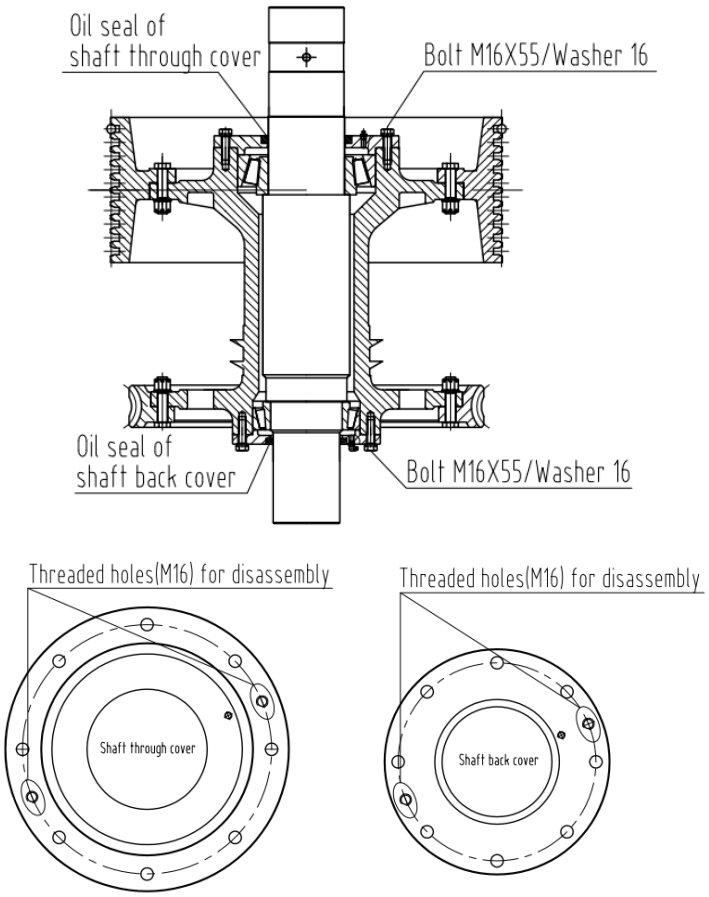


Figure 36: Remove shaft covers

5. Press the shaft from the carrier. See Figure 37.

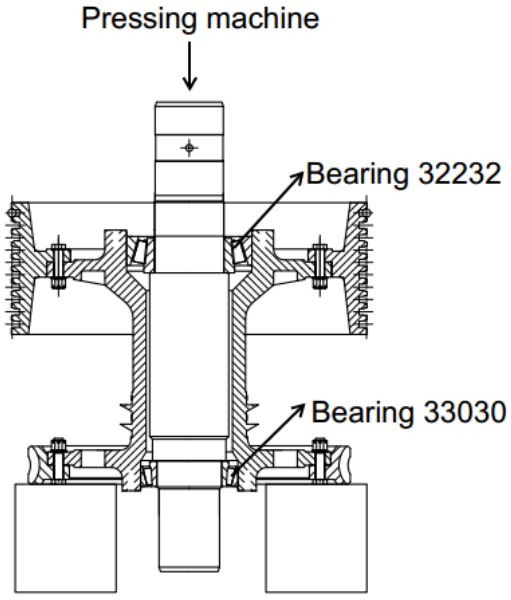


Figure 37 Shaft removal

6. Bearing 33030 will come out along with the shaft out of the carrier, bearing 32232 will remain in the carrier.
7. Remove both bearings with arm puller.
8. Install Eye Screw (M16) into the threaded hole on the shaft.
9. Remove the shaft.

8.8.1.2 Shaft Bearing installation instructions

1. Clean the shaft's mating surface with the bearing. Make sure there is no rust or greasy dirt.
2. Clean the inner hole of the carrier and apply grease (such as MOBILUX EP2) into the carrier (about 1L). See Figure 38.

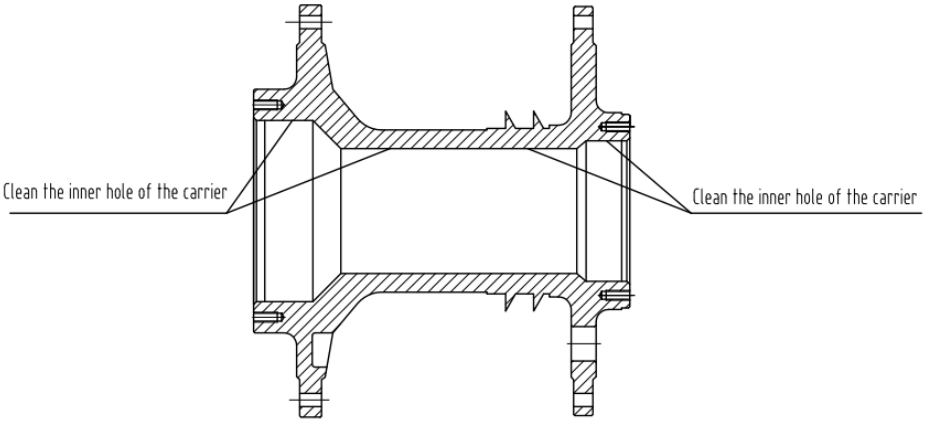


Figure 38 Clean inner hole of the carrier

3. Place the new bearing 32232 inner ring in or on the bearing heater. Heat it to about 80±15°C (176±59°F).
4. With a gloved hand, quickly slide the heated inner ring fully onto the shaft. See Figure 39.
5. When the bearing has cooled completely, spread ring amount of 3# General purpose lithium lubricating grease on the inside lane of the bearing (pack the bearing).

