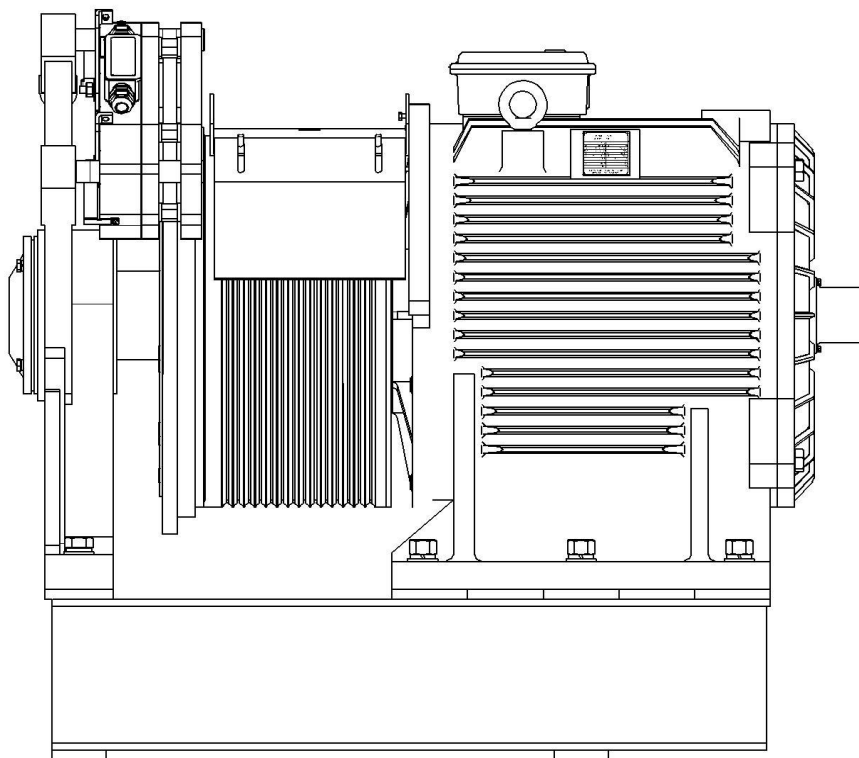


TGL1/2/2A/3

Gearless PMS Elevator Traction Machine

Complete Operation and Service Manual



SUZHOU TORIN DRIVE EQUIPMENT CO., LTD.

IMPORTANT LIMITED LIABILITY AND WARRANTY NOTICE -
PLEASE READ:
REVISED AND EFFECTIVE SEPTEMBER 1, 2014

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To obtain the benefit of TDI's express limited warranty, please contact Warranty Claim Department, TDI International, 7598 A E Beaty Drive, Suite 102, Bartlett, TN 38133 as soon as possible after a defect in the machine's material or workmanship has been discovered. Please note: you must contact TDI concerning a machine covered by this express limited warranty before you attempt any repair work. Any unauthorized disassembly, repair, or reassembling performed by you will void TDI's responsibilities under this express limited warranty.

- **Express Limited Warranty - What TDI Will Do:**

Machines that are covered by this express limited warranty will be repaired or replaced, at TDI's option, during the warranty period. TDI will cover the expenses relating to the repair or replacement of its machines under this express limited warranty. However, TDI shall not be liable for direct, indirect, proximate, incidental, economic, and/or consequential damages relating in any way to efforts by TDI to repair or replace the machines it sells to you pursuant to this express limited warranty. Specifically, TDI shall not be liable for property damage; loss of profits; labor costs; downtime; legal costs; or any other damages measurable in money that arise from or relate in any way to TDI's efforts to repair or replace the machines it sells to you pursuant to this express limited warranty. If, after two (2) attempts at repair or replacement during the warranty period, the machine defect in material or workmanship persists, then you may elect to receive a refund of your original purchase price for the machine.

(Revised Full/PDF Doc Version of Express Limited Warranty)

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1.0 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.

1.1 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.

1.2 General Safety

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

1.3 Electrical Safety

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

1.4 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.

1.5 Mainline Disconnect

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

1.6 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.

1.7 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**.

1.9 Product Specific Warnings



The TGL1/2/2A/3 Machine **MUST** be balanced during hoisting. See Hoisting in the Arrival 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.

2.0 Arrival of the Equipment

2.1 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.

2.2 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.**

2.3 Hoisting

TGL machines can be lifted by using a combination of hooks, chains and slings designed to safely carry the weight of the machine. See Figures 1-4.

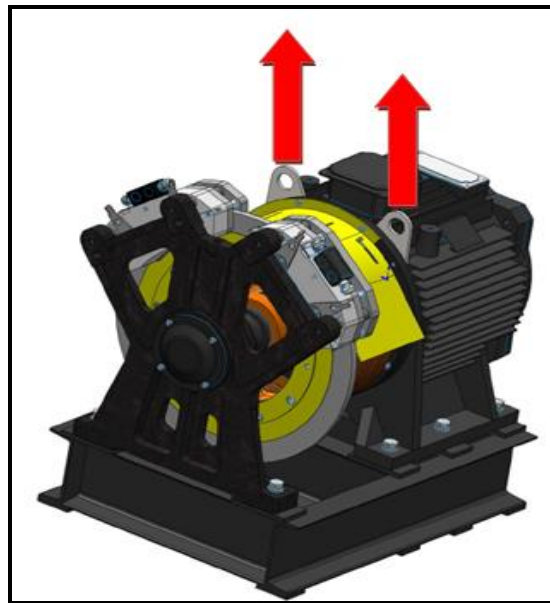


Figure 1: TGL1 Machine Recommended Hoisting Methods

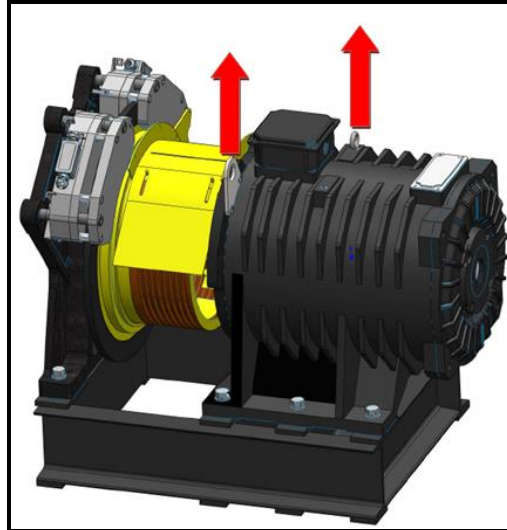


Figure 2: TGL2 Machine Recommended Hoisting Methods

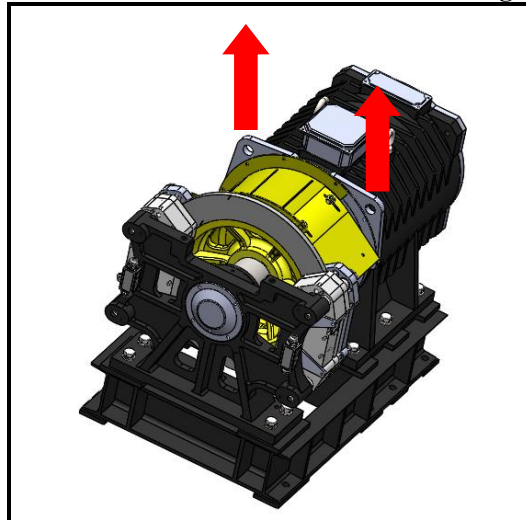


Figure 3: TGL2A Machine Recommended Hoisting Methods

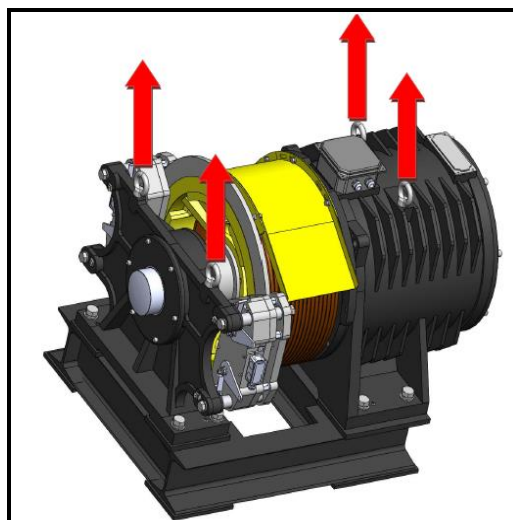


Figure 4: TGL3 Machine Recommended Hoisting Methods

3.0 Application

3.1 Overview

The TGL1/2/2A/3 Machine is a synchronous permanent magnet gearless machine designed for elevators. Its configuration allows speeds up to 1600 fpm (TGL2) and an elevator capacity up to 8000 lbs with 2 to 1 roping (TGL3) and single wrap arrangement.

The TGL1/2/2A/3 machine brake system uses two independent disc brakes: normal brake and emergency brake.

3.2 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.

3.3 Environmental Specifications

Operating ambient temperature: 0 C to 50 C

Storage temperature: 0 C to 60 C

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

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

3.4 Mechanical Specifications

- Maximum Shaft Load: up to 34859lbs (155kN) for TGL1/2/2A
up to 89984lbs (400kN) for TGL3
- Maximum Speed: up to 800fpm for 2:1roping (TGL1/2)
up to 700 fpm for 2:1roping (TGL3)
up to 1600fpm for 1:1roping (TGL2)
up to 1400fpm for 1:1roping (TGL3)
up to 700 fpm for 1:1roping (TGL2A)
- Maximum Capacity: up to 3500 lbs @ 45% Cwt for 2:1 roping (TGL1)
up to 5000 lbs @ 45% Cwt for 2:1 roping (TGL2)
up to 8000 lbs @ 45% Cwt for 2:1 roping (TGL3)
up to 2500 lbs @ 45% Cwt for 1:1 roping (TGL2)
up to 4000 lbs @ 45% Cwt for 1:1 roping (TGL2A/TGL3)
- Designed for 180 starts per hour at 50% elevator duty cycle
- Sheave Diameter: 20.47inch (520mm) for TGL2/2A (1:1 roping)
22.05inch (560mm) for TGL1/2(2:1 roping)
27.56inch (700mm) for TGL3
- Rope Size: 0.5inch (12.7mm) for TGL1/2/2A
0.625inch (16mm) for TGL3
- Lubrication: OEM is Chang Cheng BME
Equivalent is Shell EP2 or any quality EP2 grease
- Maximum Power: Up to 54.9 hp (40.9 kW) for TGL1
Up to 78.4 hp (58.4 kW) for TGL2
Up to 52.1 hp (38.8 kW) for TGL2A
Up to 109.8 hp (81.8 kW) for TGL3
- Motor Voltage: 20-poles/340VAC (suitable for 460VAC inverter drives)
20-poles/145VAC (suitable for 208VAC inverter drives)
- TGL1/2 Normal and Emergency Brake Model Number PZD300
Brake Stroke: 0.016” – 0.020” (0.4 - 0.5mm)
Pick Voltage/Current: 110VDC/2.3A
Hold Voltage/Current: 55VDC/1.15A
- TGL2A/3 Normal and Emergency Brake Model Number PZD360
Brake Stroke: 0.018” – 0.022” (0.45 - 0.55mm)
Pick Voltage/Current: 110VDC/2.2A
Hold Voltage/Current: 55VDC/1.1A

3.5 Detailed Machine Specifications

Table 1: Detailed Machine Specifications

PM Gearless Machines For Single Wrap Applications

Model Number		TGL1-3550	TGL1-3570	TGL1-3580
Roping		2:1	2:1	2:1
Elevator capacity	lbs	Up to 3500	Up to 3500	Up to 3500
Elevator speed	fpm	500	700	800
Sheave diameter./rope size/ grooves	Inch	22.05/0.5/14grooves	22.05/0.5/14grooves	22.05/0.5/14grooves
Rated power	hp	34.3	48.2	54.9
Rated torque	ft-lbs	1040	1040	1040
Acceleration torque	ft-lbs	2600	2600	2600
Rated RPM	rpm	173	243	277
Rated amps	A	50	69	79
Rated voltage (+/-5%)	V	340	340	340
Rated frequency	Hz	28.8	40.5	46.2
Max. allowable amps	A	6 x I _N	6 x I _N	6 x I _N
Total moment of inertia	lb-ft ²	390	390	390
Min. Normal brake torque	ft-lbs	1508	1508	1508
Min. Emergency brake torque	ft-lbs	2002	2002	2002
Max. shaft load	lbs	34859	34859	34859

PM Gearless Machines For Single Wrap Applications

Model Number		TGL2 (1:1) -3535-HV	TGL2 (1:1) -3535-LV	TGL2 (1:1) -3550-HV	TGL2 (1:1) -3550-LV	TGL2 (1:1) -3570-HV	TGL2 (1:1) -3570-LV
Roping		1:1		1:1		1:1	
Elevator capacity	lbs	Up to 3500	Up to 3500	Up to 3500	Up to 3500	Up to 3500	Up to 3500
Elevator speed	fpm	350	350	500	500	700	700
Sheave diameter./rope size/ grooves	Inch	20.47/0.5/8grooves		20.47/0.5/8grooves		20.47/0.5/16grooves	
Rated power	hp	22.7		33		45.6	
Rated torque	ft-lbs	1825		1825		1825	
Acceleration torque	ft-lbs	4563		4563		4563	
Rated RPM	rpm	65.4		93		131	
Rated amps	A	42	87	56	121	76	173
Rated voltage (+/-5%)	V	300	146	320	145	320	140
Rated frequency	Hz	10.9		15.5		21.8	
Max. allowable amps	A	6 x I _N		6 x I _N		6 x I _N	
Total moment of inertia	lb-ft ²	441		441		441	
Min. Normal brake torque	ft-lbs	2154		2154		2154	
Min. Emergency brake torque	ft-lbs	2860		2860		5860	
Max. shaft load	lbs	34869		34869		34869	



PM Gearless Machines For Single Wrap Applications

Model Number		TGL2-5050		TGL2-5070		TGL2-5080	
Roping		2:1	1:1	2:1	1:1	2:1	1:1
Elevator capacity	lbs	Up to 5000	Up to 2500	Up to 5000	Up to 2500	Up to 5000	Up to 2500
Elevator speed	fpm	500	1000	700	1400	800	1600
Sheave diameter./rope size/ grooves	Inch	22.05/0.5/16grooves		22.05/0.5/16grooves		22.05/0.5/16grooves	
Rated power	hp	49.0		68.8		78.4	
Rated torque	ft-lbs	1485		1485		1485	
Acceleration torque	ft-lbs	4455		4455		4455	
Rated RPM	rpm	173		243		277	
Rated amps	A	74		98.5		113	
Rated voltage (+/-5%)	V	340		340		340	
Rated frequency	Hz	28.8		40.5		46.2	
Max. allowable amps	A	6 x I _N		6 x I _N		6 x I _N	
Total moment of inertia	lb-ft ²	441		441		441	
Min. Normal brake torque	ft-lbs	2154		2154		2154	
Min. Emergency brake torque	ft-lbs	2860		2860		5860	
Max. shaft load	lbs	34869		34869		34869	

PM Gearless Machines For Single Wrap Applications

Model Number		TGL2A-4035	TGL2A-4050	TGL2A-4070
Roping		1:1	1:1	1:1
Elevator capacity	lbs	Up to 4000	Up to 4000	Up to 4000
Elevator speed	fpm	350	500	700
Sheave dia./rope size/grooves	Inch	20.47/0.5/9 grooves	20.47/0.5/9 grooves	20.47/0.5/16grooves
Rated power	hp	26.0	37.0	52.1
Rated torque	ft-lbs	2086	2086	2086
Acceleration torque	ft-lbs	2.1x I _N	2.1x I _N	2.1x I _N
Rated RPM	rpm	65.4	93	131
Rated amps	A	48	64	85
Rated voltage (+/-5%)	V	300	320	320
Rated frequency	Hz	10.9	15.5	21.8
Max. allowable amps	A	6 x I _N	6 x I _N	6 x I _N
Total moment of inertia	lb-ft ²	438	438	450
Min. Normal brake torque	ft-lbs	3025	3025	3025
Min. Emergency brake torque	ft-lbs	4302	4302	4302
Max. shaft load	lbs	40000	40000	40000

PM Gearless Machines For Single Wrap Applications

Model Number		TGL3-8050		TGL3-8060		TGL3-8070	
Roping		2:1	1:1	2:1	1:1	2:1	1:1
Elevator capacity	lbs	Up to 8000	Up to 4000	Up to 8000	Up to 4000	Up to 8000	Up to 4000
Elevator speed	fpm	500	1000	600	1200	700	1400
Sheave dia./rope size/grooves	Inch	27.56/0.625/16grooves		27.56/0.625/16grooves		27.56/0.625/16grooves	
Rated power	hp	78.7		94		109.8	
Rated torque	ft-lbs	2970		2970		2970	
Acceleration torque	ft-lbs	10000		10000		10000	
Rated RPM	rpm	139		166		194	
Rated amps	A	127		148		178	
Rated voltage (+/-5%)	V	350		350		350	
Rated frequency	Hz	27.8		33.2		38.8	
Max. allowable amps	A	6 x I _N		6 x I _N		6 x I _N	
Total moment of inertia	lb-ft ²	1417		1417		1417	
Min. Normal brake torque	ft-lbs	4300		4300		4300	
Min. Emergency brake torque	ft-lbs	4930		4930		4930	
Max. shaft load	lbs	89984		89984		89984	

4.0 Machine Overview

The following is a list of major components of the TGL Machine. Along with a description of their functions, there is an overview of some of the critical adjustments and maintenance information. See Installation and Maintenance in detail.

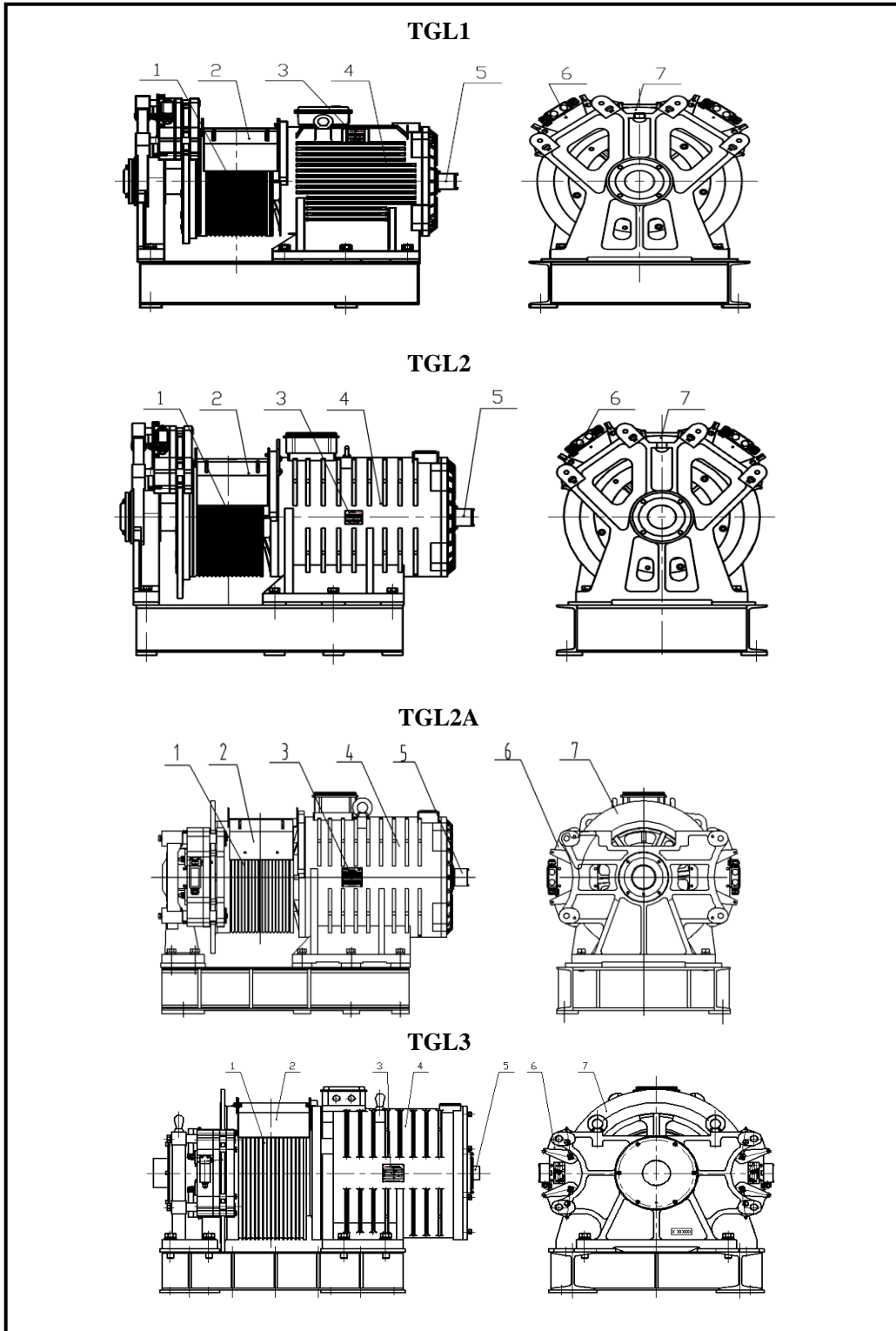


Figure 5: TGL Machine Assembly

1. **Sheave** - A grooved sheave is connected directly to the output shaft. The grooves provide the proper coefficient of traction between the sheave and the hoist ropes.
2. **Guard** - Keeps the ropes out of touch after rope installation.
3. **Nameplate** – Show the machine rated data and manual factory serial number information.
4. **PMS Motor** - The part is used to provide the necessary torque and speed to move the elevator in operation.
5. **Encoder** - This device is directly coupled to the main shaft of the hoisting motor. It is provided to give the absolute speed feedback of the hoist motor to the inverter drive system and to the elevator controller.
6. **Brake** - The electromechanical device is used to prevent the elevator from moving when the car is at rest.
7. **Brake Disc** - The smooth surfaced disc is connected to the main shaft. When the brake is energized, the brake is released from the brake disc.

5.0 Installation

5.1 Motor Connection

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



Do not connect motor directly to the three-phase power. It may damage the motor.

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.



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.

5.2 Brake Connection

The power terminal of emergency brake is EBK+ (positive pole), EBK-(negative pole), and the power terminal of normal brake is NBK+ (positive pole), NBK-(negative pole). See Figure 6.

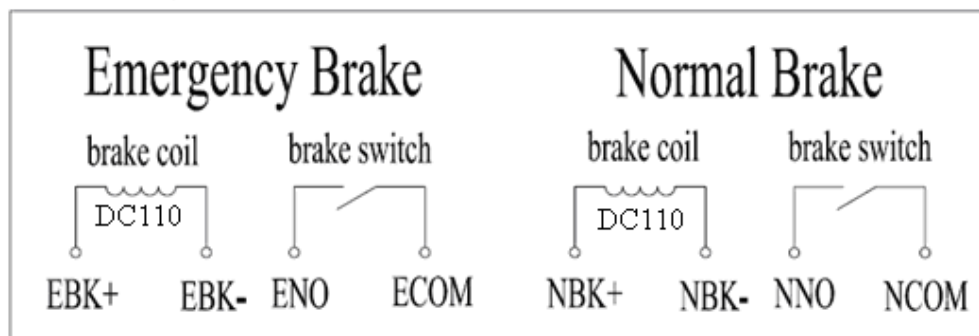


Figure 6: Normal & Emergency Brake Wiring

There are two microswitches installed in the brakes that are used to feed back the action of the brake, one is for emergency brake (ENO, ECOM normally opened contact) and another is for normal brake (NNO, NCOM normally opened contact). User can connect it according to your control system requests.

5.3 Absolute Encoder Connection

These machines are supplied with Heidenhain Endat absolute encoder ECN1313 with sub D 15-pin connector. The sine/cosine incremental resolution is 2048 pulses per revolution. See Figure 7.

Encoder Connect Cable

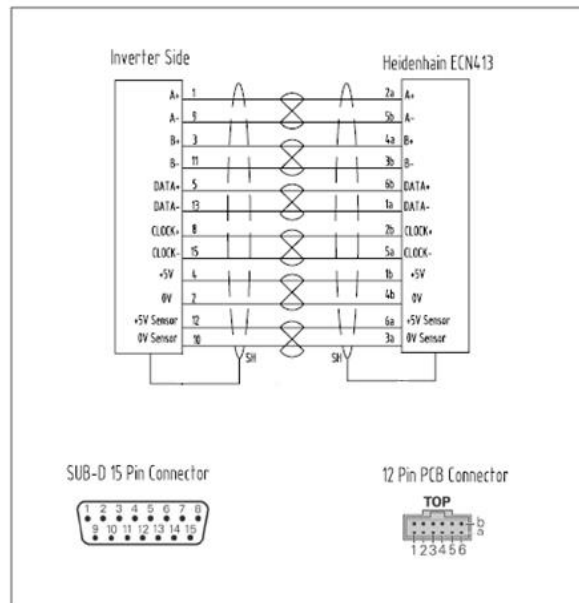


Figure 7: Encoder Connections

6.0 Adjustments

6.1 Brake Stroke Adjustment



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

Proper brake operations with regard to loading **MUST** be verified before anyone is allowed to ride on the platform.