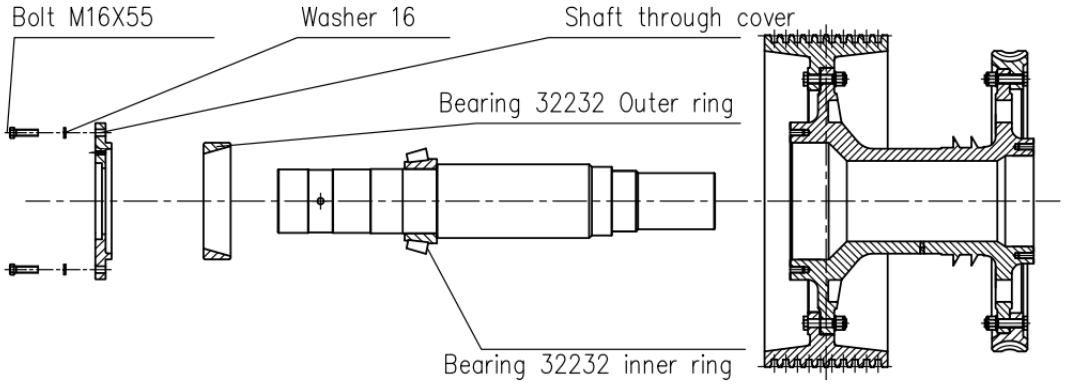


Figure 39 Install bearing 32232 inner ring

6. Install the assembly limit sleeve to the carrier using bolts M16x45, then move the shaft into the carrier. See Figure 40.

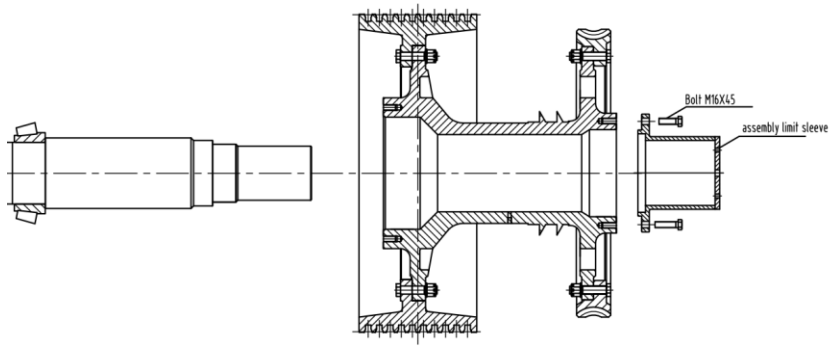


Figure 40 Install assembly limit sleeve

7. Install the bearing 32232 outer ring.
8. Install the shaft through cover and secure with bolts (M16x55). Torque to 180 Nm (133 ft-lb.).
9. Lift the sheave/shaft/ring gear assembly. Turn it so the sheave is on blocks.
10. Remove the assembly limit sleeve.
11. Place the new bearing 33030 inner ring in or on the bearing heater. Heat to about 80±15°C (176±59°F).
12. With a gloved hand, quickly slide the heated bearing inner ring fully onto the shaft.
13. When the bearing has cooled completely, spread ring amount of 3# General purpose lithium lubricating grease on the inside lane of the bearing (pack the bearing).
14. Install bearing 33030 outer ring, Shaft back cover, and shims. Secure with bolts (M16x55) tightened to 180Nm (133 ft-lb.). See Figure 41.

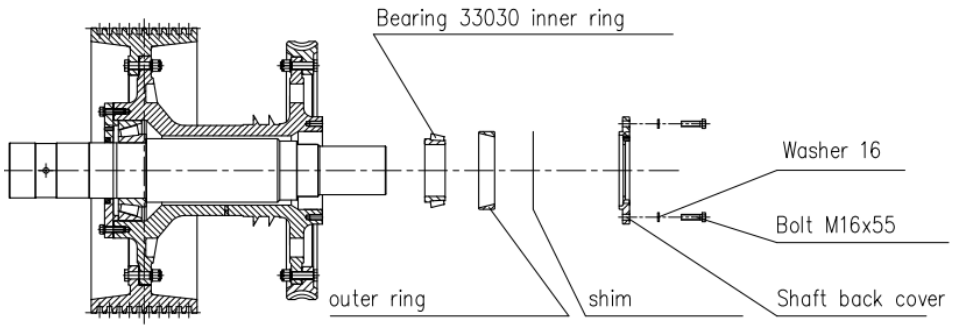


Figure 41 Bearing replacement

15. Check the force (10-15Nm) which is needed to make the shaft rotate. It should be 10-15Nm (7-11 ft-lb.).
16. Add or subtract the quantity of shims until the force is in range.
17. Hoist the carrier assembly into the bottom housing. Install Support body A and B.
18. Reassemble the machine. See Section 8.7.3 Backlash Adjustment, Steps 1-16.

8.8.2 Worm Bearing Replacement

8.8.2.1 Worm Bearing removal instructions

1. Remove the motor. See Section 8.3.1 Motor removal, steps1~6.
2. Drain the oil. Make sure the container can hold more than 15L (3.9 Gal).
3. Tighten the oil drain bolt.
4. Remove the brake system can refer to this manual Brake Replacement Methods of dis-assembly Step 1~3 and Brake Lining Replacement Methods of dis-assembly Step1~5.
5. Put down the brake arms.
6. Remove the Bolt M16X55 and washers 16 to take off the worm front cover. See Figure 42.

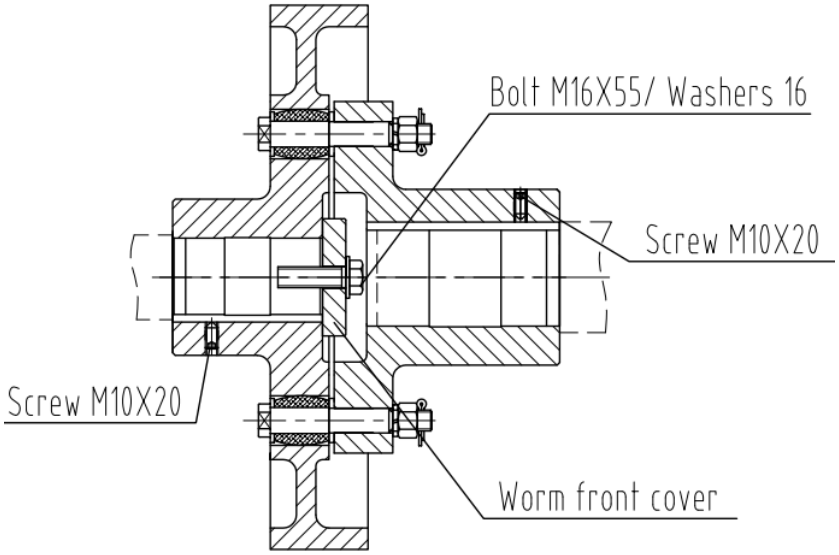


Figure 42 Remove Worm front cover

7. Remove the brake drum and put away the key by removing screw M10x20.
8. Remove the Bolt (M12x45) and the washer (12) on the worm through cover using the open end wrench (18mm), and remove the worm through cover. See Figure 43.

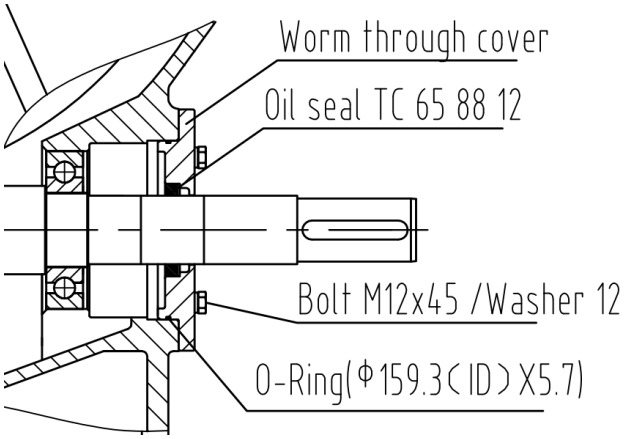


Figure 43 Remove the Worm through cover

9. Remove the butterfly screw M6X20 and Screw M5X12 (if so equipped), then remove the hand wheel cover. See Figure 44.
10. Remove the six Bolts (M16x80) and the washer (16) which are tighten the worm back cover by the open end wrench (24mm), remove the worm back cover.
11. Remove the round nut M60X2 using a 4mm hex wrench.

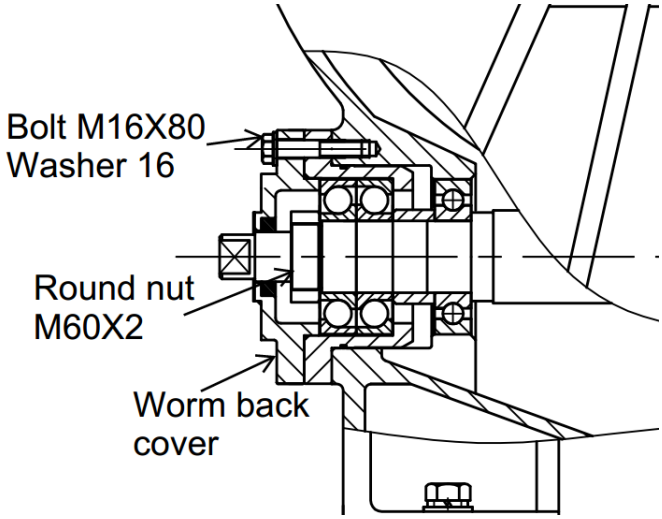


Figure 44 Worm Bearing removal

12. Use the two bolts (M16×50) into threaded holes to push the Bearing cover out. The two bearings (7313BEGAM) will come out along with the cover. See Figure 45.