If the brake lining wears out, the brake stroke will increase. If the brake stroke is $\geq 1\text{mm}$ (0.04”), the brake may not be able to open when it's energized.

Required Tools & Materials:

Open end wrench: 10mm

Open end wrench: 12mm

Open end wrench: 24mm

Hex wrench: 14mm

Torque wrench: (need to measure 150 Nm (110ft-lbs))

Phillips head screw driver

Feeler gauges: 0.08mm, 0.12mm, 0.4mm, 0.45mm, 0.5mm, 0.55mm, 0.7mm

6.1.1 Adjustment Procedure Steps for PZD300 series (TGL1 and TGL2)

1. Check the gap “A” (brake stroke) at point 1, 2, 3, and 4 with feeler gauge as Figure 7 shows. Max. Gap “A” of brake after wear should be $< 0.7\text{mm}$ (0.028”), otherwise the gap must be readjusted.
2. Go to Step 4 only if the gap is bigger than specified. Otherwise the stroke is good.
3. Loosen the screw M16 use hex wrench (14mm) about 1 turn, and then adjust the guide bushing slowly use open end wrench (24mm), tighten the screw M16 use hex wrench (14mm) to ensure the gap “A” is within:
PZD300 series: 0.4~0.5mm (0.016” ~ 0.020”), Use the 0.4 mm (0.016”) feeler gauge as a “go gauge”, and the 0.5 mm (0.020”) as a “no go gauge”.
Note: Feeler gauge should be able to be inserted to 1 inch depth.
4. If the gap is too big, tighten the guide bushing clockwise to reduce it. If the gap is too small, loose the guide bushing counter-clockwise to increase the gap.

5. Torque the screw M16 to 110 ft-lbs and reconfirm that the value of gap “A” is good. See Figure 8.
6. **Make sure the pick voltage interval is 2 seconds before dropping to the hold voltage.**

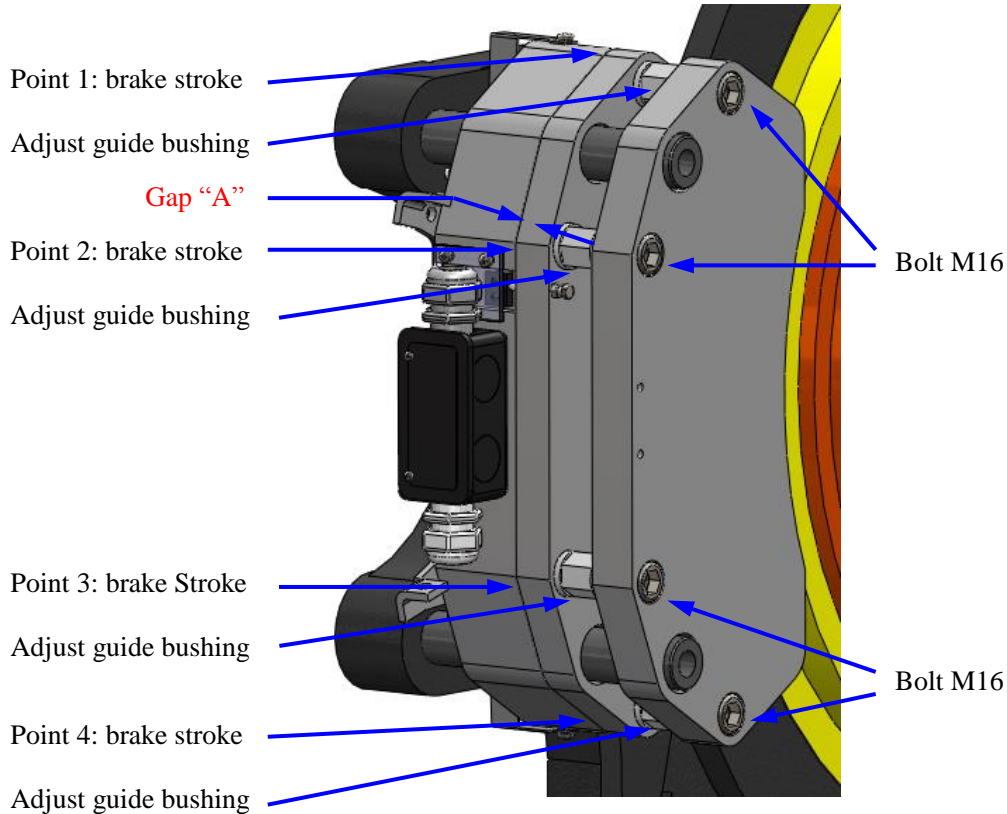


Figure 8: Brake Stroke Adjustment for PZD300 series brake

6.1.2 Adjust Procedure Steps for PZD360 (TGL2A/3)

1. Check the gap “A” (brake stroke) at point 1, 2, 3, and 4 with feeler gauge as Figure 8 shows. Max. Gap “A” of brake after wear should be <math><0.7\text{mm}</math> (0.028”), otherwise the gap must be readjusted.
 2. Go to Step 4 only if the gap is bigger than allowed. Otherwise the stroke is good.
 3. Loosen the screw M16 use hex wrench (14mm) about 1 turn, and then adjust the guide bushing slowly use open end wrench (24mm), tighten the screw M16 use hex wrench (14mm) to ensure the gap “A” is within:
PZD360: 0.45~0.55mm (0.018” ~ 0.022”), Use the 0.45 mm (0.018”) feeler gauge as a “go gauge”, and the 0.55 mm (0.022”) as a “no go gauge”.
- Note: Feeler gauge should be able to be inserted to 1 inch depth.**
4. If the gap is too big, tighten the guide bushing clockwise to reduce it. If the gap is too small, loose the guide bushing counter-clockwise to increase the gap.

5. Torque the screw M16 to 110 ft-lbs and reconfirm that the value of gap "A" is OK. See Figure 9.
6. **Make sure the pick voltage interval is 2 seconds before dropping to the hold voltage.**

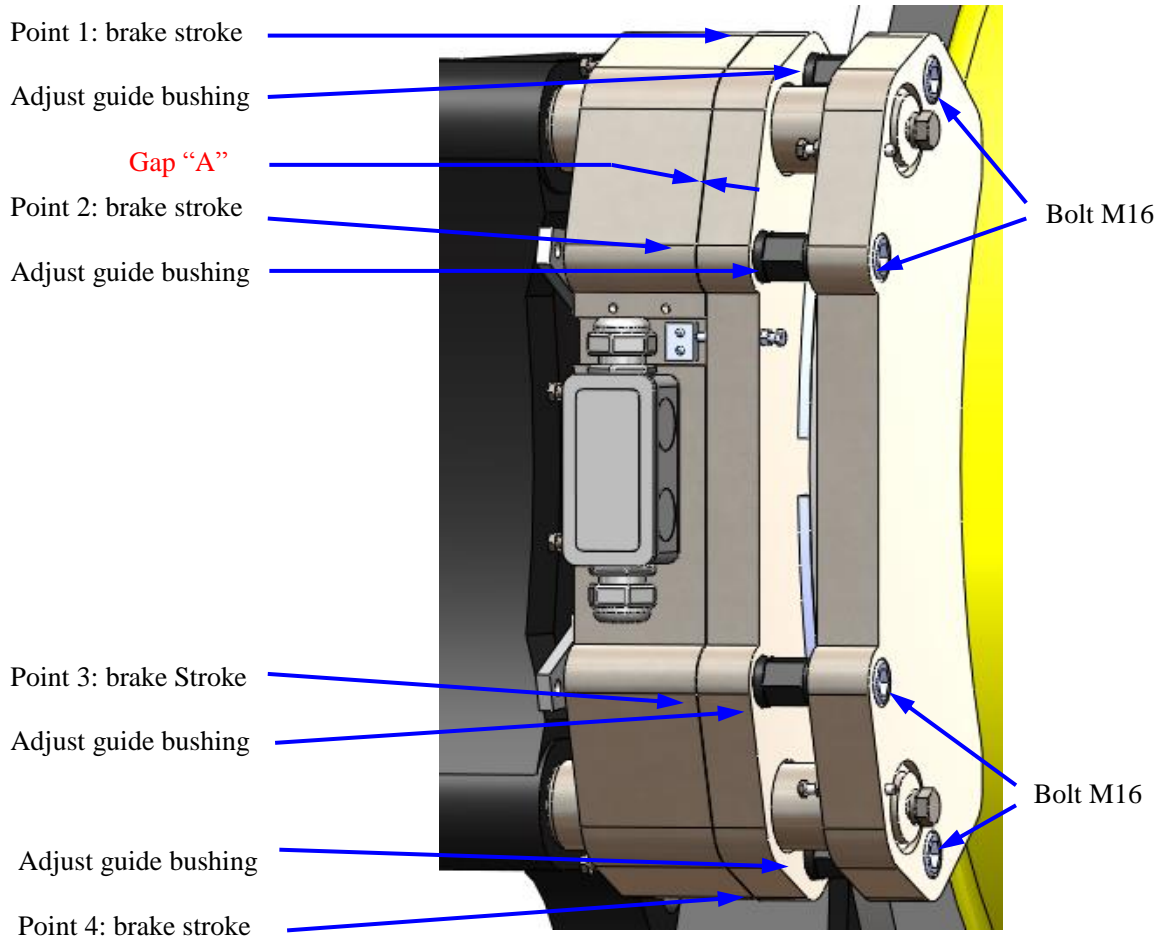


Figure 9: Brake Stroke Adjustment for PZD360

7. Open the brake, check the gap "B" between brake shoe and brake disc, it should be within: 0.08 mm~0.12mm (0.003"~0.005") , use the 0.08 mm (0.003") feeler gauge as a "go gauge", and the 0.12 mm (0.005") as a "no go gauge".
8. If the gap "B" is too big, loose the bolt M6 counter-clockwise with open end wrench 10mm. If the gap is too small, tighten the bolt M6 clockwise to increase the gap.
9. Tighten the locking nut M6 and reconfirm that the value of gap "B" is OK. See Figure 10.

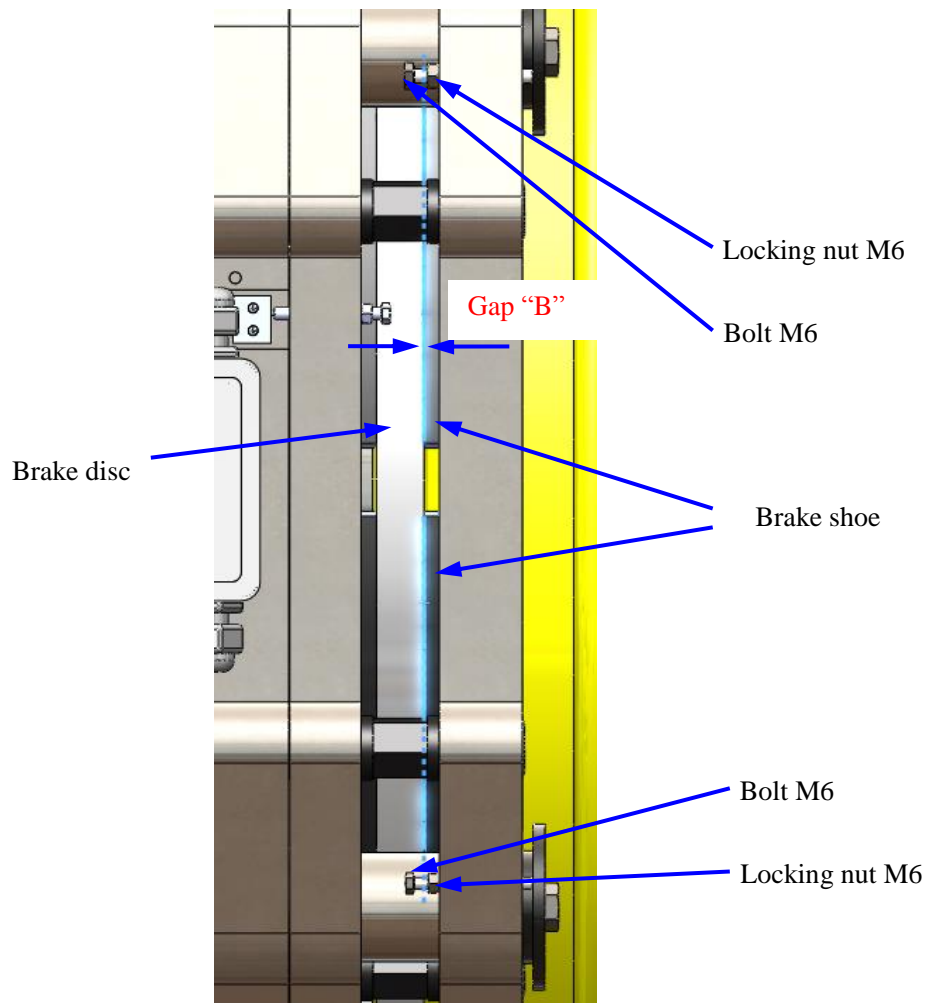


Figure 10: Brake Pad Adjustment

6.2 Brake Noise Adjustment



Generally, brake noise adjustment has been performed at the factory and there is no need to be adjusted any more.

Required Tools & Materials:

Open end wrench: 10mm

Hex wrench 3 mm

Brake Noise Adjustment

If the brake noise is too big, the brake absorb pad height should readjust.

1. Loosen the locking nut M6 use the open end wrench 10mm.
2. Tighten the screw M6 about 60° with hex wrench 3mm to increase the height of noise absorb pad.
3. Use the same method to adjust the other 5 bolts shown in Figure 11.
4. Retest the brake open noise until the noise level is acceptable. If not, repeat step 2.
5. Make sure the hold current (voltage) can hold the brake.
6. Apply Loctite 271 between the bolt M6 and luck nut M6 for anti-vibration purpose.
7. Tighten the locking nut M6. See Figure 11.

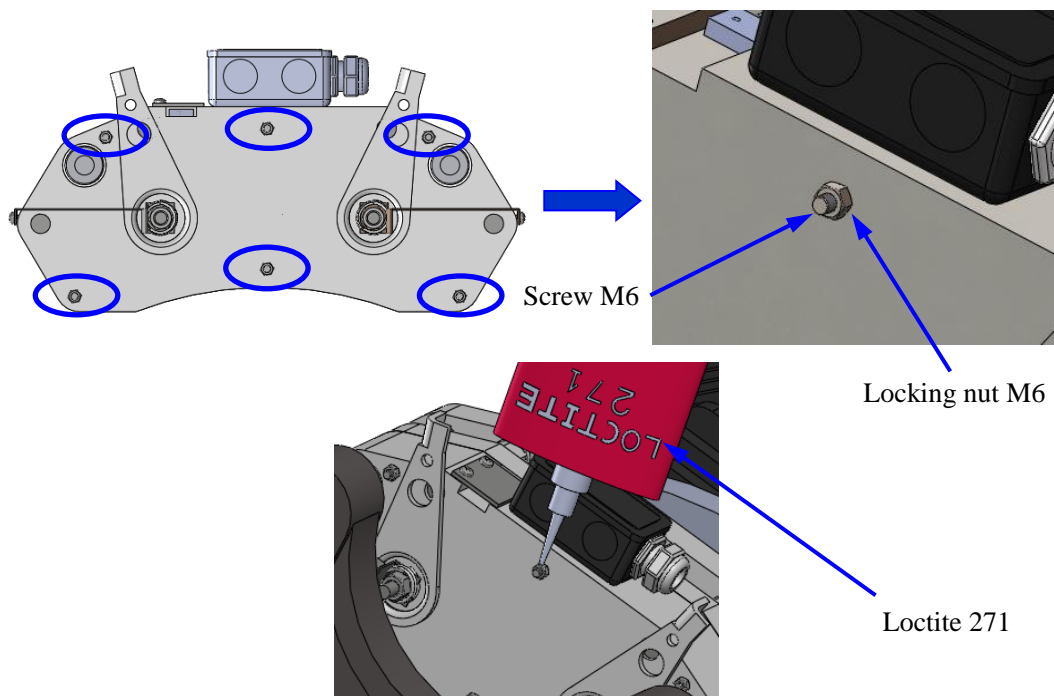


Figure 11: Brake Noise Adjustment

6.3 Brake Switch Adjustment



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

See Section 8.3.3 Brake Switch Adjustment.

7.0 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.

7.1 Brake Stroke Check



Please pay attention to the value of brake stroke during the course of routine maintenance.

If the brake lining wears out, the brake stroke will increase. If the brake stroke is $\geq 1\text{mm}$ (0.04"), the brake may be disabled. Generally, the brake stroke has been adjusted in the factory and does not need to be adjusted in the field.

Suggest check cycle

Every 3 months after install in the first 6 months. Every 1 year afterwards.

Benchmark Criteria

The brake stroke "A" should $< 0.7\text{mm}$ (0.028") for PZD300 series and PZD360.

7.2 Brake Shoe Wear Check



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

Suggest check cycle

Every 1 year

Benchmark Criteria

The brake shoe wear must be $< 1\text{mm}$ (0.04"). Use the Vernier caliper to check gap "a1" at point 1, 2, 3, and 4 between fixed plate and moving core. The gap "a1" should be $> 30\text{mm}$ (1.20"), when the brake is closed. Otherwise replace the brake shoe or the whole brake assembly. See Figure 12.

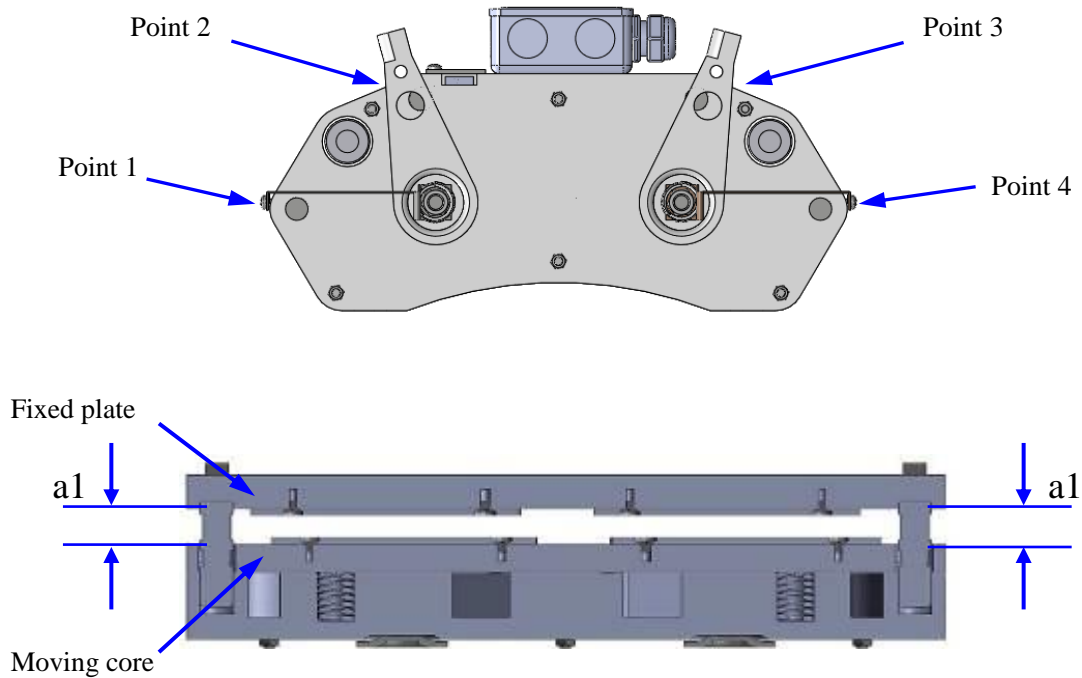


Figure 12: Brake Shoe Wear Check

7.3 Lubrication

Main and pedestal bearing grease **must** be re-greased every 6 months.

7.3.1 Machine and Pedestal bearing

To grease the main motor bearing (located behind the drive sheave) remove the plug under the machine using a 5mm hex wrench. Apply fresh grease (OEM or any EP2 grease) with a grease gun to the Alemite fitting on the top of the machine until fresh grease comes out of the hole where the plug was removed. Reinstall the plug. See Figures 13 and 14.

To grease the pedestal bearing remove the plug at the bottom front of the cover using a 5mm hex wrench. Apply fresh grease (OEM or any EP2) with a grease gun to the Alemite fitting on the top of the pedestal until fresh grease comes out of the hole where the plug was removed. Reinstall the plug.

The encoder end bearing is sealed and should not need to be greased.

7.3.2 Deflector Bearings

Use the same grease as for the motor and pedestal bearing.

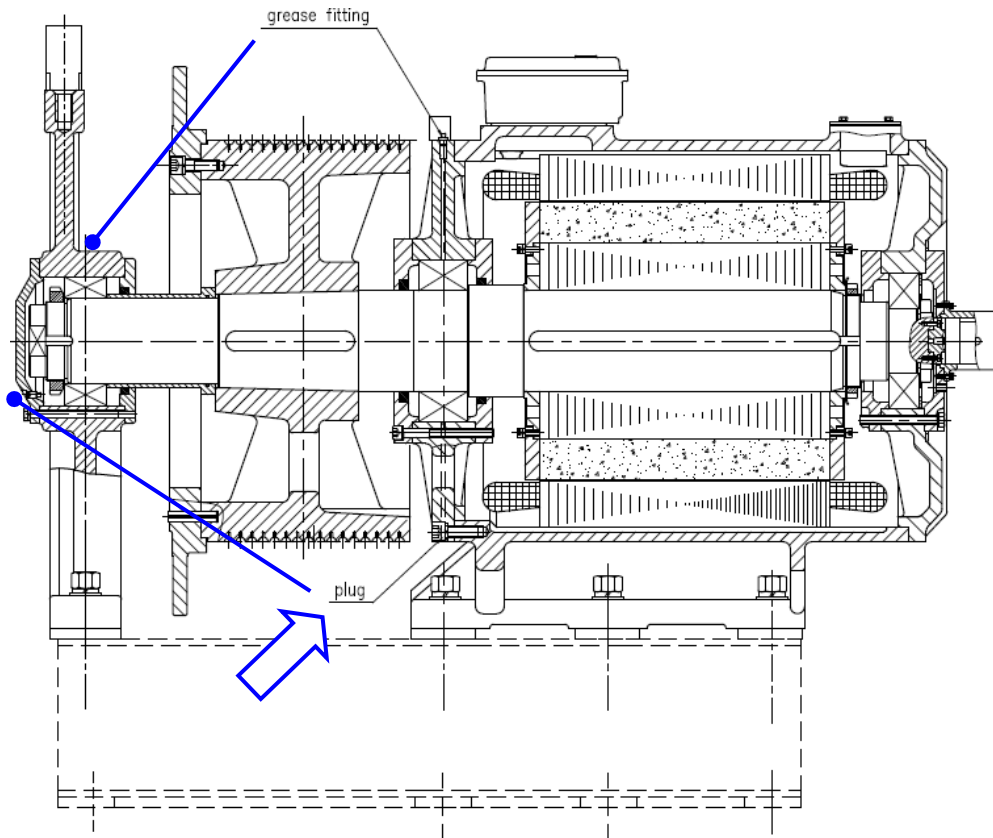


Figure 13: TGL1/2 Grease fitting and plug location

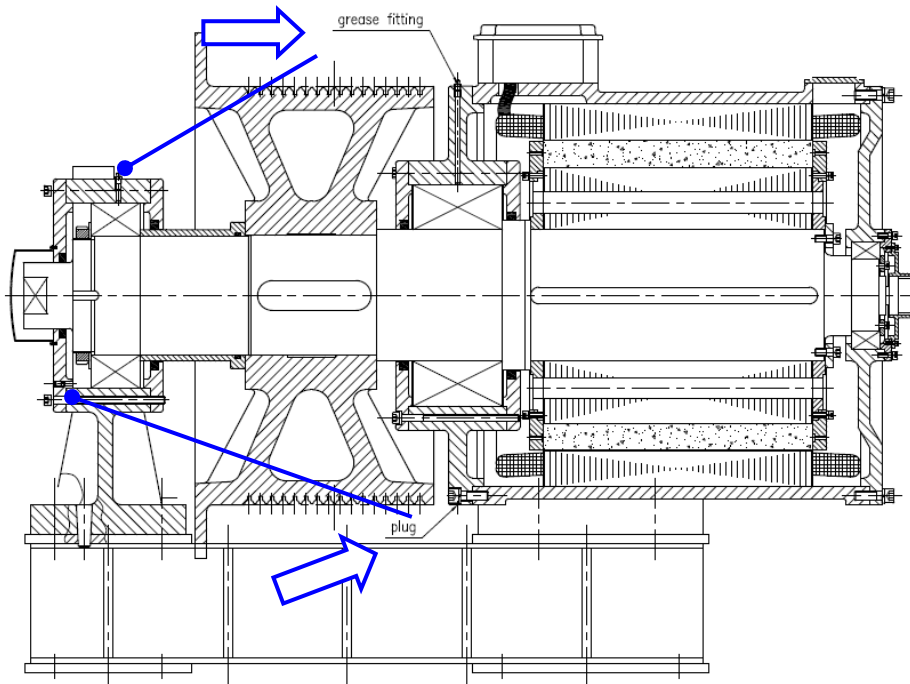


Figure 14: TGL3 Grease fitting and plug location

8.0 Replacement



Only qualified personnel are allowed to perform the replacement work. The person who performs the replacement work must make sure that the machine power is off and that the elevator will not move unexpectedly.