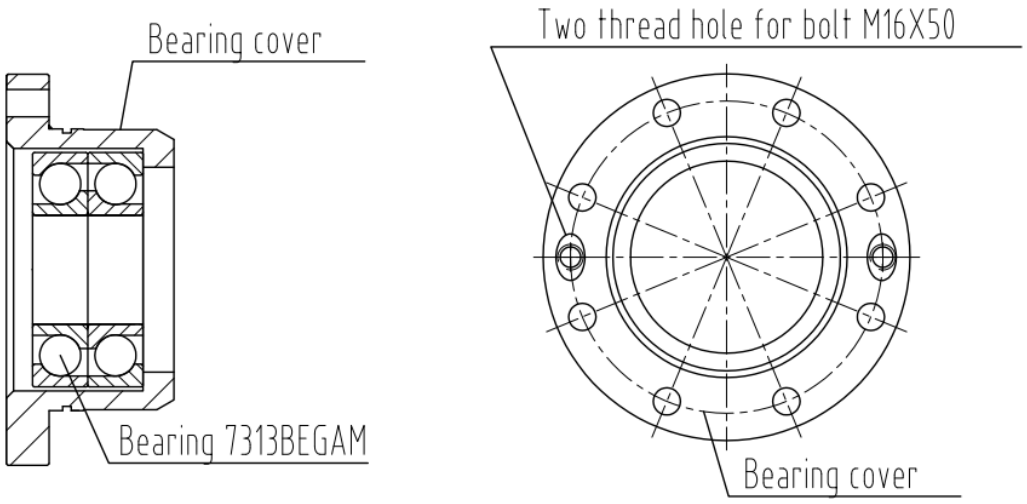


Figure 45 Bearing cover removal

13. Remove the worm shaft with bearing 6313CM, bearing spacer, and bearing 6314CM together. See Figure 46.

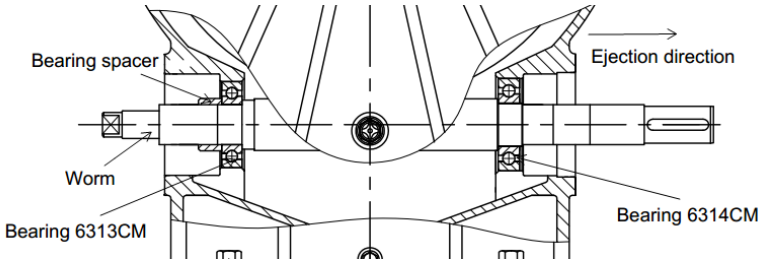


Figure 46 Worm shaft removal

14. Install an arm puller on the bearing, and remove the bearings. See Figure 47.

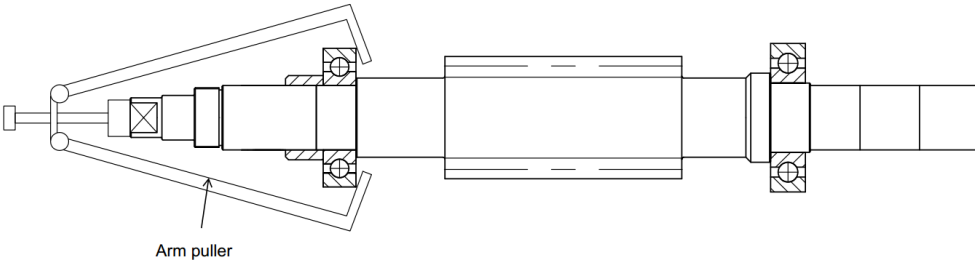


Figure 47 Worm Bearing removal

8.8.2.2 Worm Bearing installation instructions

1. Place the new bearings (6313CM and 6314 CM) in the heater, and heat bearings to about 80±15℃(176±60°F), then quickly slide the heated bearing fully onto the worm shaft. Note in Figure 46 which bearing goes on each end of the worm shaft.

NOTE: Do not wear gloves when do step 2~3.

2. When the bearings cooling to room temperature, install the worm into machine body.
3. Apply some 3# General purpose lithium lubricating grease into the new O-Ring (Φ154.3 (ID) X3.1), and install it onto the bearing cover.
4. Mount the cover to the back bearing bore.
5. Place the new bearings (7313BEGAM) in the heater, and heat bearing inner ring to about 80±15℃(176±60°F), then quickly slide the heated bearing fully onto the worm shaft (**face to face mounting**). See Figure 48.

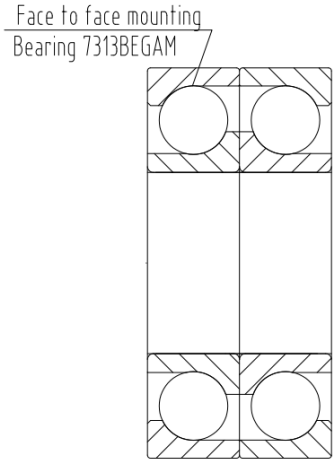


Figure 48 Face to face mounting

6. Use the round nut M60X2 to lock the two bearings (7313BEGAM) using a 4mm hex wrench.
7. Apply some 3# General purpose lithium lubricating grease into the new O-Ring (Φ139.4 (ID) X3.1), and install it onto the worm back cover.
8. Install the worm back cover using bolt M16X80 and lock washer 16. Do not fully tighten.
9. Install the hand wheel cover using butterfly bolt M6X20.
10. Apply some 3# General purpose lithium lubricating grease into the new O-Ring (Φ159.3 (ID) X5.7) and oil seal TC 65 88 12, and install it onto the worm front cover.
11. Install the Worm front cover using Bolt M12X45 and lock washer 12. Torque to 70 Nm (52 ft-lb.).
12. Press the brake drum into the worm shaft using a press machine; then install the worm end cover. Secure it with bolt (M16x55) and washer (16), note the position of the key way to install motor correctly.
13. Measure the radial travel movement of the brake pulley excircle and the axial gap of the worm shaft with dial indicator. The radial travel movement is no more than 0.1mm, the axial gap is no more than 0.1mm. Adjust the quantity of the shims at the back cover until the axial gap is within specification.

14. Measure the radial travel movement of the brake pulley ex-circle with dial indicator. The radial travel movement is no more than 0.1mm. See Figure 49.

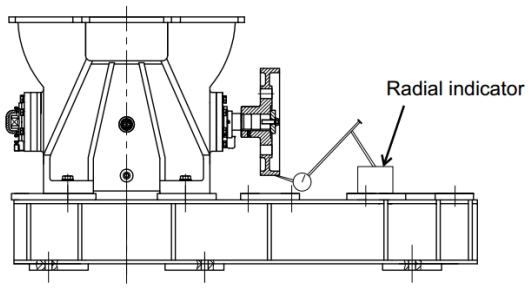


Figure 49 Measure the radial travel movement

15. Install the Motor coupling and Motor assembly. See Section 8.3.2 Motor installation.
16. Connect the mainline and test the machine.

8.9 O-Rings and Seal Replacement

WARNING! Please refer to the troubleshooting procedure first and make sure that the component is actually bad before performing this replacement procedure

If the position of installing bearing leaks oil, the O-Rings and Seal must be examined and replacement.

Required Tools & Materials:

Open end wrench: 18mm 24mm

3# General purpose lithium lubricating grease

8.9.1 Shaft O-Ring and Seal Replacement

1. If oil leak happened at the shaft through cover or shaft back cover (Inside):

a) Remove the Shaft through cover or Shaft back cover. See Section 8.6.1 Sheave removal, steps 1-7 and Section 8.8.1.1 Shaft bearing removal, steps 2-4.

b) Remove the oil seal then apply some 3# General purpose lithium lubricating grease into the new seal (SCΦ160XΦ190X15), install it into the Shaft through cover. See Figure 50.

c) Remove the oil seal then apply some 3# General purpose lithium lubricating grease into the new seal (SCΦ140XΦ170X14), install it into the Shaft back cover.

d) Reinstall the cover. See Section 8.8.1.2 Shaft bearing installation, steps 8 or 14 and 15-18.

2. If oil leak happened at the shaft through cover or shaft back cover (Outside):

a) Remove the Shaft through cover or Shaft back cover. See Section 8.6.1 Sheave removal, steps 1-7 and Section 8.8.1.1 Shaft bearing removal, steps 2-4.

b) Remove the old O-ring then apply some 3# General purpose lithium lubricating grease into the new O-ring (Φ279.4 (ID) X5.7), install it into Shaft through cover.

c) Remove the old O-ring then apply some 3# General purpose lithium lubricating grease into the new O-ring (Φ224.3 (ID) X5.7), install it into Shaft back cover.

d) Reinstall the cover. See Section 8.8.1.2 Shaft bearing installation, steps 8 or 14 and 15-18.

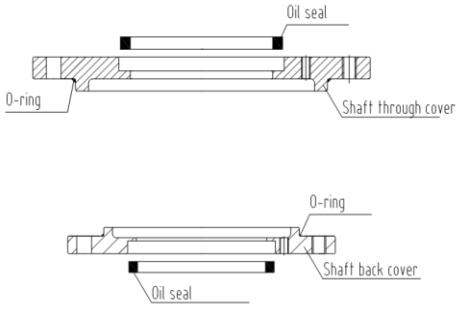


Figure 50 O-ring and seal replacement (on the shaft)

8.9.2 Worm Shaft O-Ring and Seal Replacement

1. **If oil leak happened at the worm back cover:**

a) Drain the oil. Make sure the container can hold more than 15L (3.9 Gal). Tighten the oil drain bolt.

b) Remove the worm back cover. See Section 8.8.2.1 Worm bearing removal.

c) Remove the old seal and O-ring. Apply some 3# General purpose lithium lubricating grease into the new O-Ring (Φ139.4 (ID) X3.1) and Oil seal, and install it onto the worm back cover. See Figure 51.

d) Replace the worm back cover. See Section 8.8.2.2 Worm bearing installation.

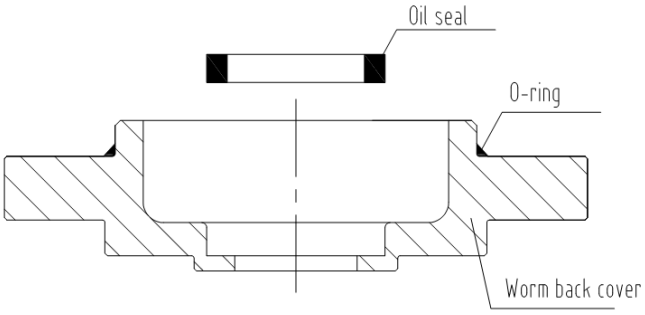


Figure 51 O-ring and seal replacement (on the worm)

2. **If oil leak happened at the worm through cover (Inside):**

a) Remove the Through cover. See Section 8.8.2.1 Worm bearing removal.

b) Remove the old seal then apply some 3# General purpose lithium lubricating grease into the new seal (TCΦ65XΦ88X12). Install it into the through cover.

c) Install the Through cover. See Section 8.8.2.2 Worm bearing installation.