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 (2mm, 4mm, 8mm)

Phillips head screw driver

Inner hexagon bolt M10x1.5x70 (Supplied with new encoder)

Clean cloth

8.1.1 Encoder removal

1. Loose the screw M4x15 and plain washer 4 by Phillips head screw driver, then remove cover plate. See Figure 15.

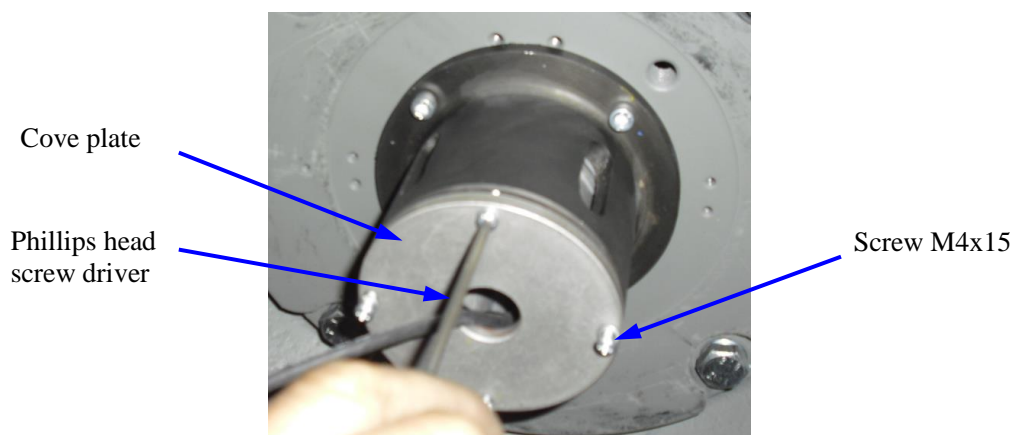


Figure 15: Cover plate removal

2. Remove the end cover with hex wrench 4mm. See Figure 16.

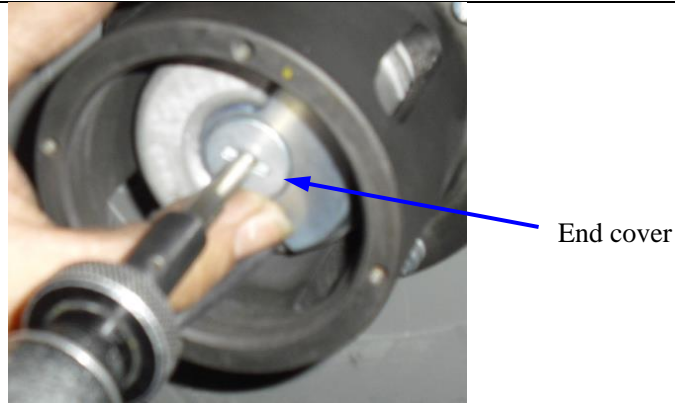


Figure 16: End cover removal

3. Pull out the plug. (If applicable) See Figure 17.

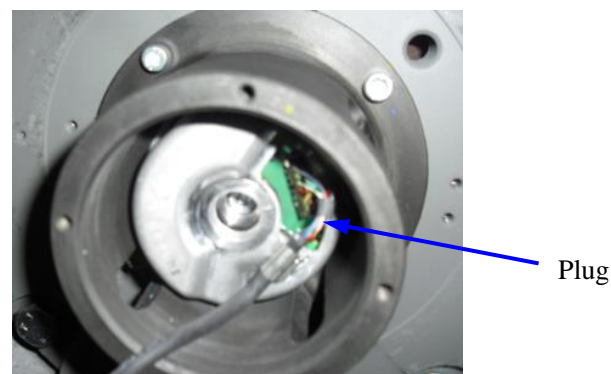


Figure 17: Plug removal

4. Loosen (do not remove) the Expansion screw with hex wrench 2mm. See Figure 18.

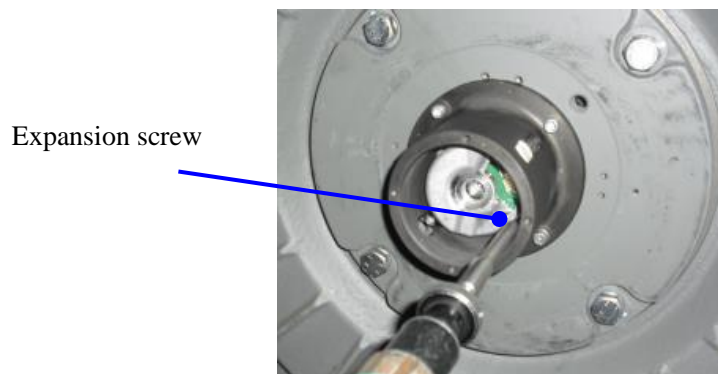


Figure 18: Loosen the Expansion screw

5. Rotate counterclockwise the bolt M5x50 1-2 turns with hex wrench 4mm, install the bolt M10 against the encoder with hex wrench 8mm. See Figure 19.
6. Turn the M10 bolt against the M5x50 bolt to pop the encoder from the shaft. Remove both bolts and the encoder. **Note: Steps 5 and 6 may have to be repeated until the encoder can be freely removed.**

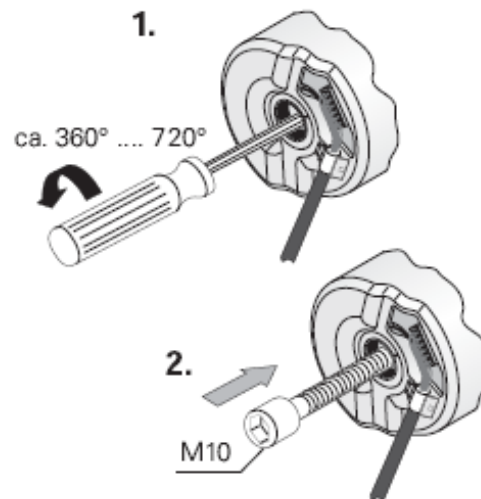


Figure 19: Use M10 bolt to loosen the encoder

8.1.2 Encoder installation

1. Remove the end cover with hex wrench 4mm. See Figure 20.



Figure 20: Remove end cover of new encoder

2. Reconnect the encoder cable for the ECN1313 only. See Figure 21.

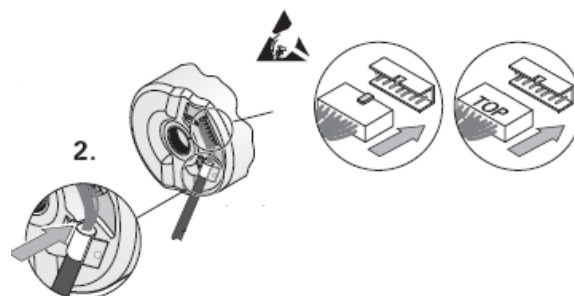


Figure 21: Reconnect encoder cable

3. Install the encoder to the encoder shaft. Use the bolt M5 to attach the encoder to the encoder shaft with hex wrench 4mm. Use torque wrench to tighten the bolt to 44 in-lbs. (5Nm). See Figure 22.

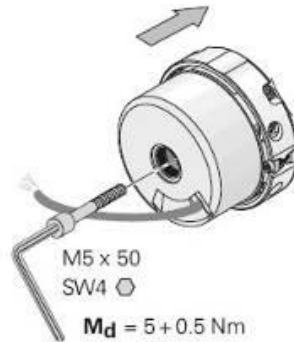


Figure 22: Attach the encoder

4. Install the end cover, and then tighten it with hex wrench 4mm. Use torque wrench to tighten the bolt to 44 in-lbs (5 Nm). See Figure 23.
5. Tighten the Expansion screw with hex wrench (2mm) to 9 in-lbs (1.25 Nm). See Figure 23.

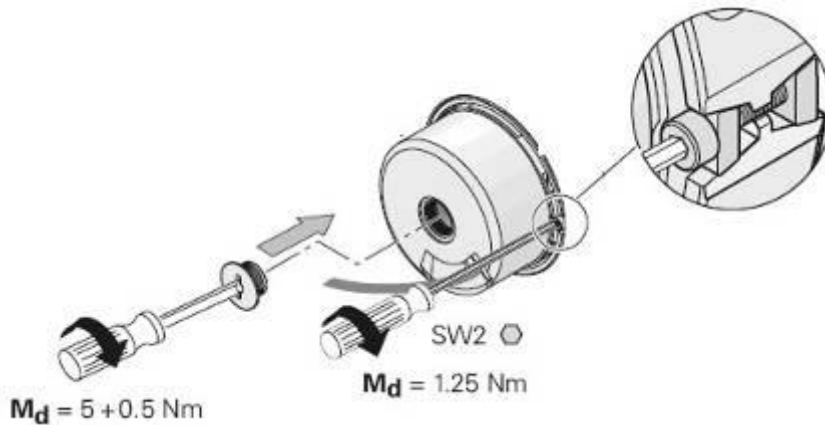


Figure 23: Final installation

6. Power up the machine, and test the machine.

Make sure that correct torque specified by the encoder manufacturer is observed when tightening these bolts.

8.2 Brake Replacement



The personnel who perform this replacement work must make sure that the machine power is off and the elevator will not move unexpectedly. Brakes are the safety devices! Only Qualified Personnel are allowed to perform any assembly, adjusting or maintenance work!

Required Tools & Materials:

Open end wrench 24mm, 36mm

Hex wrench 10 mm

Hex wrench 4 mm, 5mm

Torque wrench (need to measure 110ft-lbs, 360ft-lbs)

Torque screw driver (Need to measure 35 in-lbs., 60 in-lbs.)

Feeler gauges

Clean cotton fabric

Loctite 243

8.2.1 Brake PZD300 Series Replacement

8.2.1.1 Brake removal

1. Loosen the bolt M5 by hex wrench 4mm, remove the fixing plate. (Let's take the right side brake for example shown in the following figure). See Figure 24.

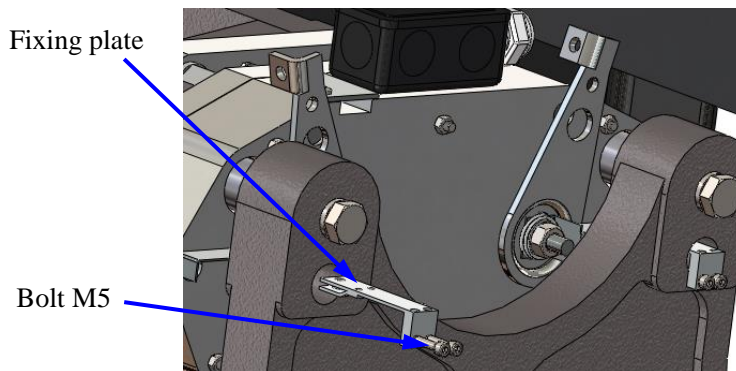


Figure 24: Fixing plate removal

2. Use the open end wrench 24mm to remove the bolt M16. See Figure 25.

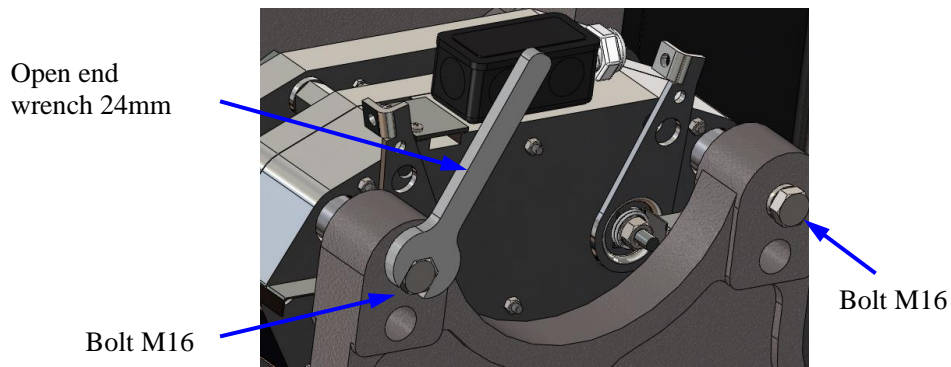


Figure 25: M16 Bolt removal

3. Remove the guide pole 1 and guide pole 2. See Figure 26.

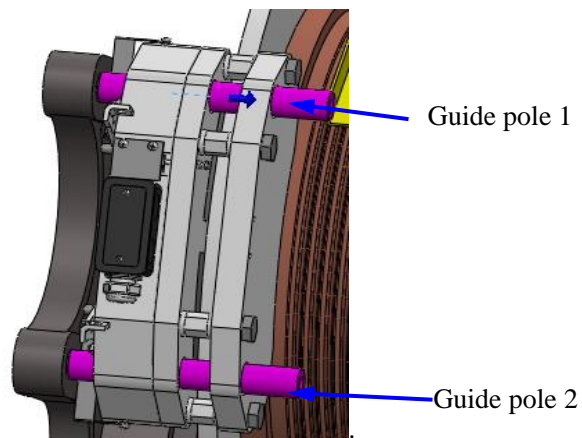


Figure 26: Guide pole removal

4. Open the brake, and then remove the brake assembly. See Figure 27.

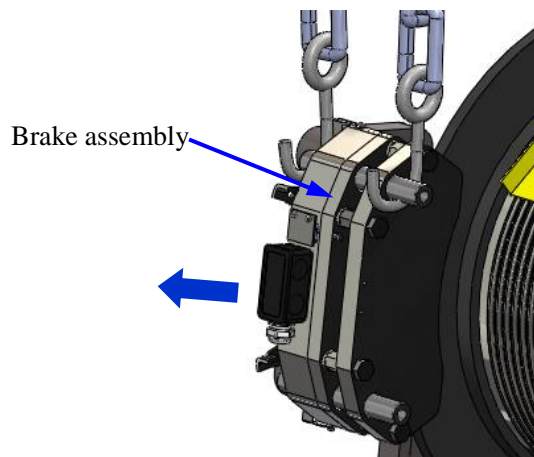


Figure 27: Brake removal

8.2.1.2 Brake installation

1. Open the brake. Install the brake assembly on the brake disc properly. See Figure 28.

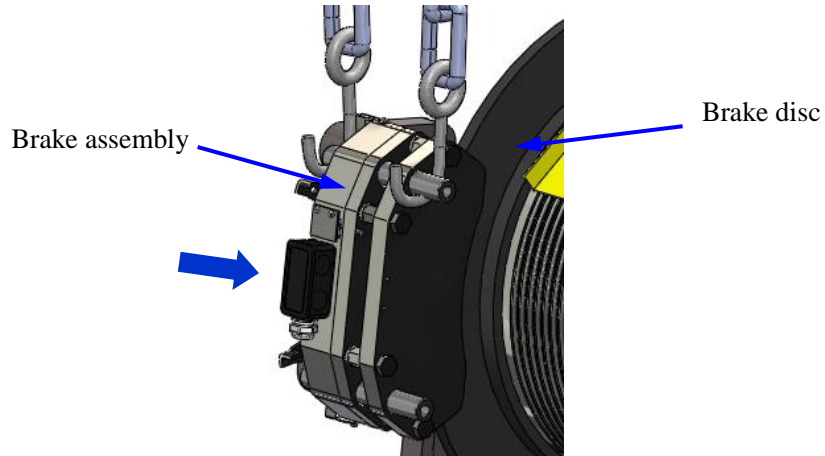


Figure 28: Brake installation

2. Clean the guide pole 1 and 2, and then install them using a hammer in the brake assembly; then close the brake. See Figure 29.

Note: Do not clean the poles with any abrasive material.

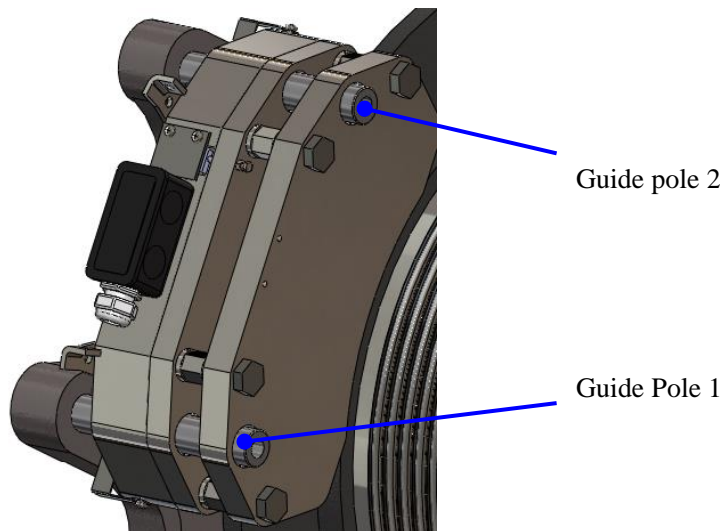


Figure 29: Guide pole installation

3. Apply Loctite on bolt M16 as Figure 27 shows. Tighten bolt to 110 ft-lbs. See Figures 30 and 31.

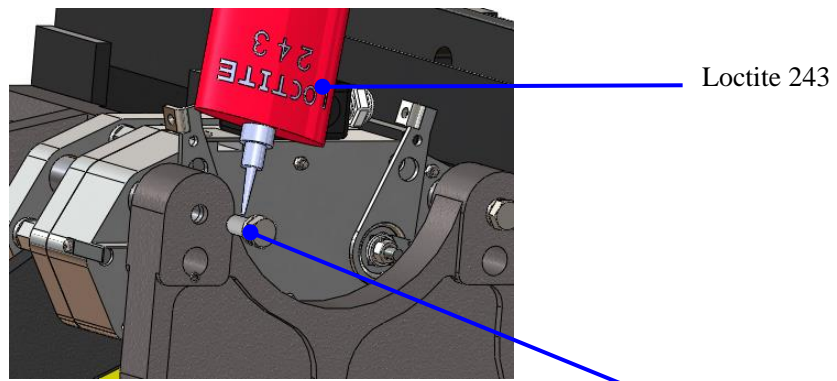


Figure 30: Apply Loctite 243

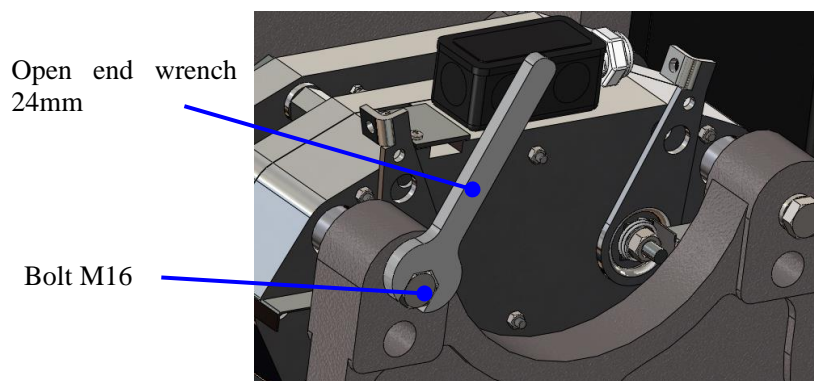


Figure 30: Tighten M16 bolts

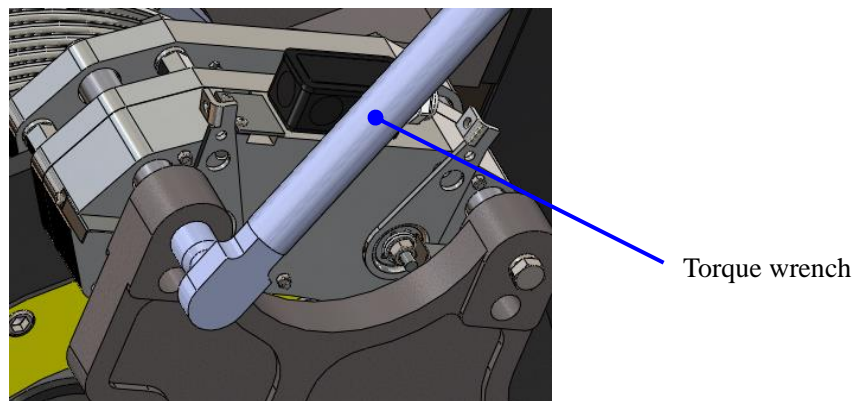
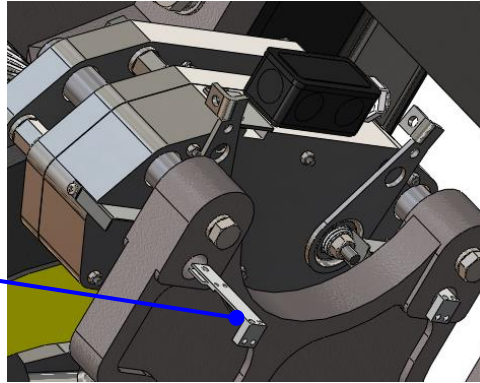


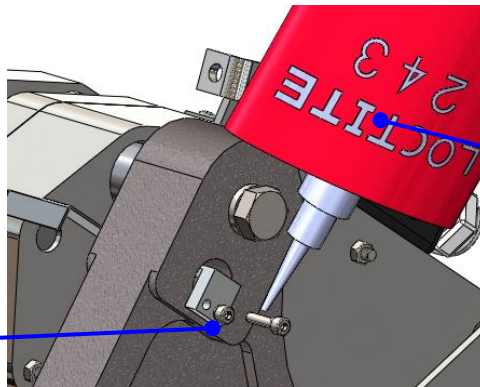
Figure 31: Torque bolts to specification

4. Install the fixing plate on the pedestal body, and then apply Loctite on bolt M5 as Figures 32 and 33 show. Tighten bolt to 35 in-lbs.

Fixing plate

**Figure 32: Install Fixing plate**

Bolt M5



Loctite 243

Figure 33: Apply Loctite 243

5. After replacement, the brake gap must be readjusted. Refer to Brake Stroke Adjustment procedure, Section 6.1.1.

6. Test the brake.



Retest and confirm the new brake's brake torque before using the elevator.

8.2.2 Brake PZD360 Replacement

8.2.2.1 Brake removal

1. Loose the bolt M6 using hex wrench 5mm, then remove the fixing plate. (Let's take the right side brake for example show in the following picture. See Figure 34.