3. **If oil leak happened the worm through cover or bearing cover (Outside):**

a) Remove the Through cover or bearing cover. See Section 8.8.2.1 Worm bearing removal.

b) Remove the old O-ring then apply some 3# General purpose lithium lubricating grease into the new O-ring(Φ159.3 (ID) X5.7), install it into the Worm through cover. See Figure 52.

c) Remove the old O-ring then apply some 3# General purpose lithium lubricating grease into the new O-ring(Φ154.3 (ID) X5.7), install it into the Bearing cover.

d) Install the Through cover and Bearing cover refer to this manual Worm Bearing Replacement.

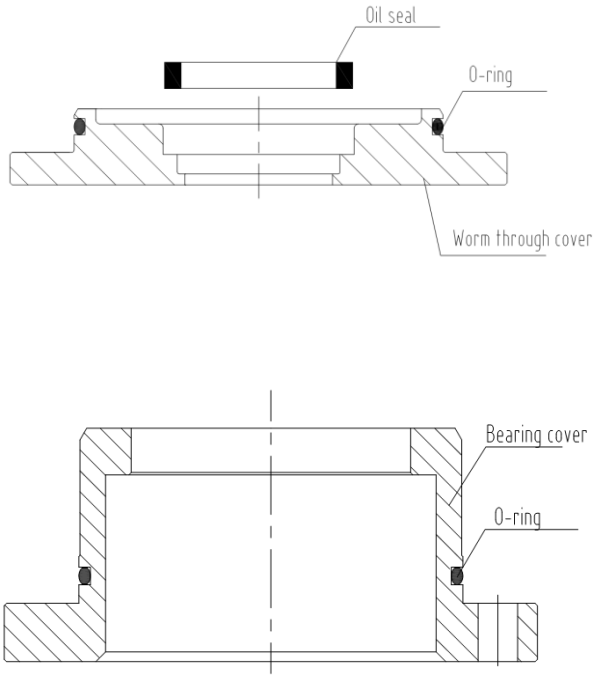


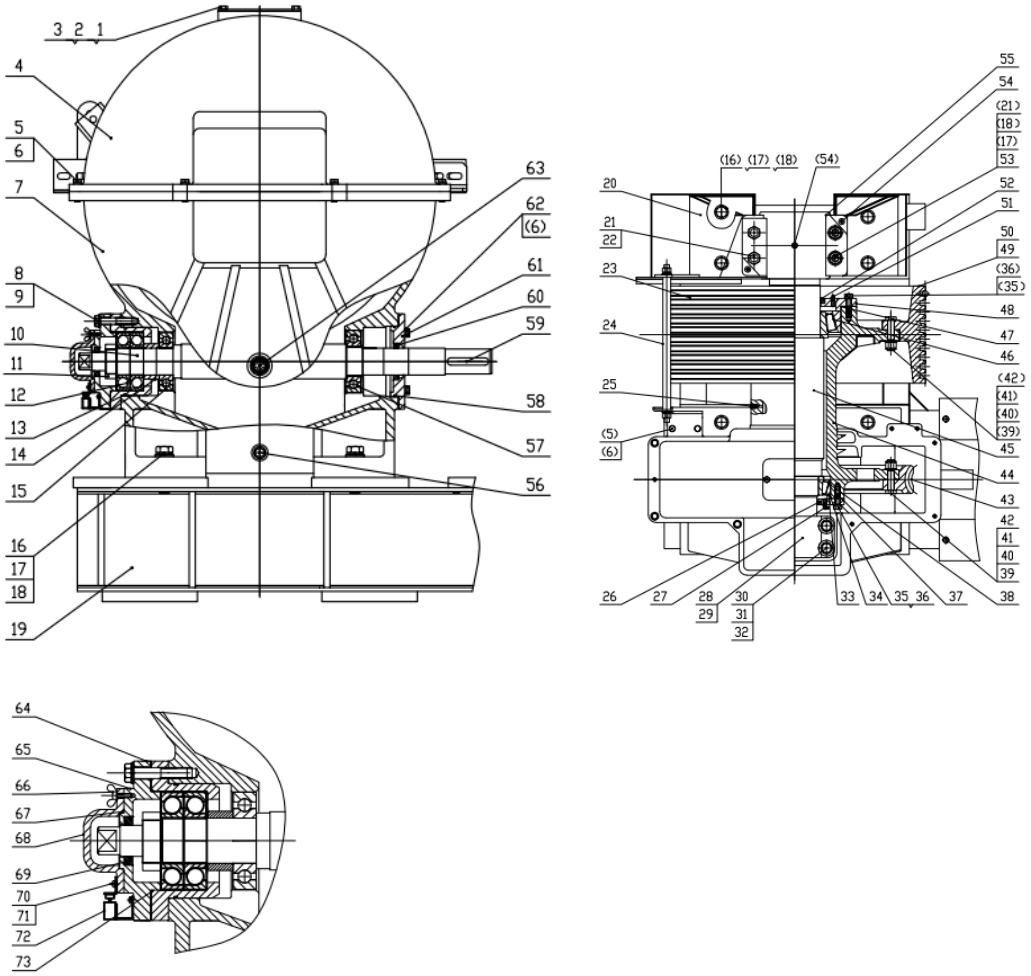
Figure 52 O-ring and seal replacement (on the worm)

9.0 Troubleshooting chart

WARNING! The proper maintenance of the gear machines requires adequately trained qualified personnel and proper tools.

Faults	Possible causes	Possible solutions
Motor not working	a. Incorrect inverter wiring	Verify the inverter wiring to make sure it is done correctly.
	b. Incorrect inverter parameters	Verify the inverter parameters.
	b. Incorrect encoder wiring	Verify the encoder wiring is correct.
	c. Bad encoder alignment	Verify the inverter alignment procedure is performed correctly.
	d. Loose encoder mounting	Tighten the encoder mounting screws
	e. Bad encoder	Replace the encoder.
	f. Bad brakes	Verify the brake operations
	g. Bad motor contactor	Replace motor contactor.
Abnormal noise or vibration	a. Brake friction noise	a. Verify brake control currents. b. Verify brake strokes.
	b. Bad grounding	Verify that earth ground is good.
	c. Bad inverter parameters	Make sure inverter parameters are correct
	d. Bad encoder feedbacks	Check grounding and shielding.
	e. Bad bearing	Replace the machine or bearing.
Electrical shocks	a. Bad grounding	Make sure that ground is solid.
	b. Bad humidity level	Make sure the humidity is within the specs.
	c. Broken cable insulation	Replace the cable.
Brake not working	a. Oil or grease on brake disk	Remove the oil and change the brake lining.
	b. Incorrect brake stroke	Readjust the brake stroke to factory standard
	c. Brake lining wear out to much	Check the brake lining thickness and readjust the brake stroke or replace the brake
	d. Bad brake coils	Replace the brake assembly
	e. Incorrect counterweight percentage	Verify counterweight percentage
	f. Noise absorber height is too big	Reduce the absorber height
Brake switch Not working	a. Bad wiring	Verify brake wiring
	b. The position of brake switch not installed correctly	Readjust the brake switch position
	c. Bad brake switch	Replace the switch
Motor is too hot	a. Elevator is overloaded	Verify elevator loading and duty cycle
	b. Incorrect counterweight percentage	Verify counterweight percentage

10.0 Traction Machine Assembly



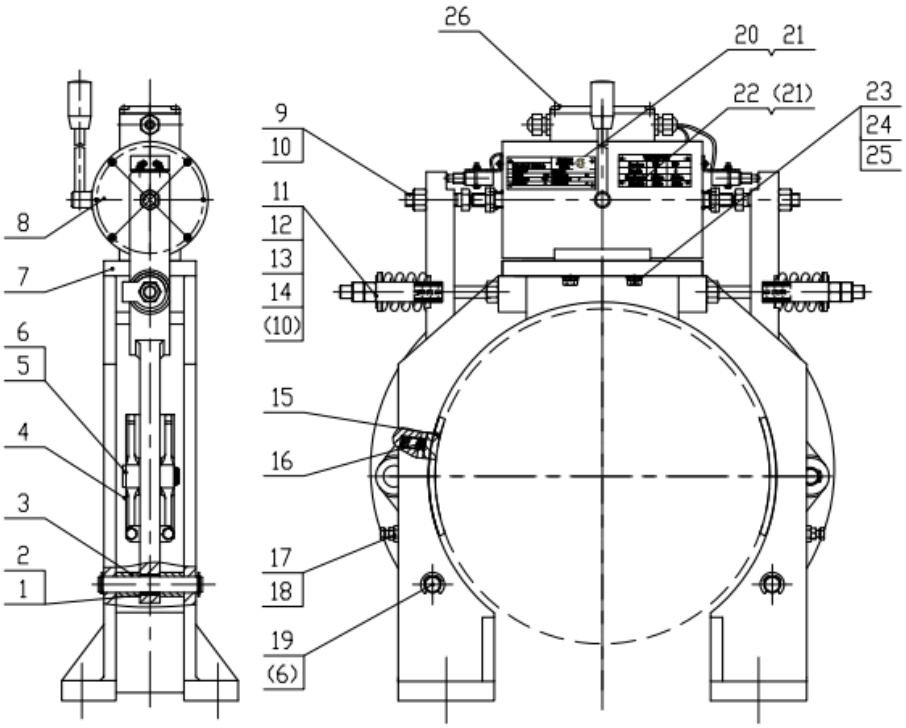
* Indicates a non-stock part

No.	Torin Drive Part No.	Description
1	*	Bolt M10X20
2	*	Oil window cover
3	*	Gasket of Oil window cover
4	*	Top gear case
5	*	Screw M12X45
6	*	Washer 12
7	*	Machine body
8	*	Bolt M16X80
9	*	Spring lock washer 16
10	*	Worm
11	*	Precision Round nut M60X2
12	*	Bearing SKF 7313 BEGAM

13	*	O-ring NOK φ154.3 (ID)X5.7
14	*	Bearing spacer
15	*	Bearing NSK 6313CM
16	*	Bolt M24X100
17	*	Washer 24
18	*	Plain washer 24
19	*	Machine frame
20	*	Pedestal
21	*	Nut 24
22	*	Double end bolt M24X290
23	*	Sheave
24	*	Rope retainer
25	*	Set screw M10X20
26	*	NOK Oil seal SC 140 170 14
27	*	90°Grease fitting M10X1
28	*	Support body B
29	*	Shim for Support body B
30	*	Bolt M20X200
31	*	Washer 20
32	*	Plain washer 20
33	*	Shim for shaft
34	*	NOK O-ring φ224.3 (ID) X5.7
35	*	Bolt M16X55
36	*	Washer 16
37	*	Shaft back cover
38	*	Bearing NSK HR33030J
39	*	Bolt M20X1.5X95
40	*	Nut M20X1.5
41	*	Split pin φ4x45
42	*	Washer 20
43	*	Worm gear
44	*	Carrier
45	*	Shaft
46	*	Bearing NSK HR32232J
47	*	NOK O-ring φ279.4 (ID) X5.7
48	*	Shaft through cover
49	*	Nameplate for sheave