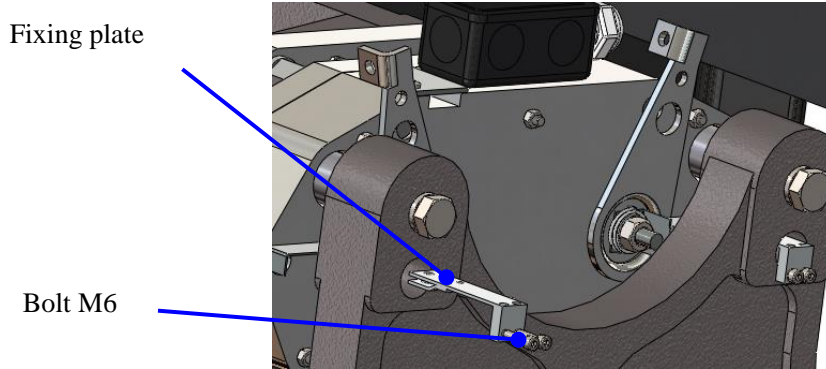


Figure 34: Remove the Fixing plate

2. Use the open end wrench 36mm to remove the bolt M24. See Figure 35.

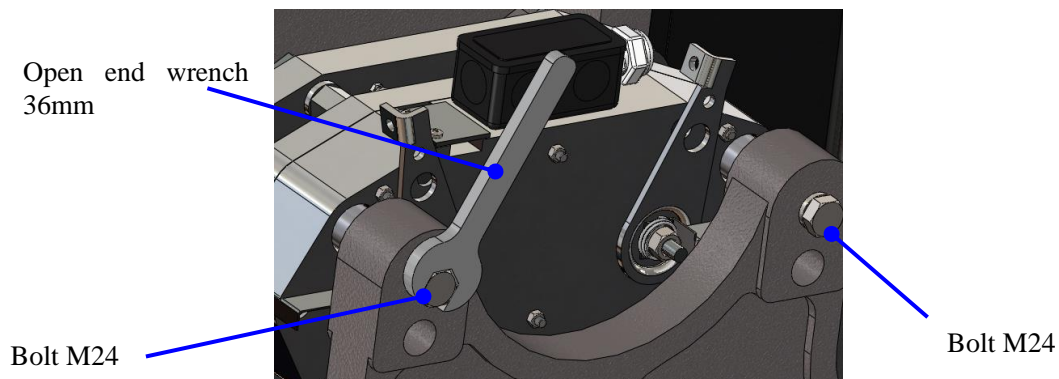


Figure 35: Bolt removal

3. Remove the Guide pole 1 and Guide pole 2. See Figure 36.

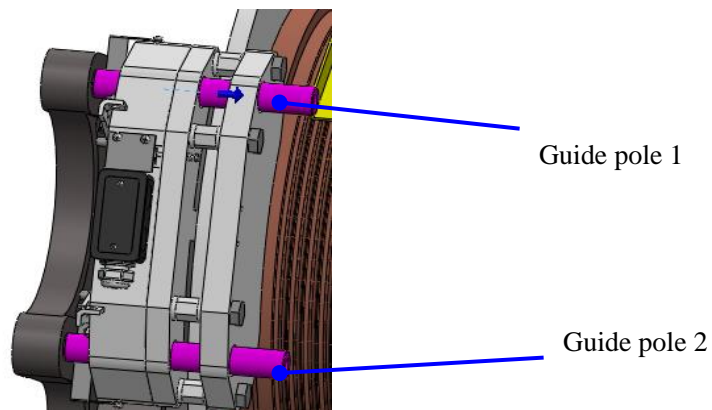


Figure 36: Guide pole removal

4. Open the brake by connecting to the power, and then remove the brake assembly. See Figure 37.

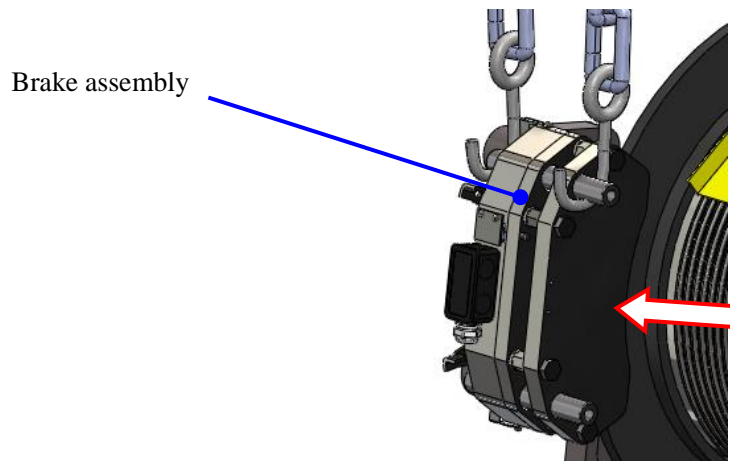


Figure 37: Brake removal

8.2.2.2 Brake installation

1. Open the brake by connecting to the power. Install the brake assembly on the brake disc properly. See Figure 38.

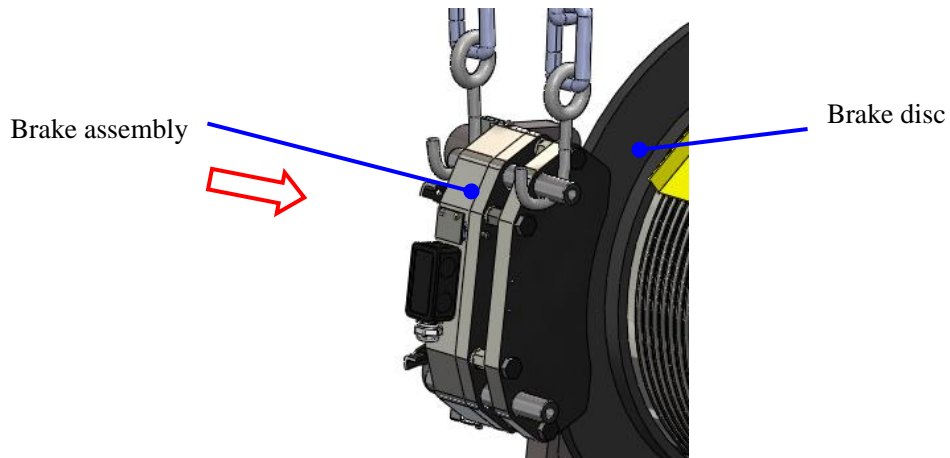


Figure 38: Brake installation

2. Clean the Guide pole 1 and 2, then install them in the brake assembly tapping with a hammer, then close the brake. See Figure 39.

Note: Do not clean the poles with any abrasive material.

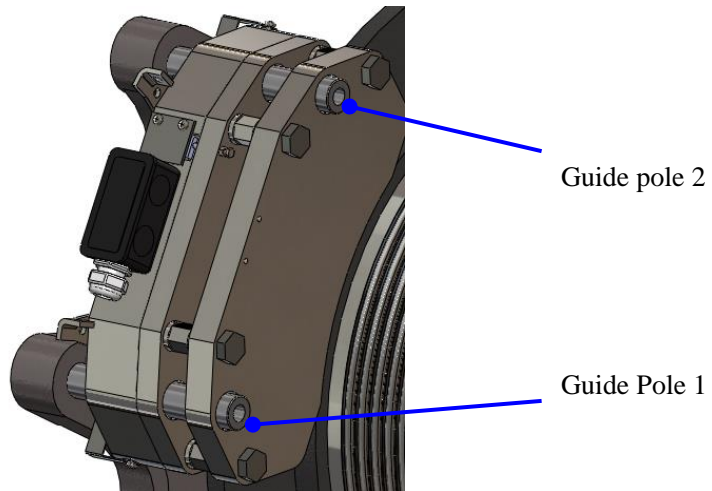


Figure 39: Guide pole installation

3. Apply Loctite 243 on bolt M24 as Figure 40 shows. Tighten bolt to 488 Nm (360 ft-lbs.). See Figures 41 and 42.

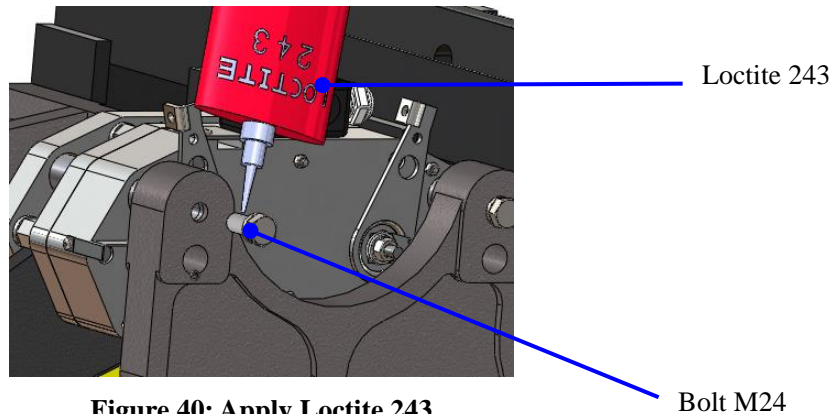


Figure 40: Apply Loctite 243

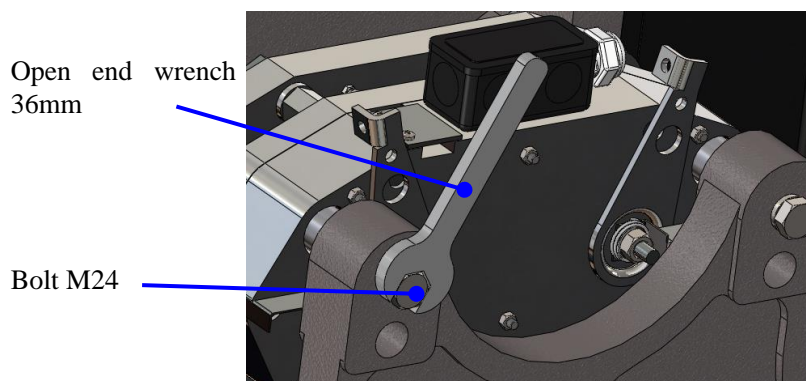


Figure 41: Tighten M16 bolts

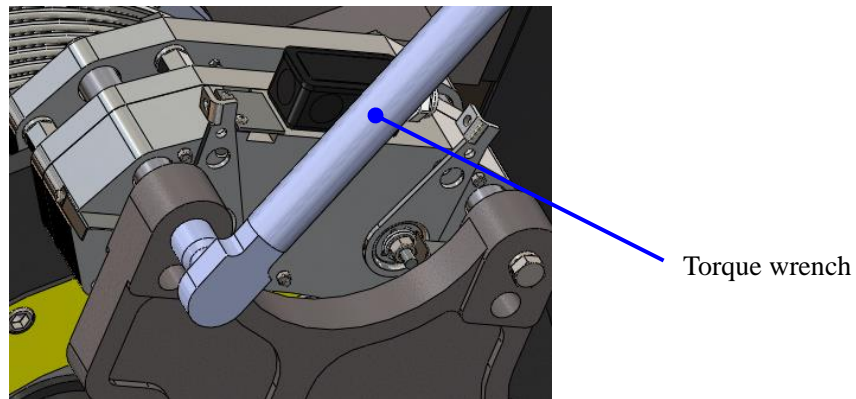


Figure 42: Torque to specification

4. Install the fixing plate on the pedestal body, and then apply Loctite 243 on bolt M6 as Figures 43 and 44 show. Tighten bolt to 60 in-lbs.

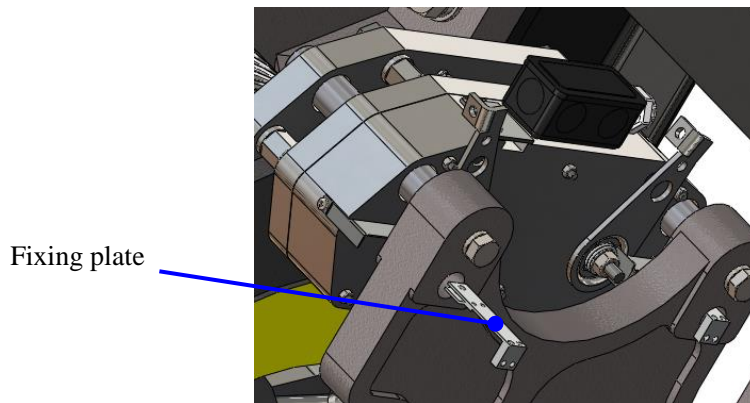


Figure 43: Install Fixing plate

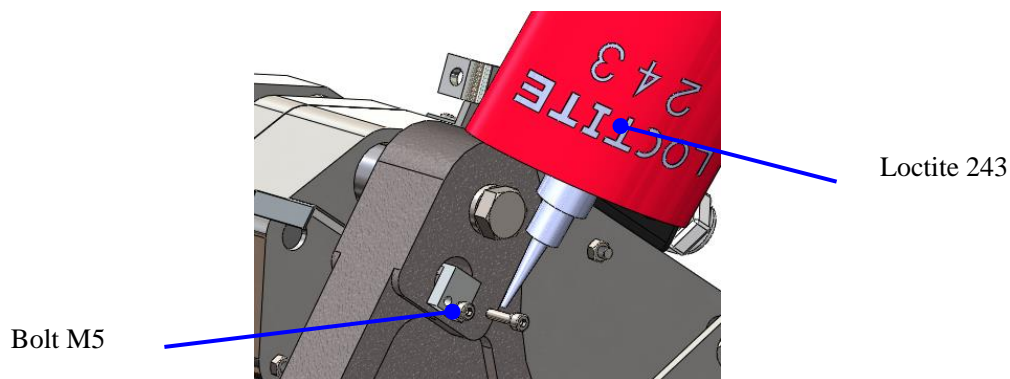


Figure 44: Apply Loctite 243

5. After replacement the brake, the brake gap must be readjusted. Refer to the Brake Stroke Adjustment procedure, Section 6.1.2
6. Test brake



Retest and confirm the new brake's brake torque before use the elevator.

8.3 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

General adhesive

Phillips head screw driver

Straight head screw driver

Torque screw driver (Need to measure 35 in-lb)

Open end wrench 8mm (x2)

Loctite 271

Cable ties

Multimeter

Feeler gauges (0.1mm, 0.2 mm)

8.3.1 Brake Switch removal

1. Loosen the screw M5x10 using the Phillips head screw driver, then remove the cover plate. See Figure 45.
2. Loosen the screw M3x10 in the brake terminal box using the Phillips head screw driver, and remove the terminal box cover. See Figure 46.
3. Remove the brake switch cable of the switch that needs to be replaced from the brake terminal with a small straight head screw driver and then move it out from the hole in the brake terminal box.
4. Loosen the screws M2x10 using a straight head screw driver, then remove the broken switch.

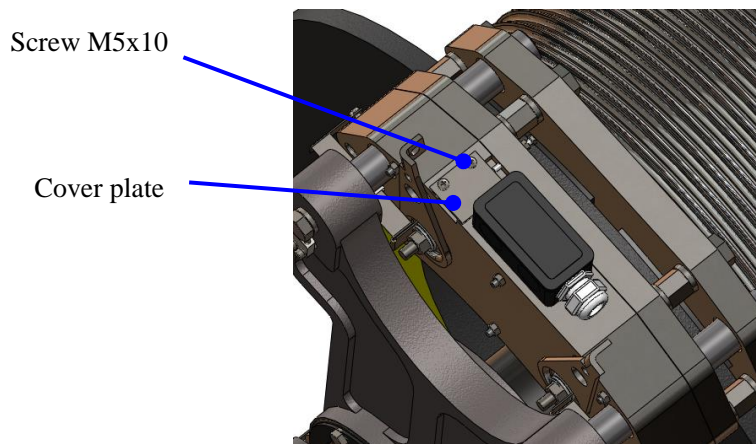


Figure 45: Cover plate removal

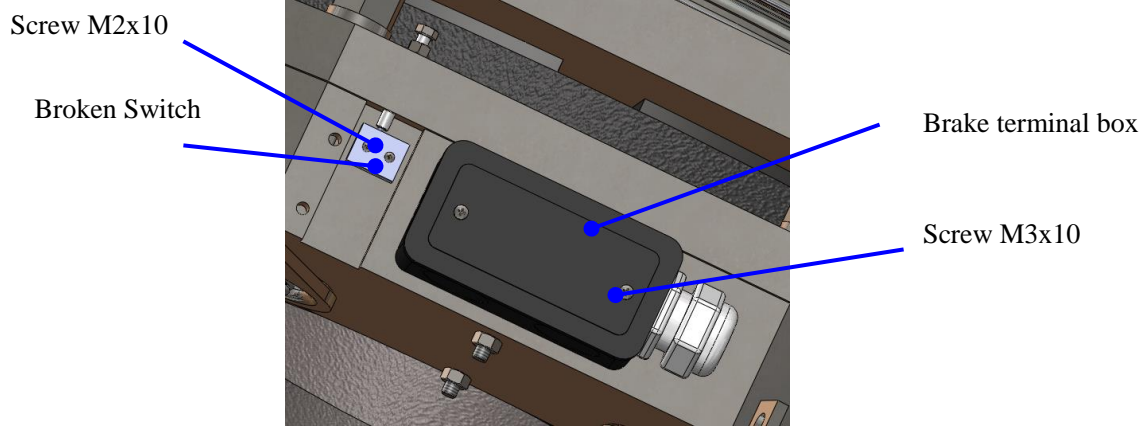


Figure 46: Brake switch removal

8.2.3 Brake Switch installation

1. Clean the brake switch mating surface. See Figure 47.

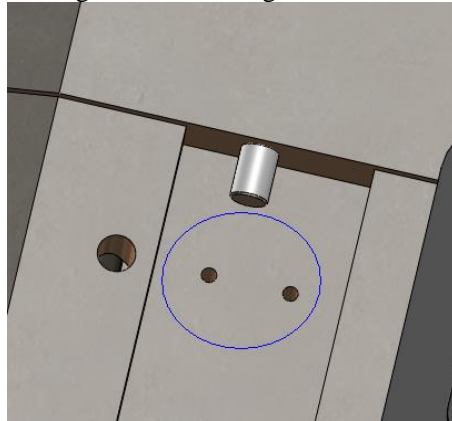


Figure 47: Clean mating surface

2. Coating general adhesive on brake switch installing surface. See Figure 48.

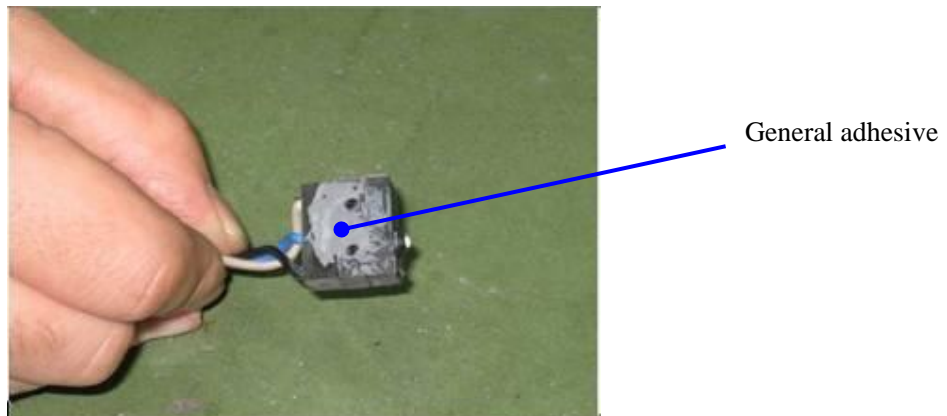


Figure 48: Apply general adhesive

3. Install the brake switch on the brake body by tightening the screws M2x10 with a straight head screw driver. Apply Loctite 271 between the screw heads and the switch body, then use torque screw driver to tighten the bolt to 35 in-lb. See Figure 49.

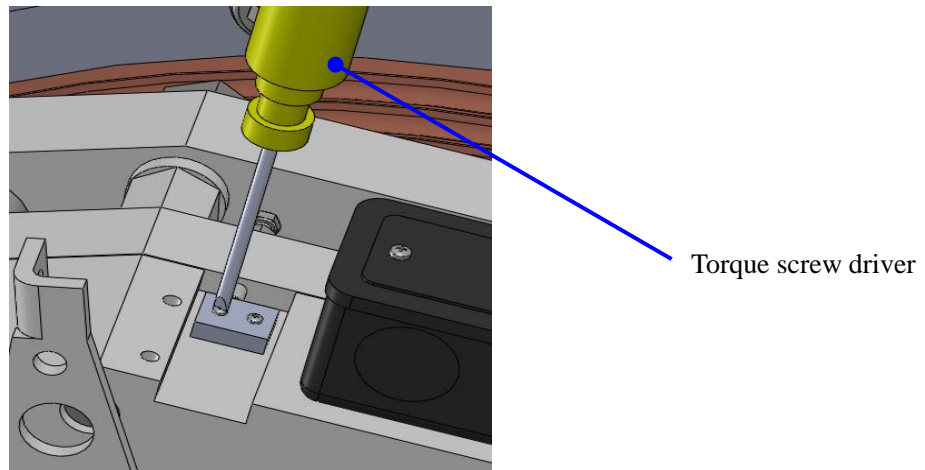


Figure 49: Secure new brake switch

4. Reconnect the new brake switch cable and secure it with cable ties.

8.3.3 Brake switch adjustment

1. Use the open end wrench 8mm to loose the lock nut M5. See Figure 50.

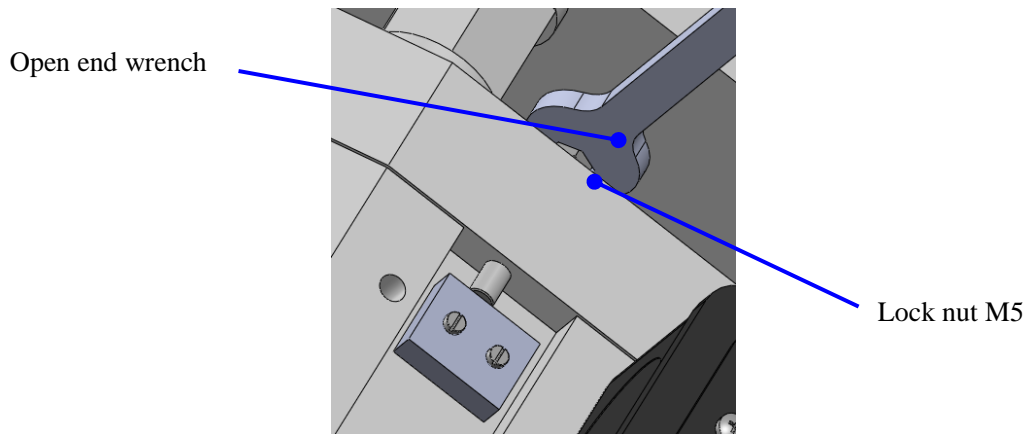


Figure 50: Brake switch adjustment

2. Adjust the bolt M5x40 with open end wrench (8mm) slowly clockwise until you hear the switch action sound.
3. Then adjust bolt M5 counterclockwise about 80° (0.177mm).
4. Use open end wrench 8mm to hold the bolt M5x40, then use another open end wrench 8mm to tighten the lock nut M5. See Figure 55.

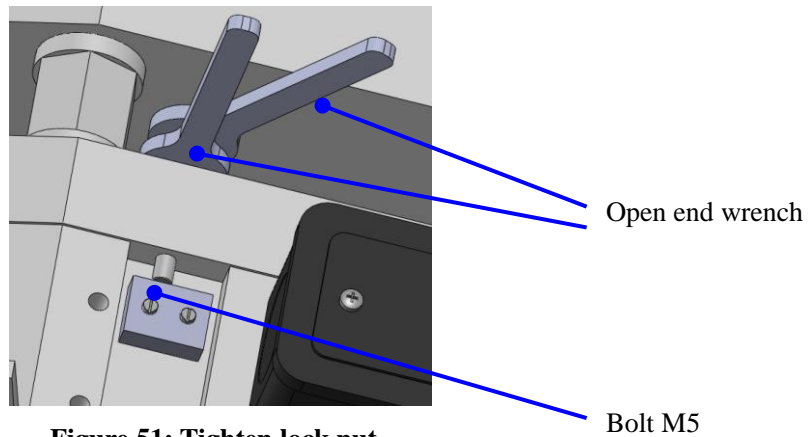


Figure 51: Tighten lock nut

5. Use the multimeter to make sure the new switch functions by inserting feeler gauges between the bolt M5x40 and the switch. The switch should not act when inserting a 0.1mm (0.004") feeler gauge and should act when inserting a 0.2mm (0.008") feeler gauge. See Figure 52.

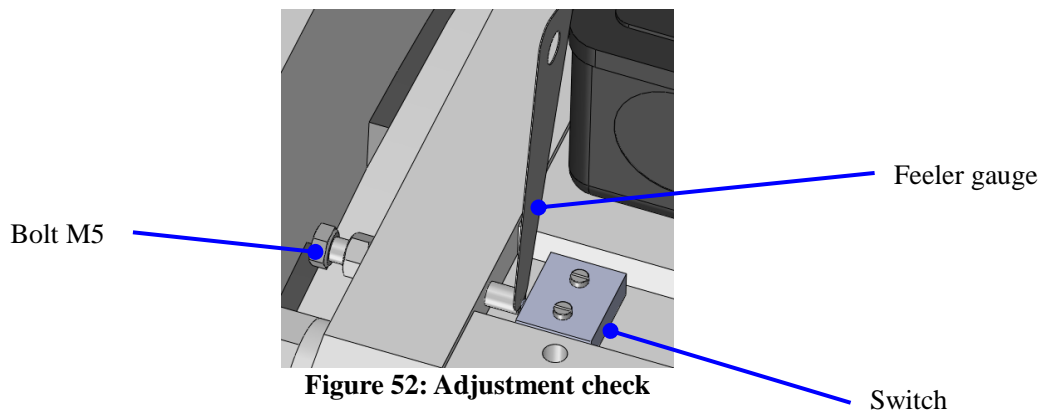


Figure 52: Adjustment check

6. Apply Loctite 271 between the nut and the bolt thread for anti-vibration purpose. See Figure 53.

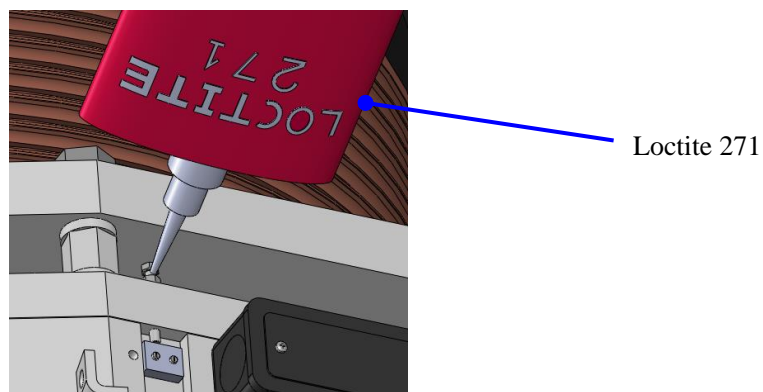


Figure 53: Apply Loctite 271

7. Install the cover plate on the brake body with tighten the screws M5x10 using a Phillips head screw driver. Apply Loctite 271 between the screw heads and the cover plate, then use torque screw driver to tighten the bolt to 35in-lb. See Figure 54.

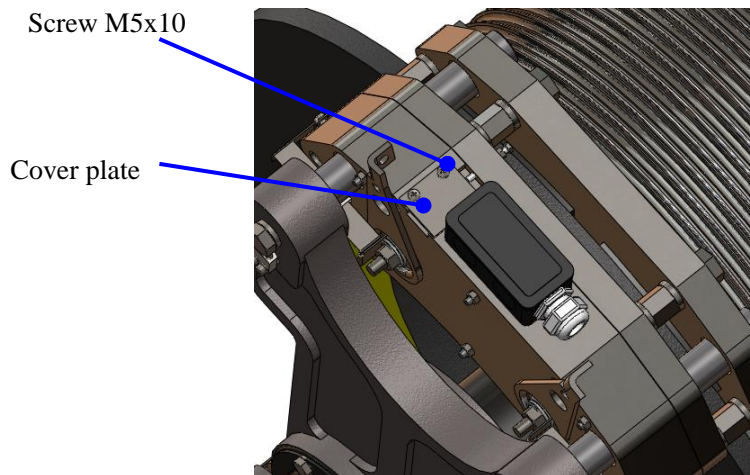


Figure 54: Install cover plate

8.4 Sheave Replacement

8.4.1 TGL1/2/2A Sheave Replacement

Required Tools & Materials:

Open end wrench (16mm, 18mm, 36mm)

Hex wrench (14mm)

Dial gauge

Machine oil

File

Hoist chain

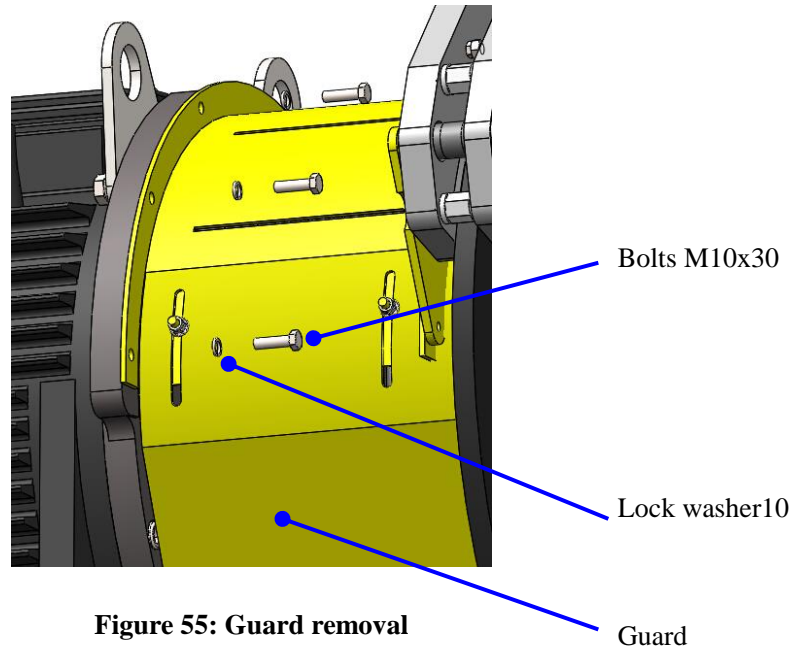
Clean cotton fabric

Rope

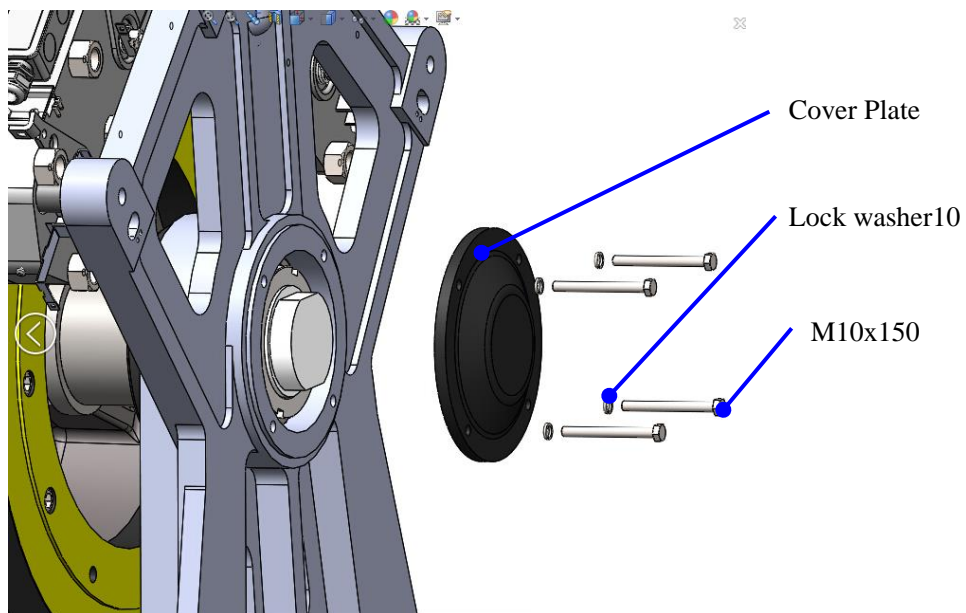
Sheave Replacement Took Kit (available from Torin Drive International)

8.4.1.1 Sheave removal

1. Cut off the power to the machine.
2. Loosen the bolts M10x30 (4 pieces) with spring washer10 with open end wrench (16mm), and take off the guard. See Figure 55.
3. Remove the ropes. Move the machine to a level place where there is enough room to complete the sheave replacement.



4. Remove the brake (Refer to Brake PZD300 series replacement, Section 8.2.1).
5. Loosen the bolts M10x150 (4 pieces) with spring washer10 with open end wrench (16mm), and take off the Cover Plate. See Figure 56.



6. Loosen the M110 round nut and tap washer using a screwdriver and hammer; then remove them from the main shaft. See Figure 57.

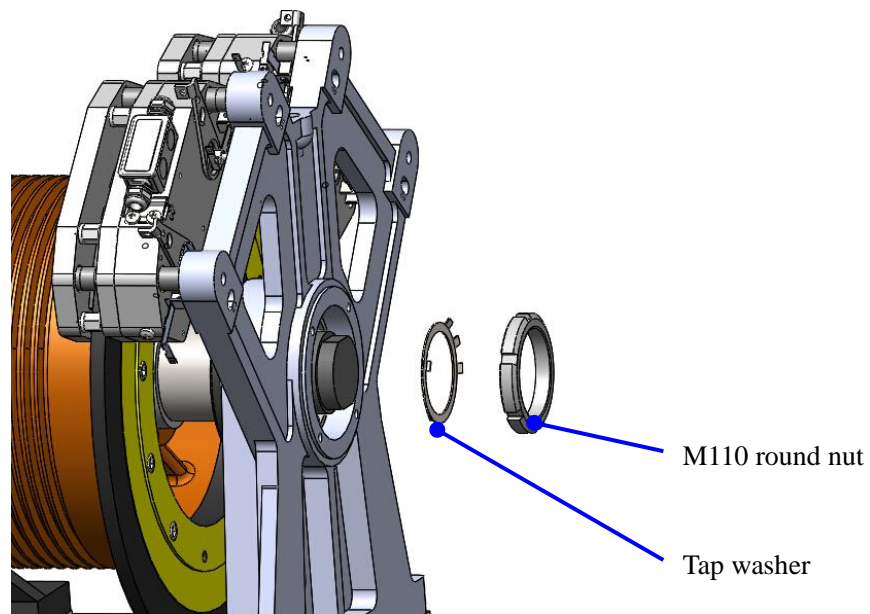


Figure 57: Remove M110 Round nut and Tap washer

7. Loosen the bolts M24x80 (2 pieces) with lock washer24 with end wrench (36mm). Also remove 2 alignment pins using a M10 bolt to pull the pins. See Figure 58.

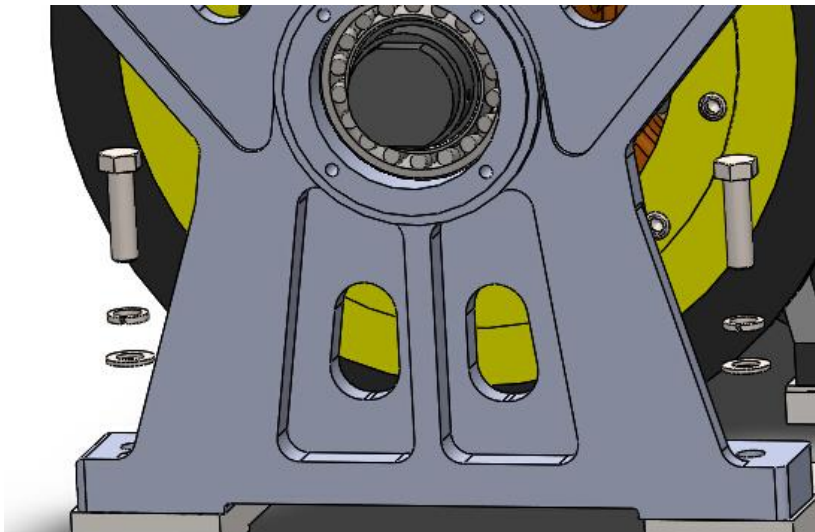


Figure 58: Remove M24x80 bolts

8. Use the pull-off device to dismantle the pedestal body and pedestal together.
9. Take off the bearing (24024CAME4). See Figure 59.

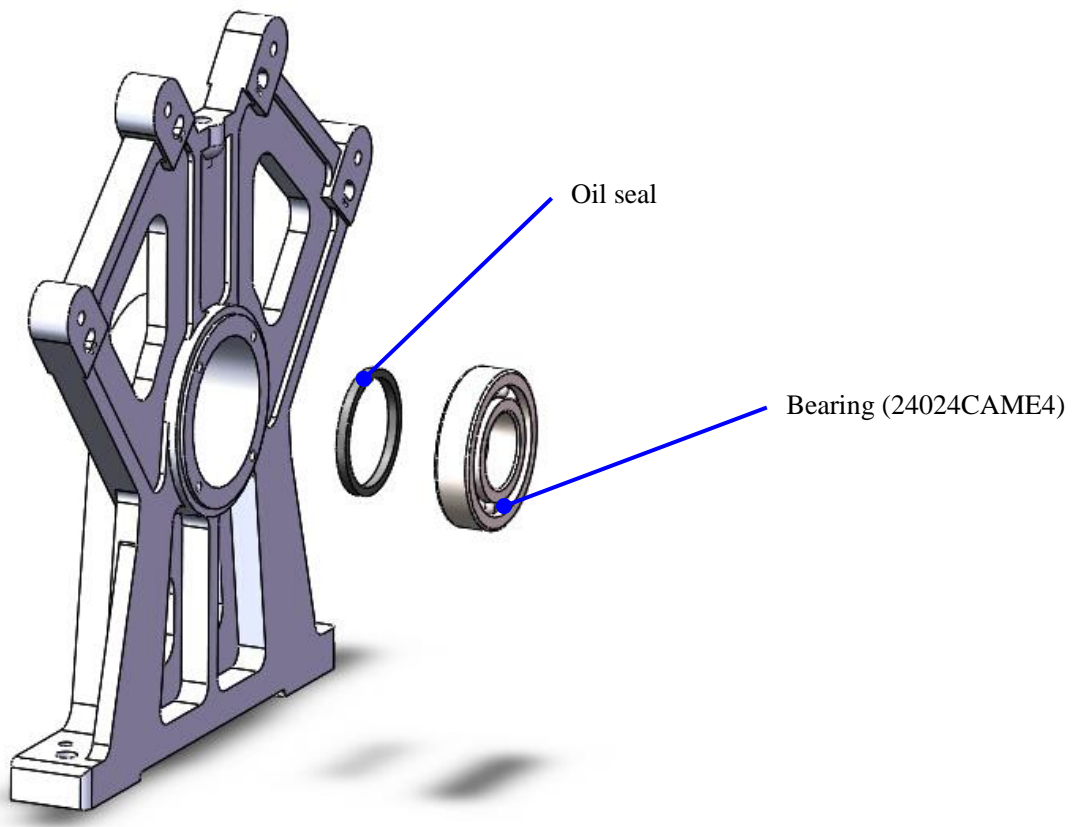


Figure 59: Remove the bearing

10. Replace the oil seal SC Ø130xØ150x12 if necessary.
11. Take off the steel-cover. See Figure 60.

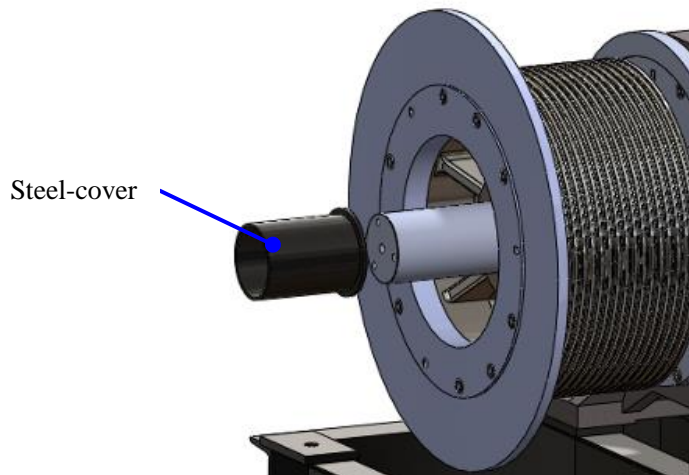


Figure 60: Remove Steel cover

12. Use a lifting device to suspend the Sheave. Remove 3 M16x50 bolts equally spaced around the sheave/brake disc. Attach 3 M16x500 threaded rods to the sheave. Install the Special Sheave Removal plate on the rods against the end of the output shaft. Thread M16 nuts onto the rods. Tighten each nut successively to pull the sheave loose from the shaft. Then hoist the sheave clear of the shaft. See Figures 61 and 62.



Figure 61: Install Special Sheave Removal plate and tighten equally

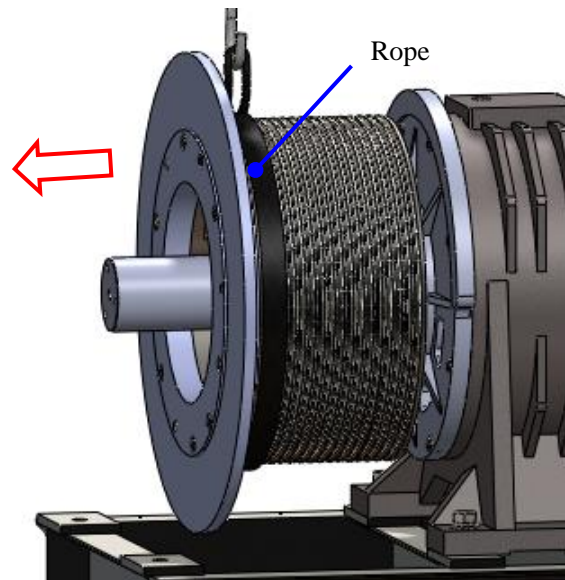


Figure 62: Lift sheave from shaft

8.4.1.2 Sheave installation

1. Debur the key and sheave with a file; then clean the shaft and sheave, coat with some machine oil on the key.
2. Check and clean the Sheave.
3. Use a lifting device to suspend the sheave and clean the mating surface. Then slide the sheave onto the cone shaped section of the shaft, making sure it is fully seated. See Figure 63.

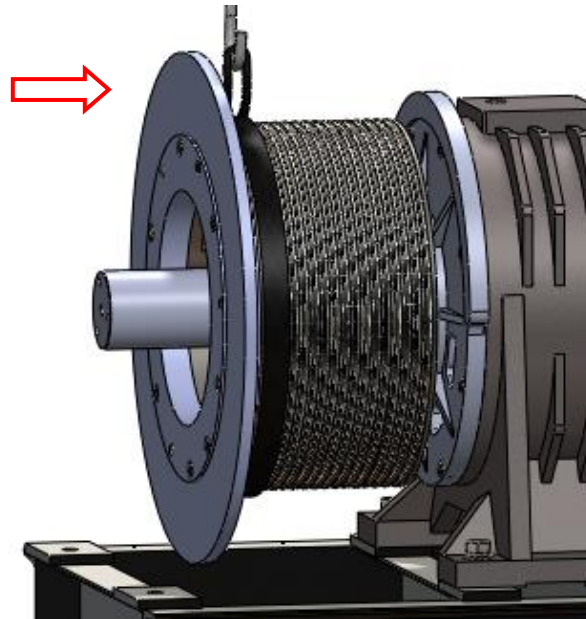


Figure 63: Lift sheave onto shaft

4. To ensure the sheave is fully seated, attach the sheave press apparatus as shown in Figure 64 after sliding the Special Steel Cover onto the shaft. Use a hydraulic jack to apply 45 Mpa (15T) pressure to the sheave. Then remove the pressing apparatus.

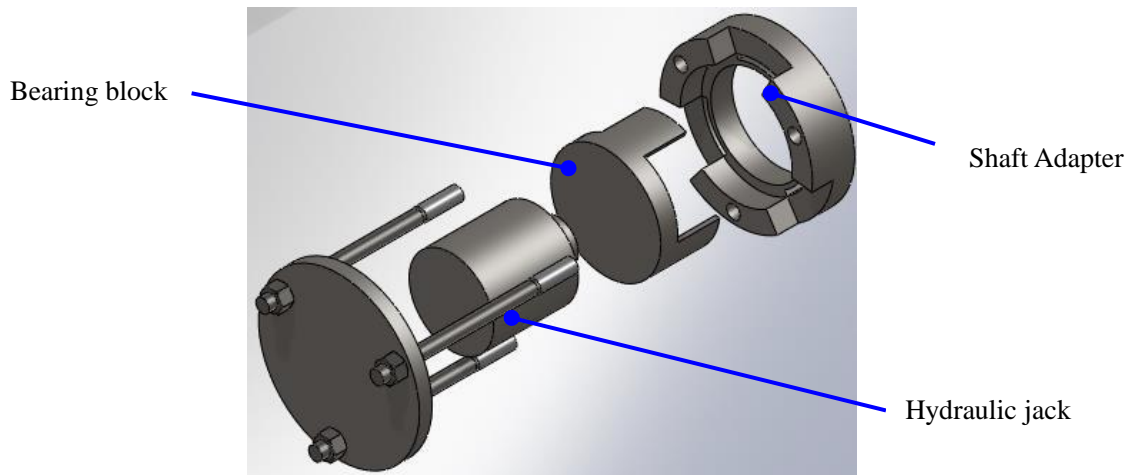


Figure 64: Sheave repress apparatus

5. Install the pins 16x60 (3 pieces)
6. Tighten the bolt M16x50 (6 pieces) with lock washer 16 with hex wrench (14mm). Torque them to 125-150Nm (92-110 ft-lbs.).
7. Use the dial gauge to check the vertical allowable tolerance of the brake disk ≤ 0.1 mm, and the vertical allowable tolerance of the sheave groove ≤ 0.15 mm.
8. Put grease in the oil seal SC $\varnothing 130 \times \varnothing 150 \times 12$. Install it in the pedestal body. See Figure 65.

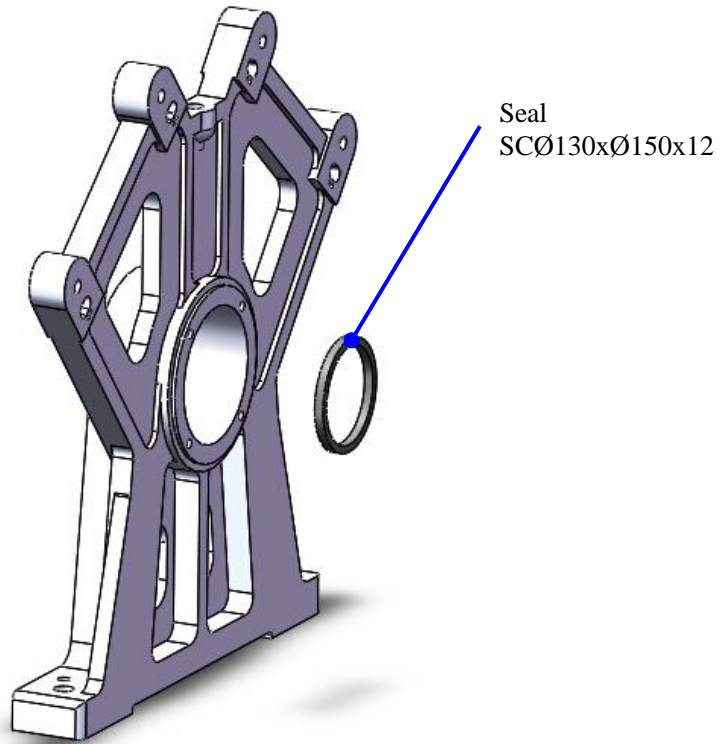


Figure 65: Install oil seal in pedestal

9. Fully pack the bearing (OEM or Equivalent. See Specifications on page 4.). Then install it in the pedestal. See Figure 66.