50	*	Rivets 3x6
51	*	Grease fitting M10X1
52	*	NOK Oil seal SC 160 190 15
53	*	Shim for support body A
54	*	Pin 16x60
55	*	Support body A
56	*	Oil plug
57	*	Bearing NSK 6314CM
58	*	NOK O-ring φ159.3 (ID)X5.7
59	*	Key 18X100
60	*	NOK Oil seal TC 65 88 12
61	*	Worm through cover
62	*	Bolt M12X45
63	*	Grease fitting M33X1.5
64	*	Bearing cover
65	*	Worm back cover
66	*	Butterfly screw M6X20
67	*	NOK O-ring φ79.4 (ID) X3.1
68	*	Hand wheel cover
69	*	NOK Oil seal TC 45 70 12
70	*	Screw M5X12
71	*	Washer 5
72	*	Hand wheel switch
73	*	NOK O-ring φ139.4 (ID) X3.1

11.0 Brake Assembly

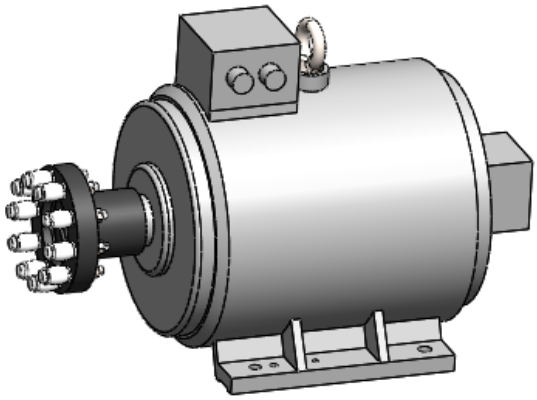


* Indicates a non-stock part

No.	Torin Drive Part No.	Description
1	*	Brake arm
2	*	Copper bush
3	*	Transition sleeve
4	*	Brake shoe
5	*	Pin A
6	*	Circlips for shaft 20
7	*	Brake pedestal
8	*	Brake DZE-14E
9	*	Limit bolt M8X12
10	*	Nut 16
11	*	Main spring
12	*	Spring cover
13	*	Double end bolt M16 X 222
14	*	Scale plate
15	*	Brake band
16	*	Press spring
17	*	Bolt M8X35
18	*	Nut 8
19	*	Pin B

20	*	Nameplate for brake
21	*	Rivets for nameplate
22	*	Spring compression identification

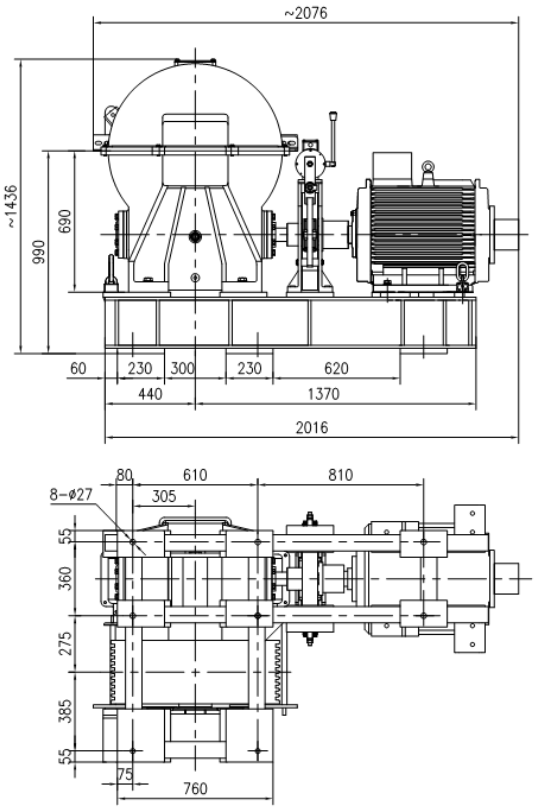
12.0 Induction Motors & Encoders

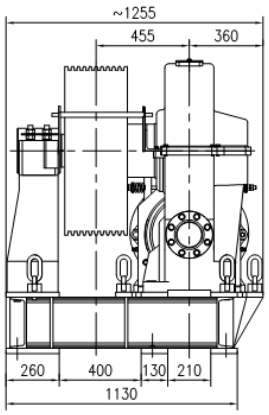


No.	Item	Description
1	PMNC-8035-HV-R	75 HP motor for TGD4-8035. Coupling installed, 480V
2	PMNC-12020-HV-R	75 HP motor for TGD4-12020. Coupling installed, 480V
3	PMNC-20010-HV-R	75 HP motor for TGD4-20010. Coupling installed, 480V
	PMNC-EC001	Elastic coupling insert for TGD1/2/3/4

No.	Item	Description
1	PEN004	HS35F-100-R2-SS-2048-ABZC-28V/V-TB BEI Encoder
2	PEN004A	HS35R2048H37X36 Dynapar Encoder
3	PEN009	Encoder Cap for TGD1/2/3/4, with Hardware

13.0 MECHANICAL DIMENSIONS





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