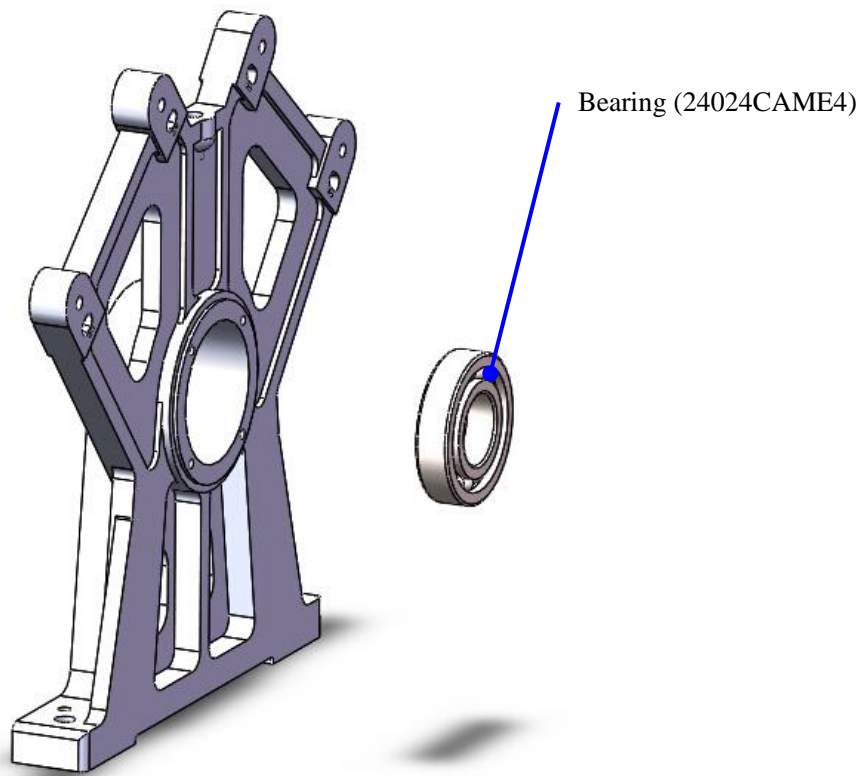


Figure 66: Install bearing in the pedestal

10. Install the Steel-Cover. See Figure 67.

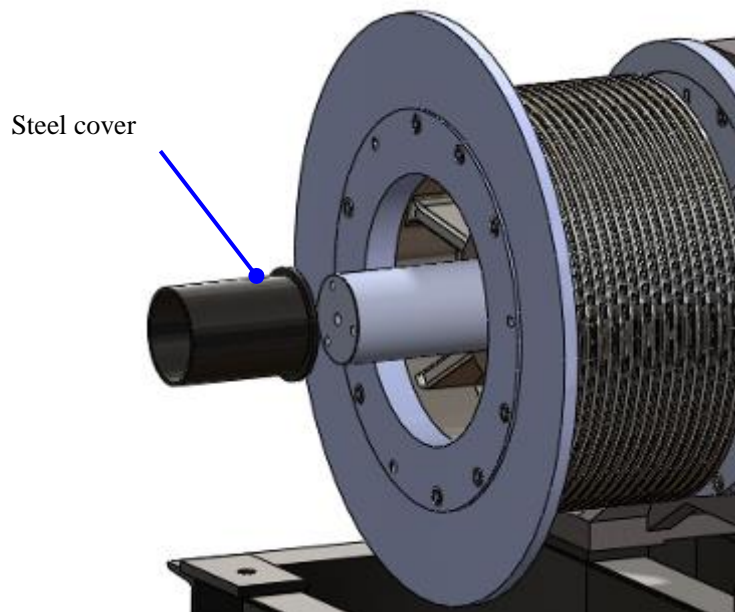


Figure 67: Install Steel cover

11. Install the pedestal on the main shaft. See Figure 68.

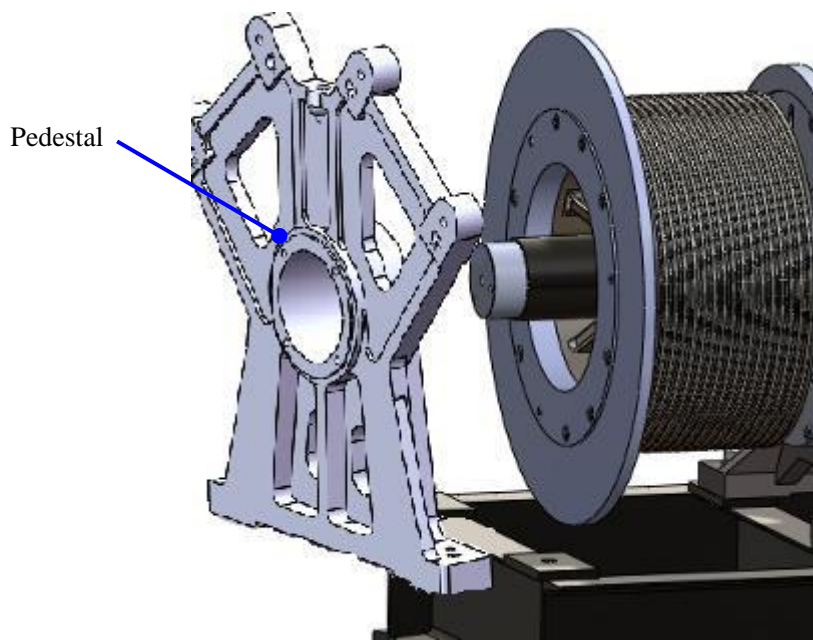


Figure 68: Install the Pedestal on the main shaft

12. Adjust the pedestal. (Refer to Section 8.4.1.3 Pedestal Installation and Adjustment).
13. Install the M110 round nut and tap washer **making sure the tapered side of the Round nut is toward the machine.** Tighten and lock the round nut by bending over a tab on the tap washer. See Figure 69.

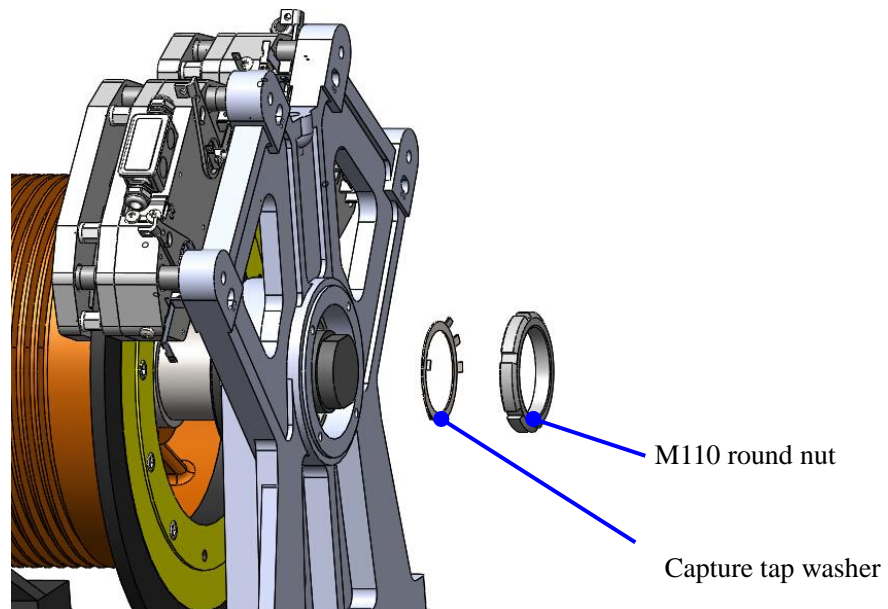


Figure 69: Install the M110 Round nut and Tap washer

14. Install Cover plate and grommet type seal; then tighten the bolt M10x150 (4 pieces) to 40 Nm (30 ft-lbs). See Figure 70.

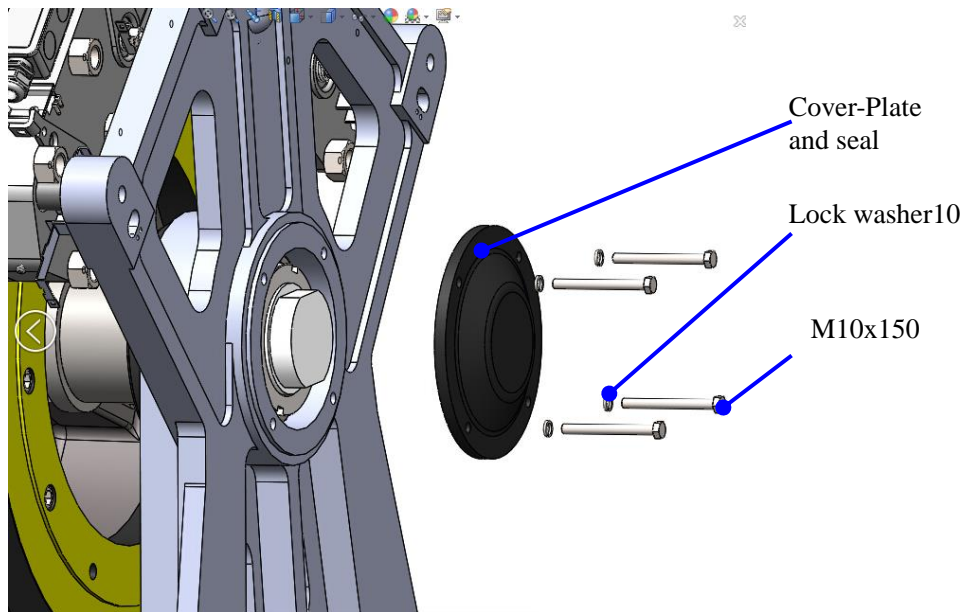


Figure 70: Install cover plate

15. Reinstall the brakes. Refer to Section 8.2.1 Brake Replacement.
16. Attach the ropes; test the machine and install the guard. See Figure 71.

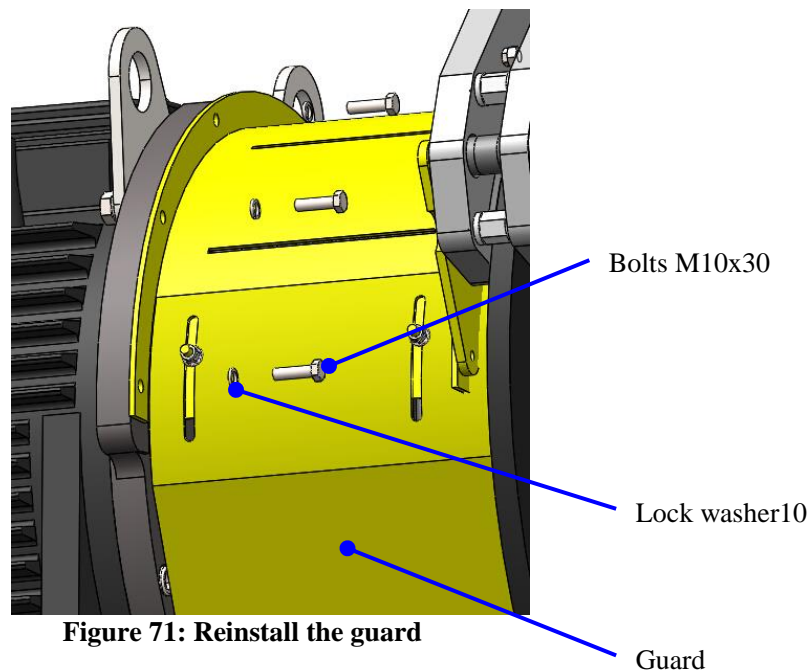


Figure 71: Reinstall the guard

8.4.1.3 Pedestal Body Installation and Adjustment

1. Tighten the bolts M24x80 (6). See Figure 72.
2. Place the pedestal body on the same location as that of the removed base, insert, thread the bolts M24x80 (2 pieces) with flat washers24 (2) and lock washers24 (2). Do not tighten these bolts at this time.

3. With the dial indicator, insert the adjusting shim into gap until the reading of dial indicator is between -0.05 to 0 (mm). Tighten the bolts M24x80 (2 pieces). Reinstall the alignment pins.
4. Turn on the power and running machine at low speed to check for any abnormal sound in the bearing or interference with the stator occurs.

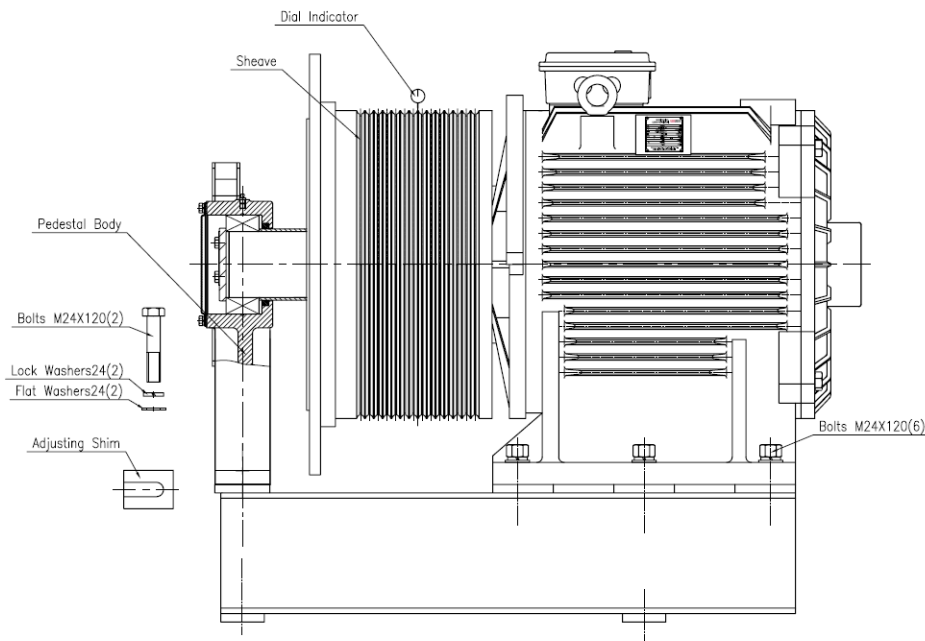


Figure 72: Pedestal Installation and Adjustment

8.4.2 TGL3 Sheave Replacement

Required Tools & Materials:

Open end wrench (18mm, 24mm, 46mm)

Hex wrench (10mm)

Dial gauge

Machine oil

File

Hoist chain

Clean cotton fabric

Rope

8.4.2.1 Sheave removal

1. Cut off the power to the machine. Loosen the bolts M12x35 (4 pieces) and bolts M16x40 (2 pieces) with an open end wrench and take off the guard. See Figures 72 and 73. Remove the ropes.
2. Loosen the bolts M12x35 (4 pieces) and bolt M16x40 (2 pieces) with open end wrench, and take off the guard. See Figures 73 and 74.

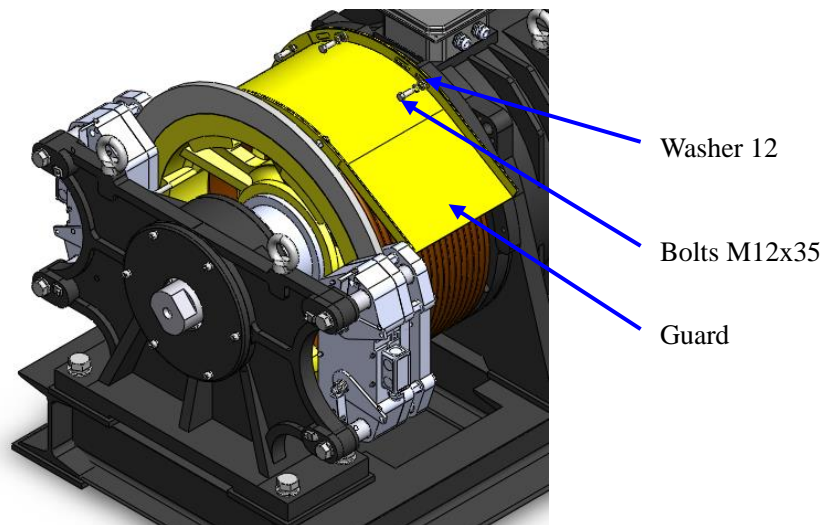


Figure 73: Remove M12x35 bolts

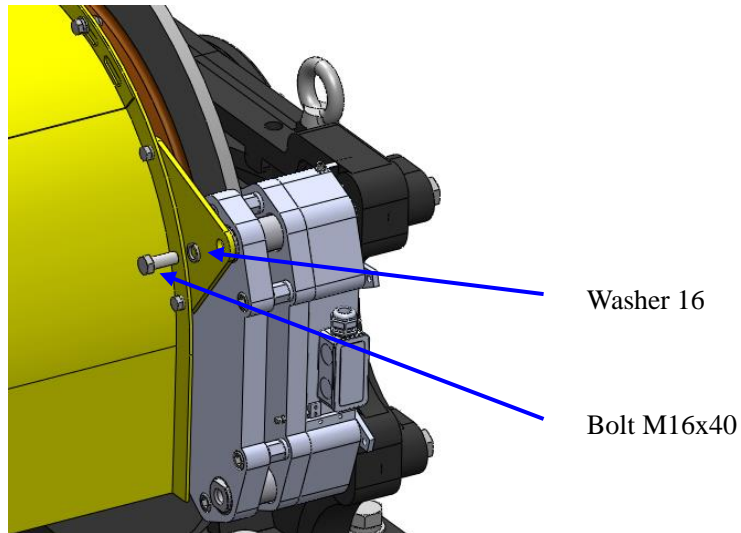


Figure 74: Remove M16x40 bolts

3. Remove the brake (Refer to section 8.2.2 Brake PZD360 Replacement)
4. Loosen the bolts M30x110 (8 pieces) with end wrench (46mm). Loosen the pin 20x70 (4 pieces). See Figure 75.

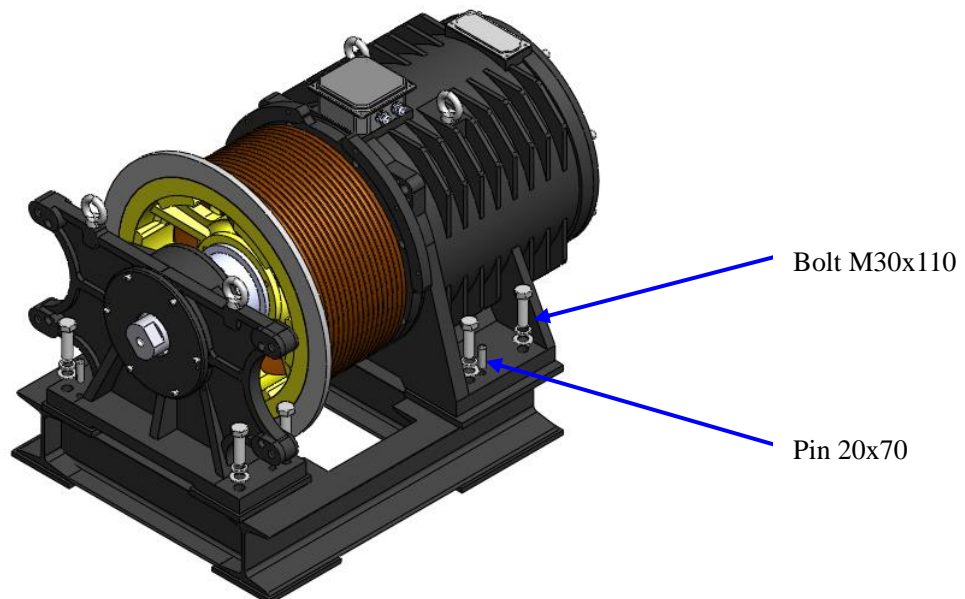


Figure 75: Separate Machine from base

5. Use the lifting device to take the machine to level place where there is enough space to complete the sheave replacement work. See Figures 76 and 77.
6. Put two metal spacers under the machine body at both sides.
7. Put two wood spacers under the sheave body at both sides.

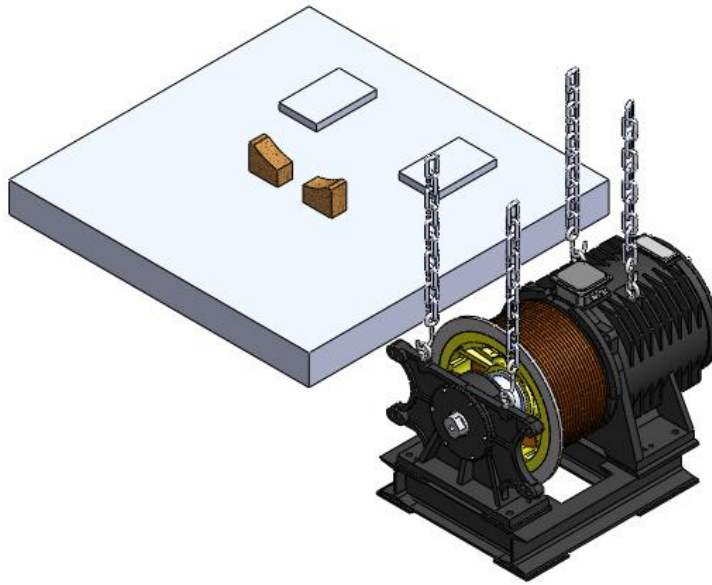


Figure 76: Hoist machine to spacers

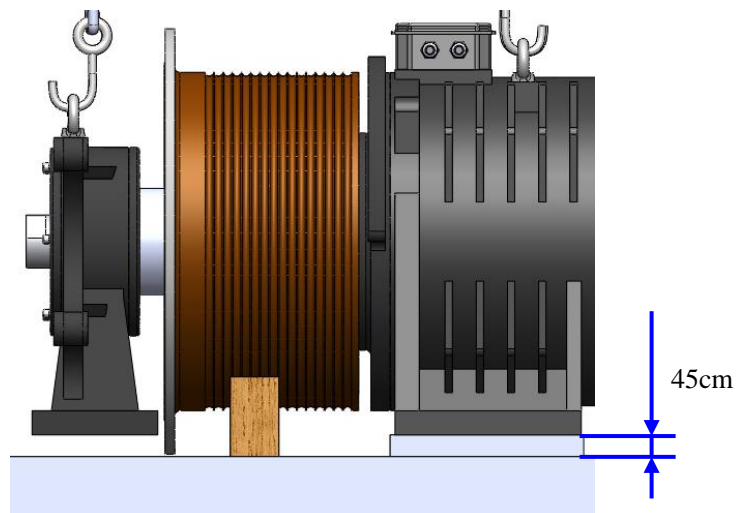


Figure 77: Spacer location

8. Loosen the bolts M12x190 (6 pieces) with lock washer12 with hex wrench (10mm), and take off the Cover 1. See Figures 78 and 79.

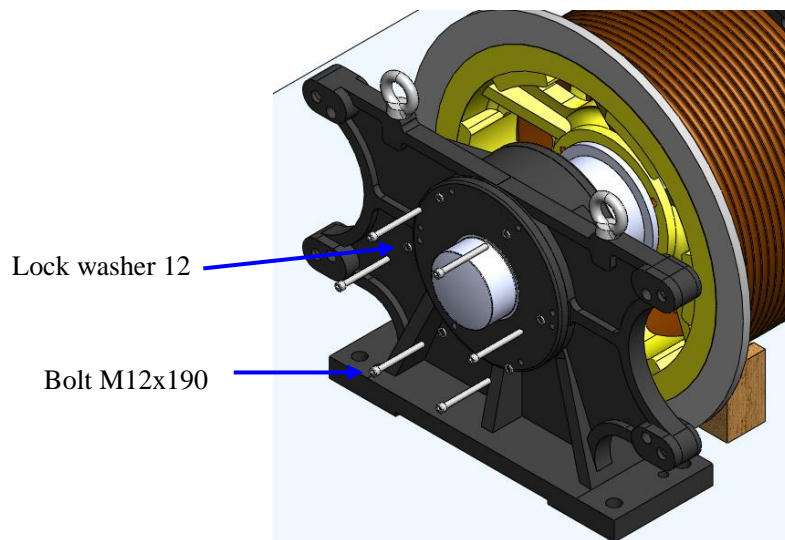


Figure 78: Remove M12x190 bolts

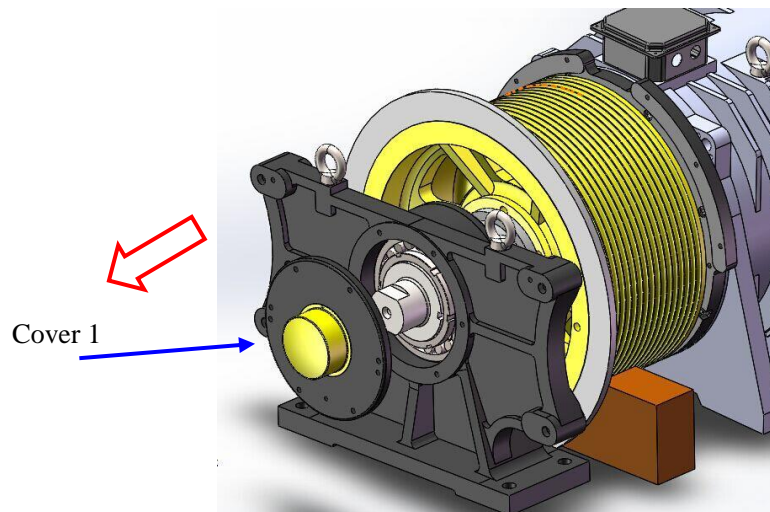


Figure 79: Remove Cover 1

9. Replace the oil seal SC $\text{Ø}110 \times \text{Ø}140 \times 12$ if necessary.
10. Use the pull-off device to dismantle the pedestal body and pedestal together. See Figure 80.

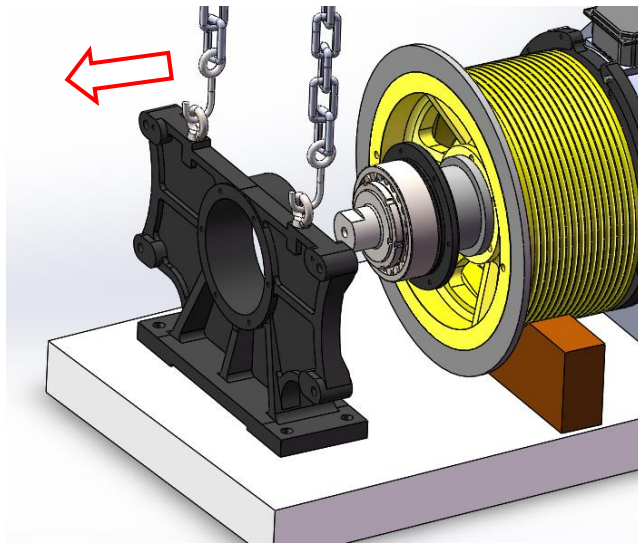


Figure 80: Remove Pedestal

11. Remove the M190 Round Nut and Tap washer with a large screwdriver and hammer. See Figure 81.

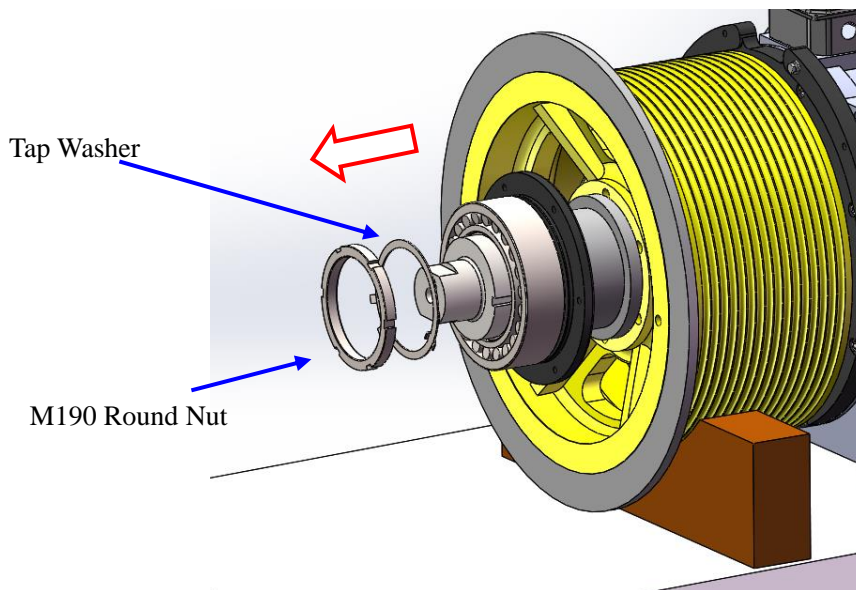


Figure 81: Remove M190 Round Nut and Tap washer

12. Take off the bearing (23040CAME4) See Figure 82.
13. Take off the cover 2.
14. Take off the steel-cover.
15. Replace the oil seal SC Ø220xØ250x15 if necessary.

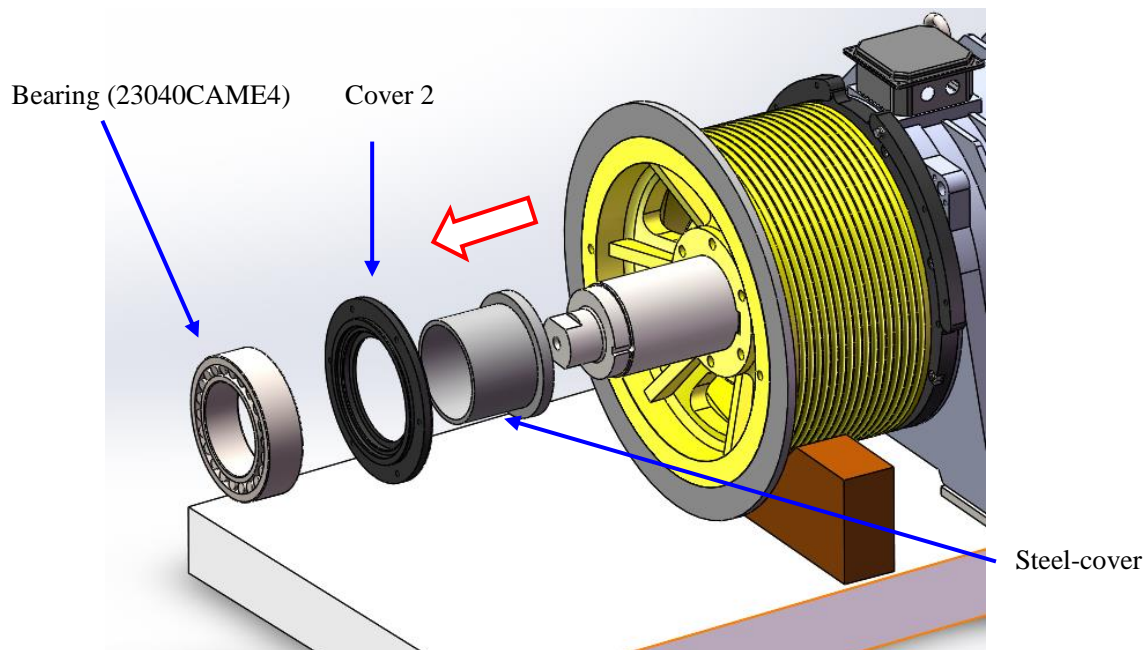


Figure 82: Bearing, Cover 2 and Steel cover removal

16. Use a lifting device to suspend the Sheave. Remove 3 M16 bolts equally spaced around the sheave/brake disc. Attach 3 M16x500 threaded rods to the sheave. Install the Special Sheave Removal Plate on the rods against the end of the output shaft. Thread M16 nuts onto the rods. Tighten each nut successively to pull the sheave loose from the shaft. Then hoist the sheave clear of the shaft. See Figures 83-85.

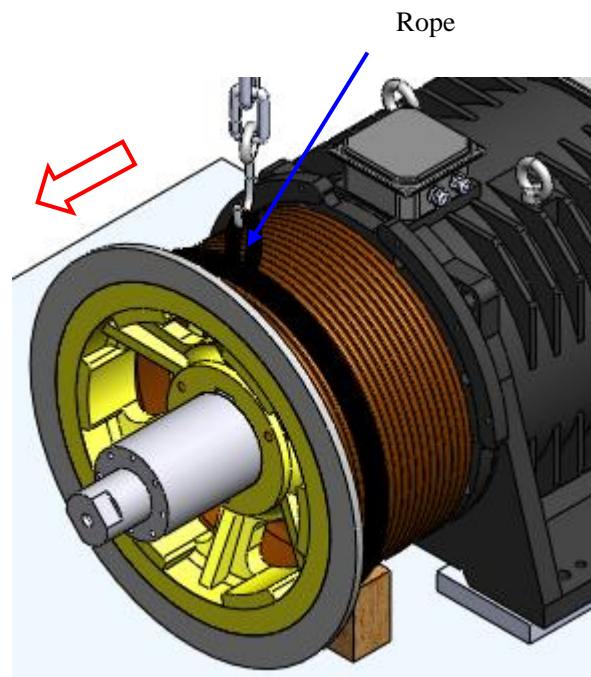


Figure 83: Lift the sheave



Figure 84: Pull the sheave from the shaft

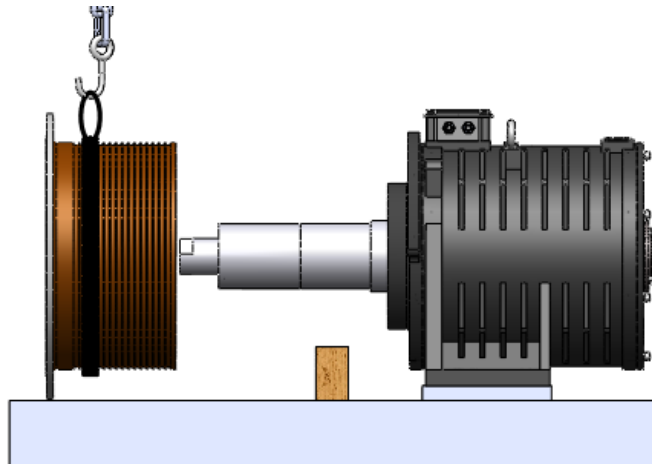


Figure 85: Hoist sheave clear

8.4.2.2 Sheave installation

1. Debur the key and sheave with a file; then clean the shaft and sheave, coat with a little machine oil on the key.
2. Check and clean the Sheave.
3. Use a lifting device to suspend the Sheave and clean the mate surface. Then slide it onto the main shaft making sure it is fully seated. See Figure 86.

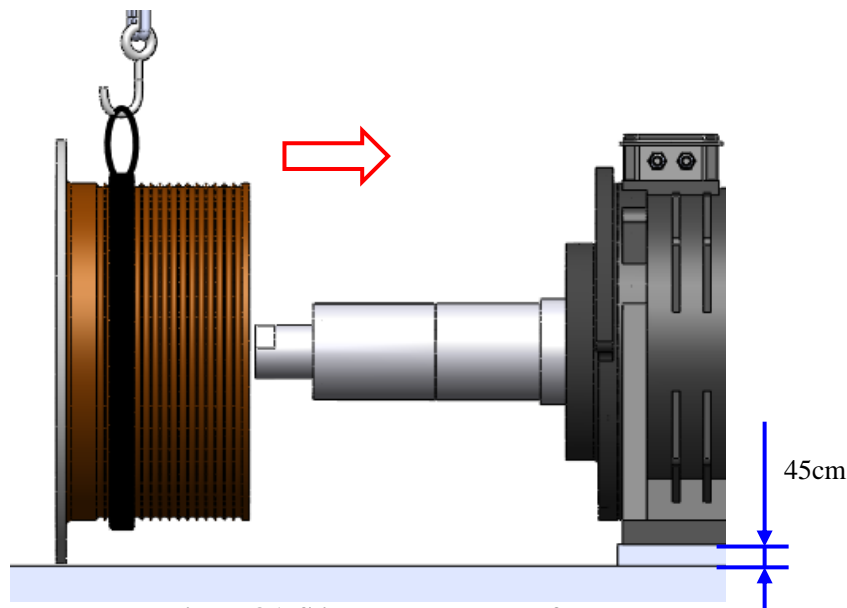


Figure 86: Slide sheave onto shaft

4. To ensure the sheave is fully seated, attach the sheave press apparatus as shown in Figure 61 (page 44) after sliding on the Special Steel Cover on the shaft. Use a hydraulic jack to apply 39Mpa (20T) pressure to the sheave. Then remove the pressing apparatus.
5. Use a dial gauge to check the vertical allowable tolerance of the brake disk ≤ 0.1 mm, the vertical allowable tolerance of the sheave groove ≤ 0.3 mm.
6. Put two wood spacers under the sheave body at both sides.
7. Install the steel-cover, the cover 2, and the bearing (23040CAME4). See Figure 87.

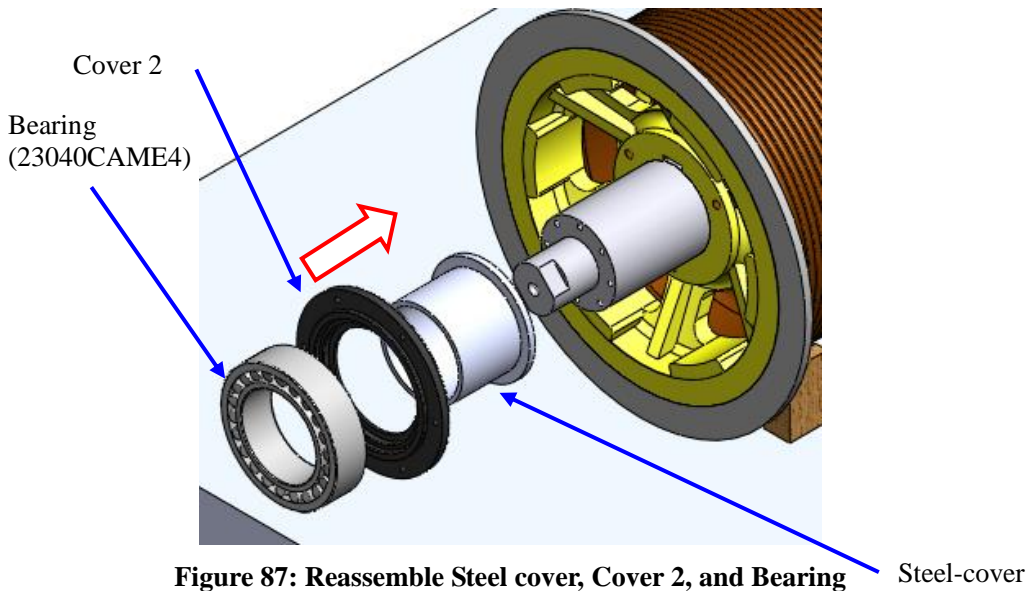


Figure 87: Reassemble Steel cover, Cover 2, and Bearing

8. Install the Tap Washer and M190 Round Nut. **Make sure the beveled edge of the M190 Round Nut is toward the sheave.** Align a notch of the M190 Round Nut with a tab on the Tap Washer and bend down the tab into the notch. See Figure 88.

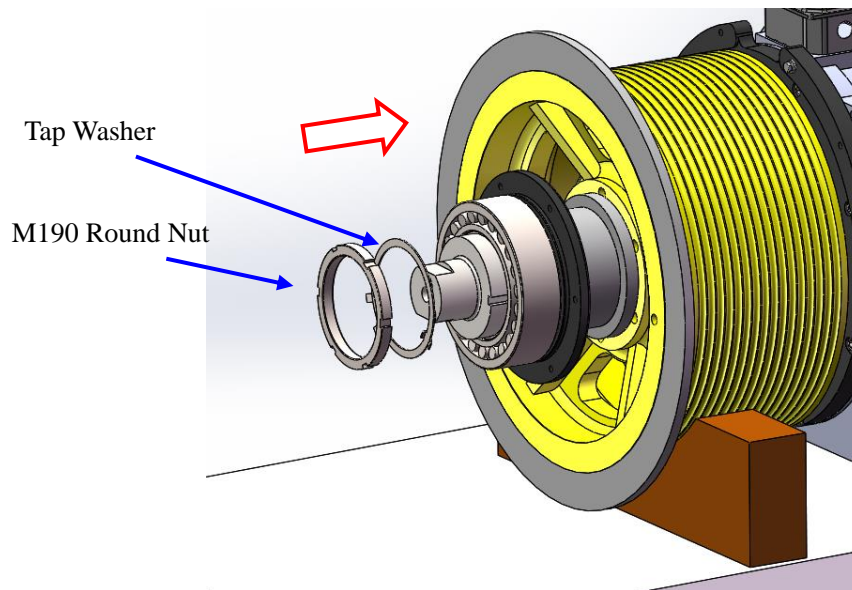


Figure 88: Reinstall the Tap Washer and M190 Round Nut

9. Install the pedestal on the main shaft. See Figure 88.

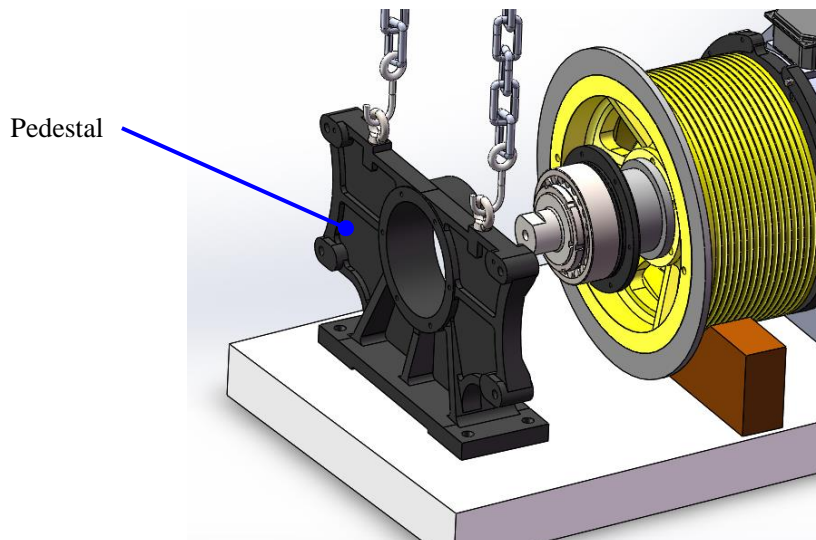


Figure 89: Install the pedestal to main shaft

10. Install Cover 1 in the pedestal, and then tighten the bolt M12x190 (6 pieces) with lock washer¹² with hex wrench (10mm) See Figure 90.

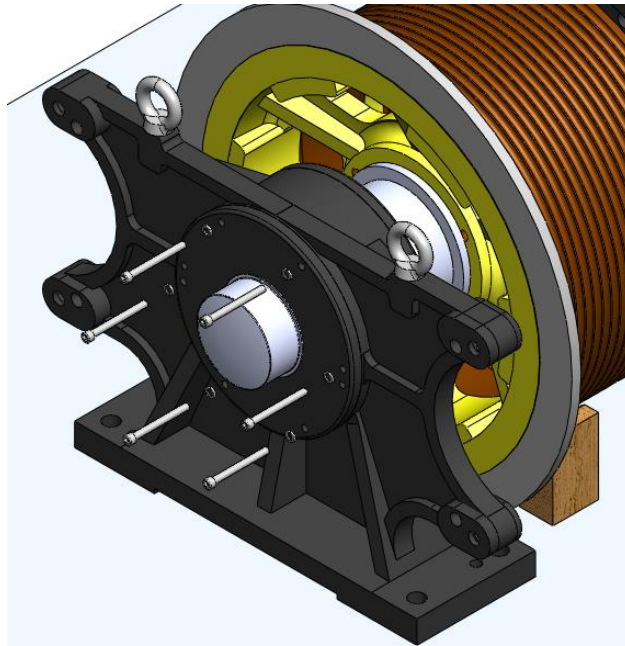


Figure 90: Install Cover 1 on pedestal

11. Use the lifting device to take the machine to the frame foundation. See Figure 91.

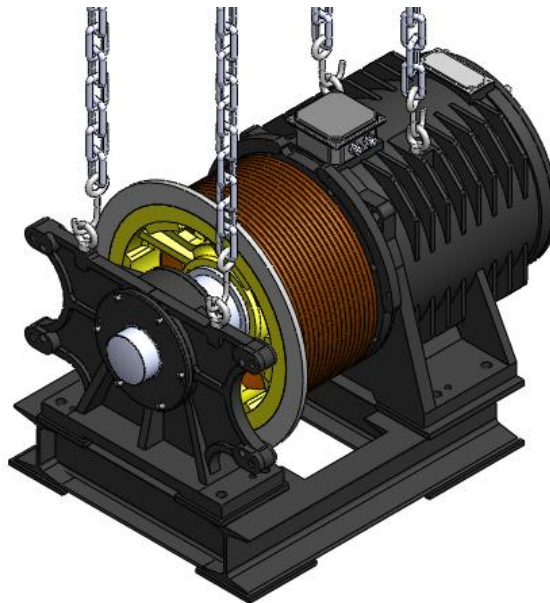


Figure 91: Lift machine to foundation

12. Tighten the bolt M30x110 (4 pieces) with lock washer 30 and flat washer 30 with open end wrench (46mm). See Figure 92.
13. Install the pins 20x70 (2) until snug.

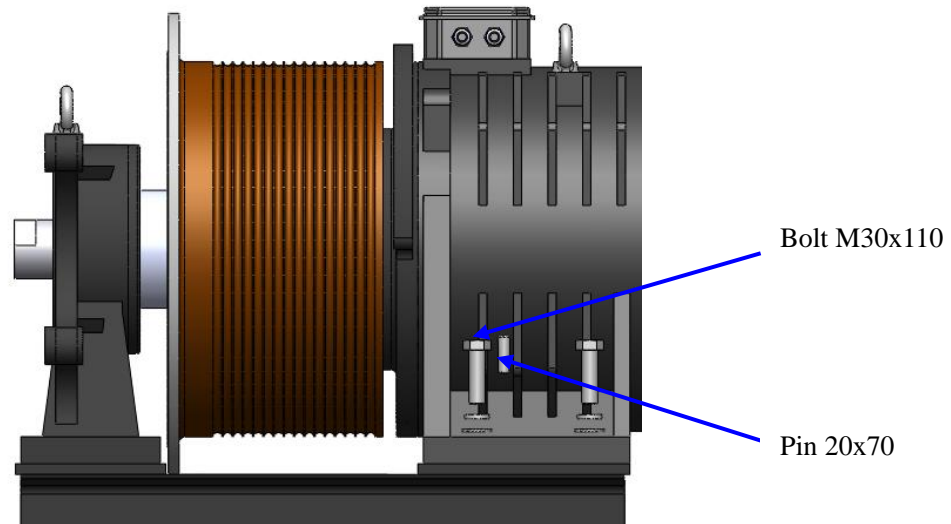


Figure 92: Install bolts and pins

14. Adjust the pedestal body (refer to Section 8.4.2.3 Pedestal Body Installation and Adjustment).
15. Install the brakes. (Refer to Section 8.2.2 TGL3 Brake replacement)
16. Install the ropes and guards. See Figures 93 and 94.

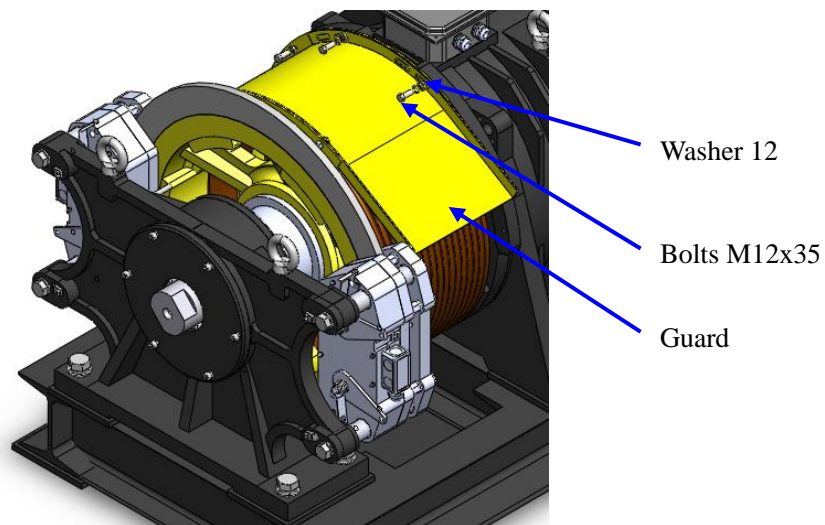


Figure 93: Install Guard

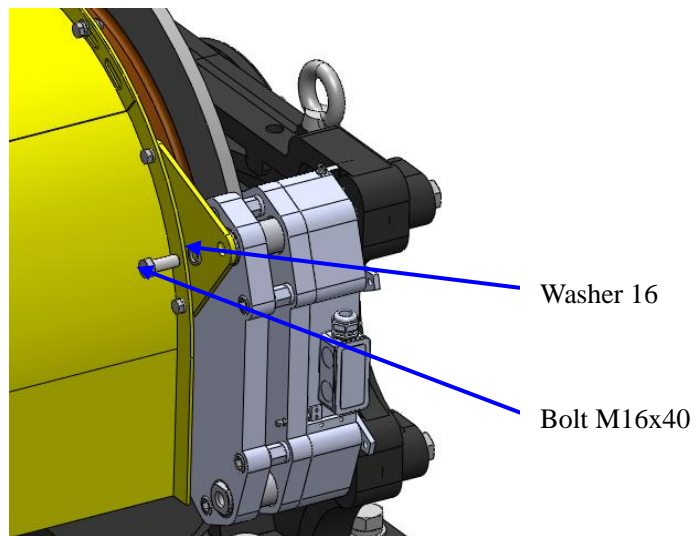


Figure 94: Secure guard

17. Reconnect the power and test the machine.

8.4.2.3 Pedestal Body Installation and Adjustment

1. Insert and thread the bolts M30x110 (4 pieces) with flat washers30 (4) and lock washers30 (4). Do not tighten these bolts at this time. See Figure 95.
2. With the dial indicator, insert the adjusting shim into gap until the reading of dial indicator is between -0.05 to 9 (mm). Tighten the bolts M30x110 (4 pieces)
3. Turn on the power and run the machine at low speed to check whether there is any abnormal sound in the bearing or interference with the stator occurs.

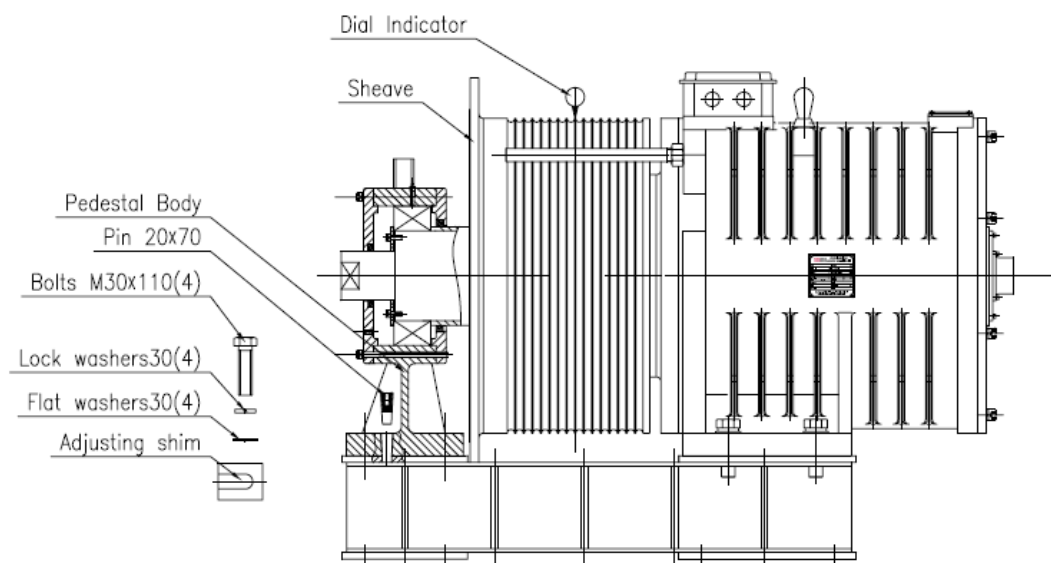


Figure 95: Pedestal Body Installation and Adjustment

8.5 Bearing Replacement



The bearing replacement work must be done in ground, so the machine must be lifted and moved out off hoist way when perform the bearing replacement work!

8.5.1 Rear Bearing Replacement

8.5.1.1 TGL1/2/2A Rear Bearing Replacement

Required Tools & Materials:

Open end wrench (7mm, 18mm, 24mm, 30mm)

Hex wrench (4mm)

Bearing puller

Rubber hammer

Clean cloth

Double end studs (Threaded rod) M20x150 (2 pieces)

Bearing heater

Double end studs (Threaded rod) M12x200 (2 pieces)

Bolt M16x120-8.8

Hoist chain

Rope

Loctite 680

8.5.1.1.1 Rear bearing removal

1. Cut off the power to the machine and remove the guards and ropes. Then take the machine to a level place where there is enough space to complete the bearing replacement work.
2. Remove the encoder. See Section 8.1.1 Encoder Removal. **NOTE: The encoder is a precision part and should be removed carefully.**
3. Loosen the bolt M12x130 (4 pieces) and lock washer¹² with the end wrench, then remove the outside cover and the wavy spring. See Figure 96.

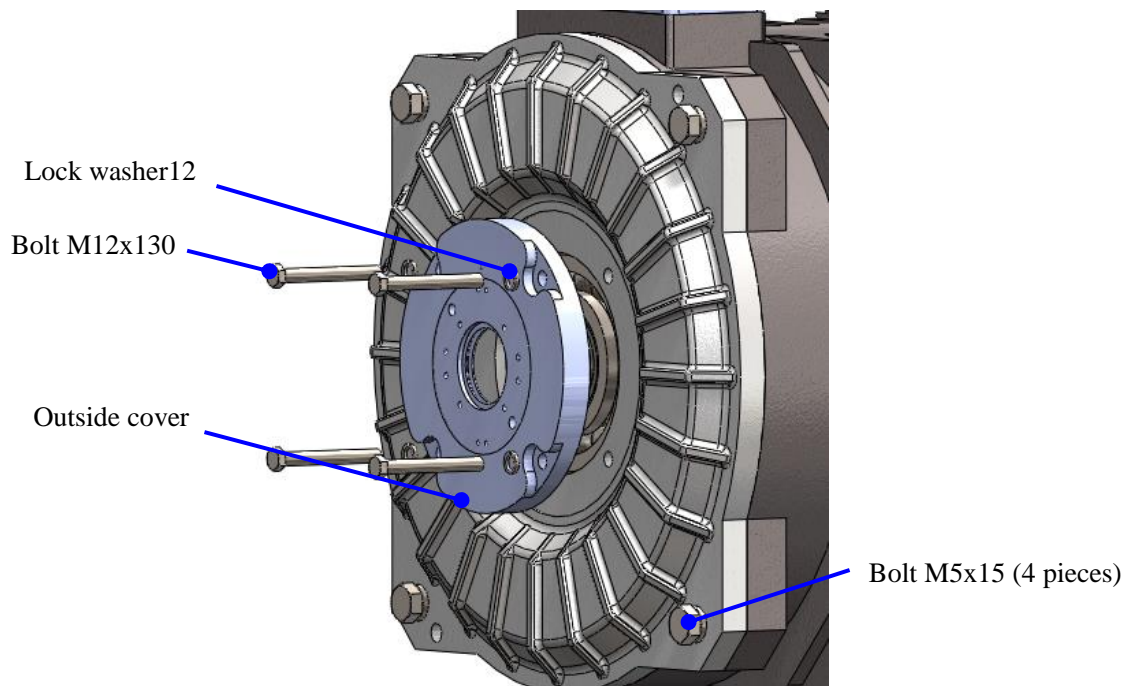


Figure 96: Remove Outside Cover

4. Loosen the bolt M20x70 (4 pieces) and lockwasher20 with the end wrench, screw a pair of double end studs (M20x150) into the thread holes opposite each other. See Figures 97 and 98.

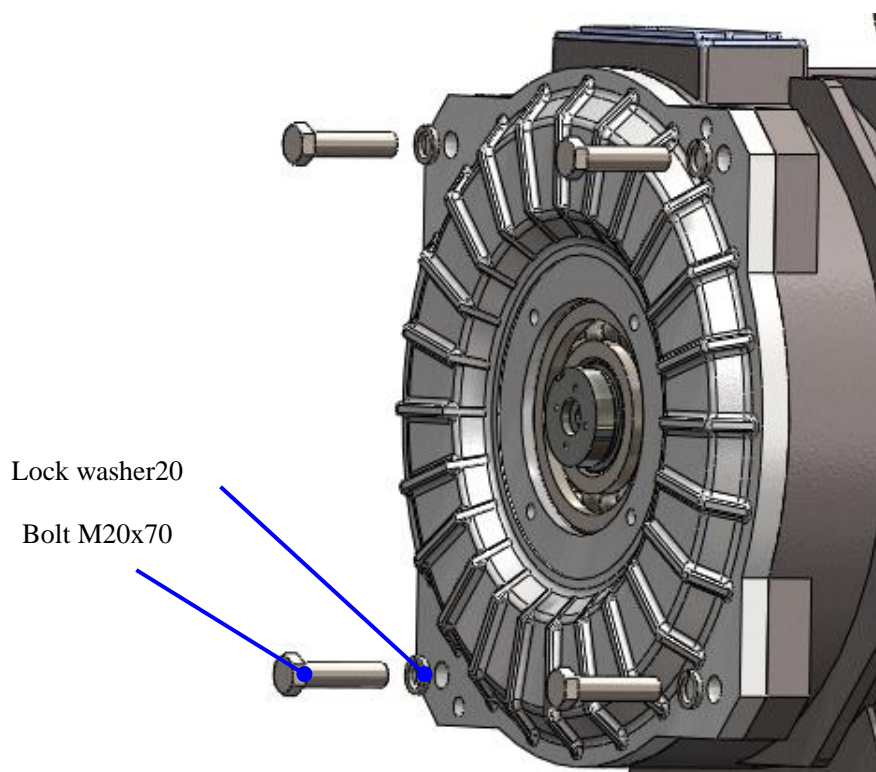


Figure 97: Remove M20x70 bolt and lockwasher20

Double end studs M20x150

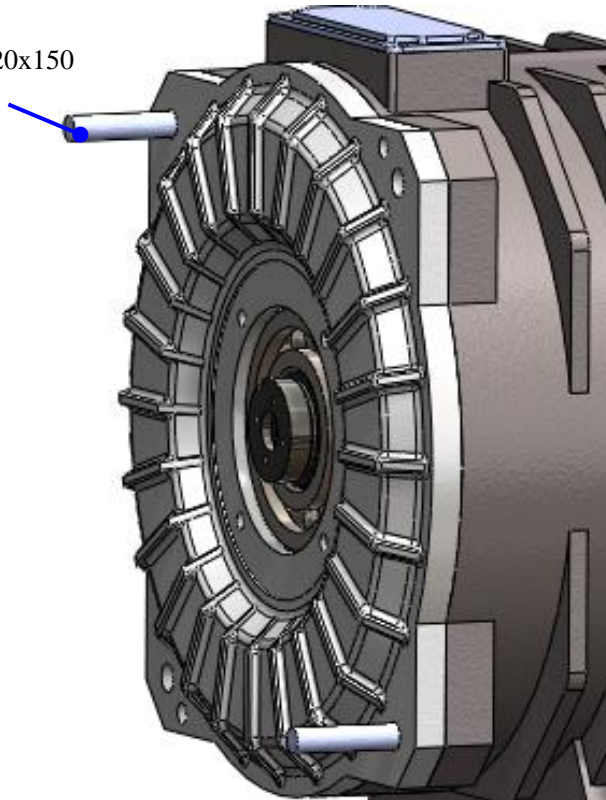


Figure 98: Install M20x150 studs

5. Screw a pair of bolts M16x120-8.8 into the disassembly thread holes in back cover, to separate the back cover from the machine body. See Figures 99 and 100.

Bolt M16x120

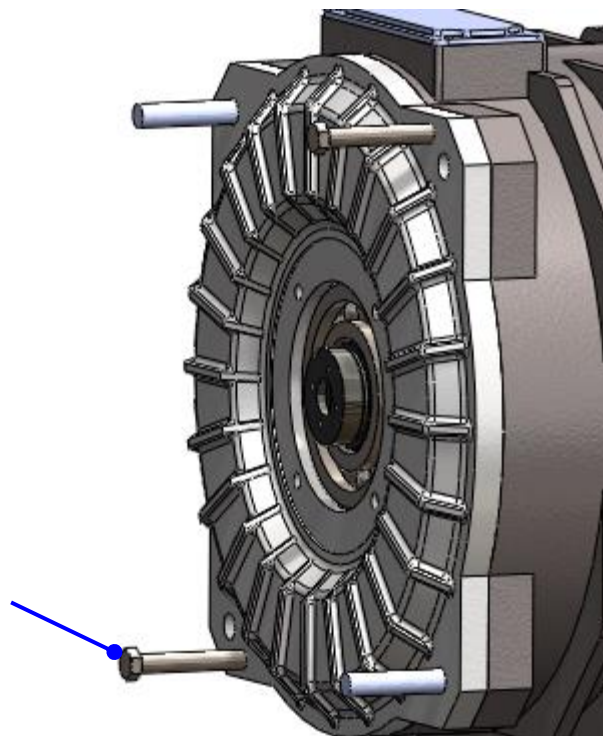


Figure 99: Thread M16x120 bolts to loosen back cover



Figure 100: Back cover separated from machine body

6. Use lifting equipment to suspend the back cover, then remove the double end studs (M20x150). Then remove the outside cover. See Figures 101 and 102.

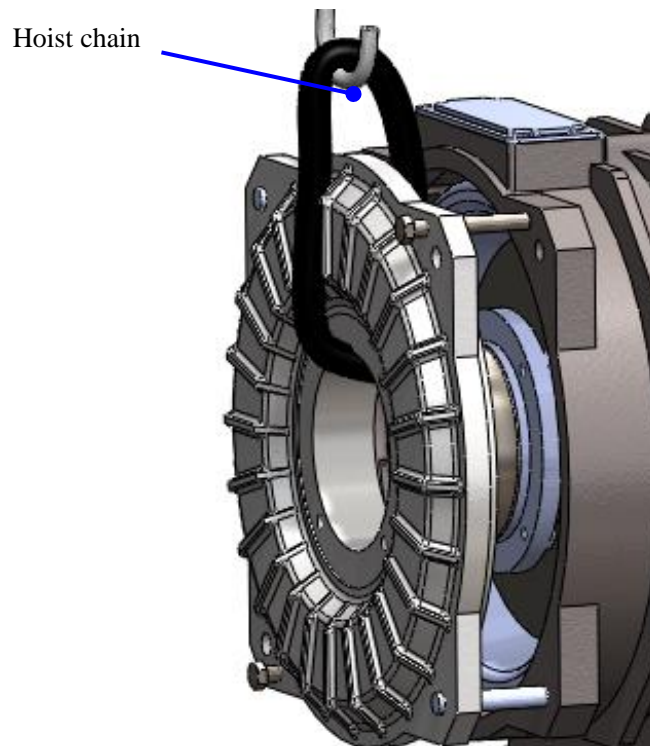


Figure 101: Lift the back cover

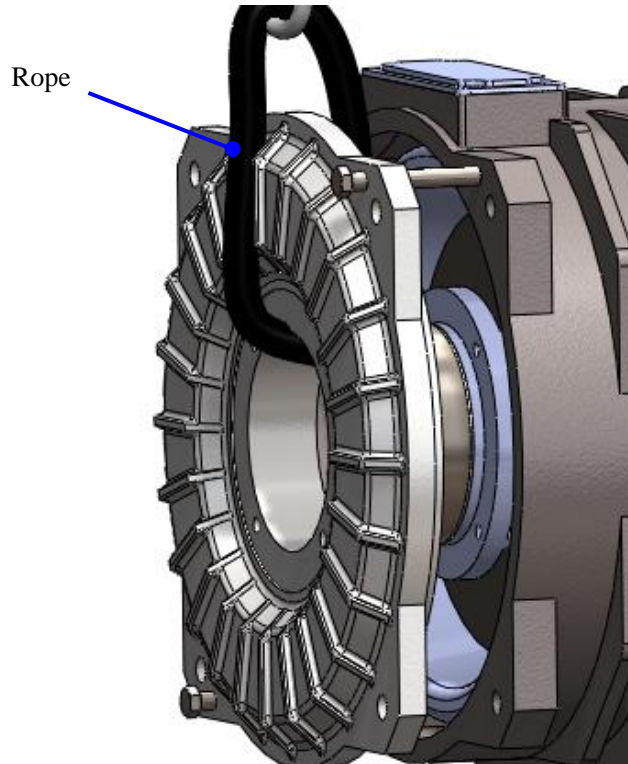


Figure 102: Lift the back cover

7. Take off the lock washer⁸⁰, then screw off the circle nut M80x2.
8. Use the bearing puller to dismantle the Bearing and Inside cover together. (Cutting the bearing off is permissible.) See Figure 103.

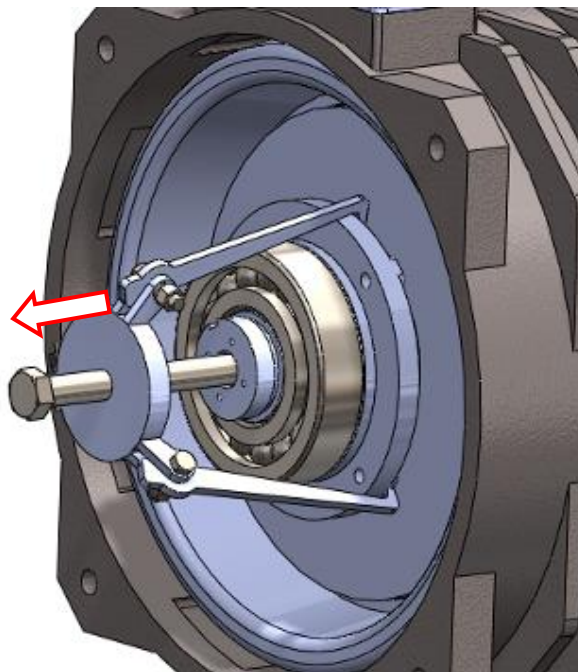


Figure 103: Remove Bearing and Inside cover

8.5.1.1.2 Rear bearing installation

1. Put the Inside cover on the shaft. See Figure 104.

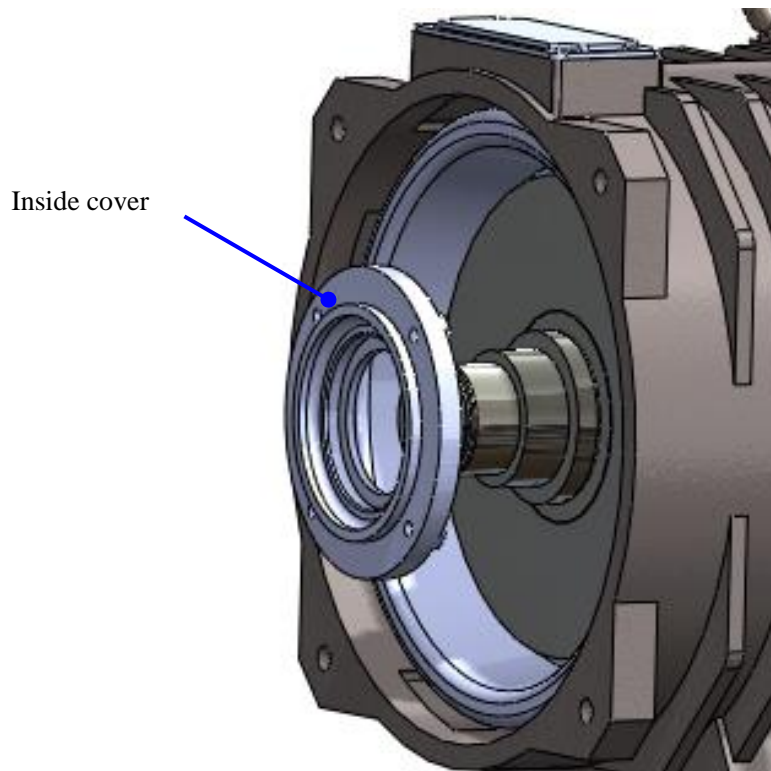


Figure 104: Install Inside cover

3. Heat the new bearing (6318DDU) in the heating equipment to $70\pm 15^{\circ}\text{C}$ ($158\pm 59^{\circ}\text{F}$) set it quickly and fully onto the shaft. Lock the bearing with the M80 circle nut and lock washer. See Figure 105.

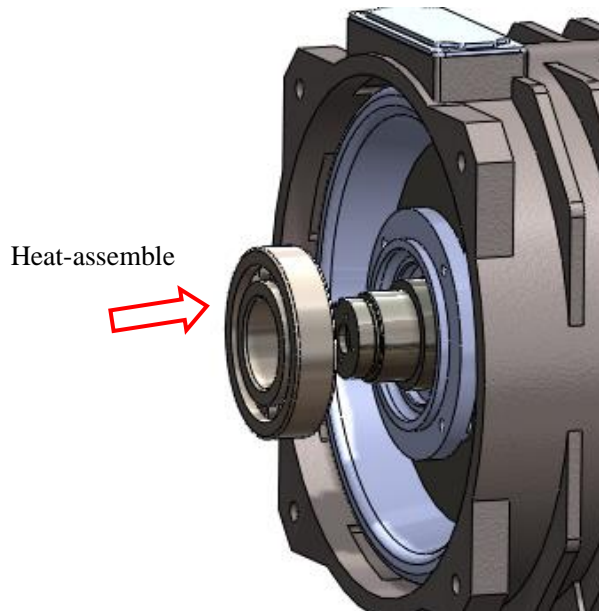


Figure 105: Install bearing

4. Use a pair of double end studs M12x200 tightened into the threaded holes in the inside cover opposite each other. See Figure 106.

5. Use a lifting device to suspend the back cover, then back it into the shaft through double end studs M12x200 after clean the bearing hole.

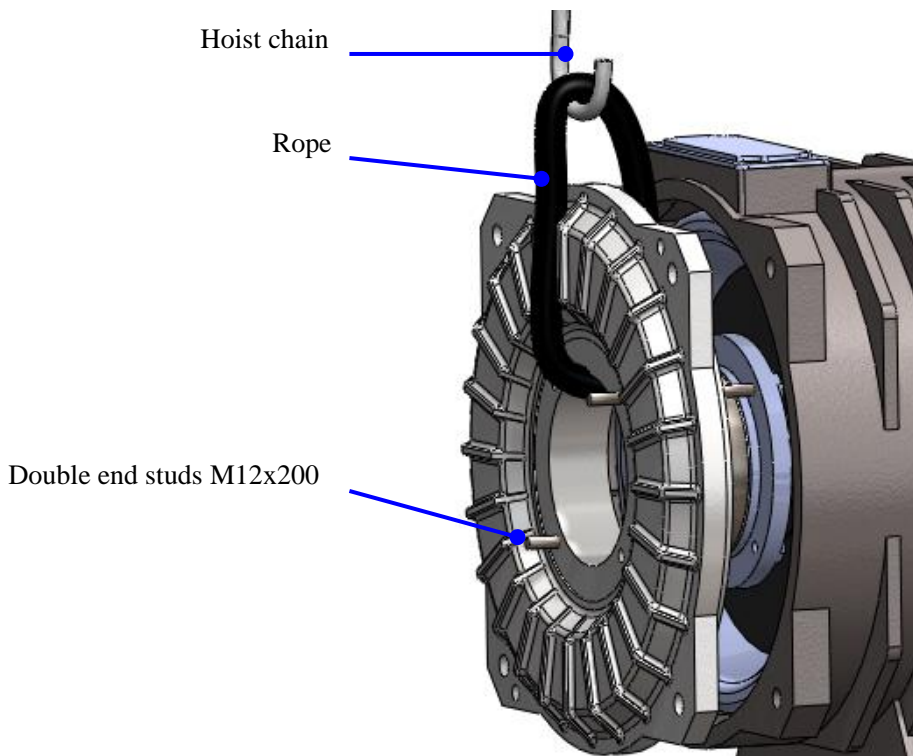


Figure 106: Install double end studs and lift back cover

6. Use a pair of double end studs M20x150 tightened into the threaded holes in the machine body. Then knock the back cover into position with a rubber hammer. See Figure 107.

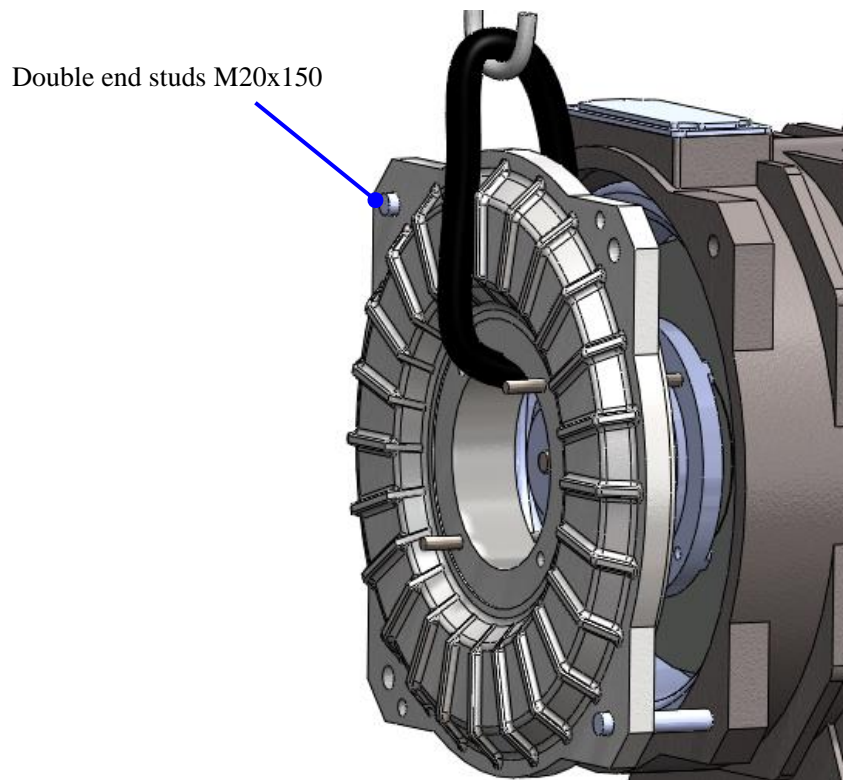


Figure 107: Install Studs and knock into position

7. Secure the back cover and the machine body with the bolt M20x70 (4 pieces) and lockwasher20 (4 pieces). Disassemble the double end studs M20x150. See Figure 108.

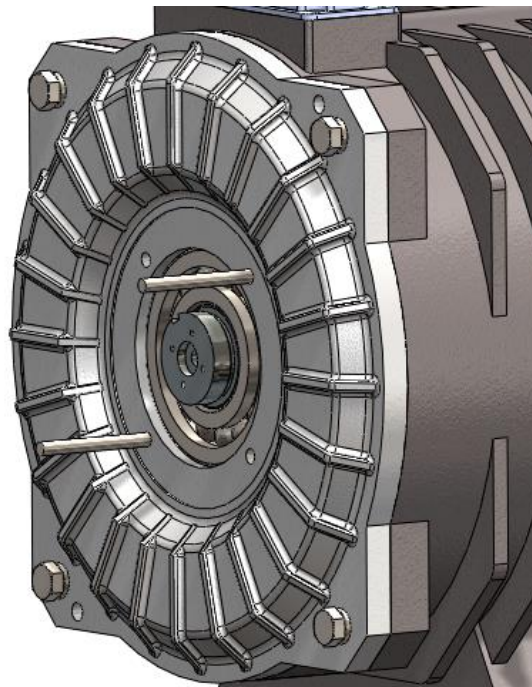


Figure 108: Back cover secured

8. Install the wavy gasket next to bearing, then slide the outside cover into the shaft through double end studs M12x200. Use the bolt (smear some Loctite 680 outside) M12x110 (4 pieces) and lock washer12 (4 pieces) to secure the inside cover, back cover, and outside cover together. Disassemble the double end studs M12x200 at same time. See Figures 109 and 110.

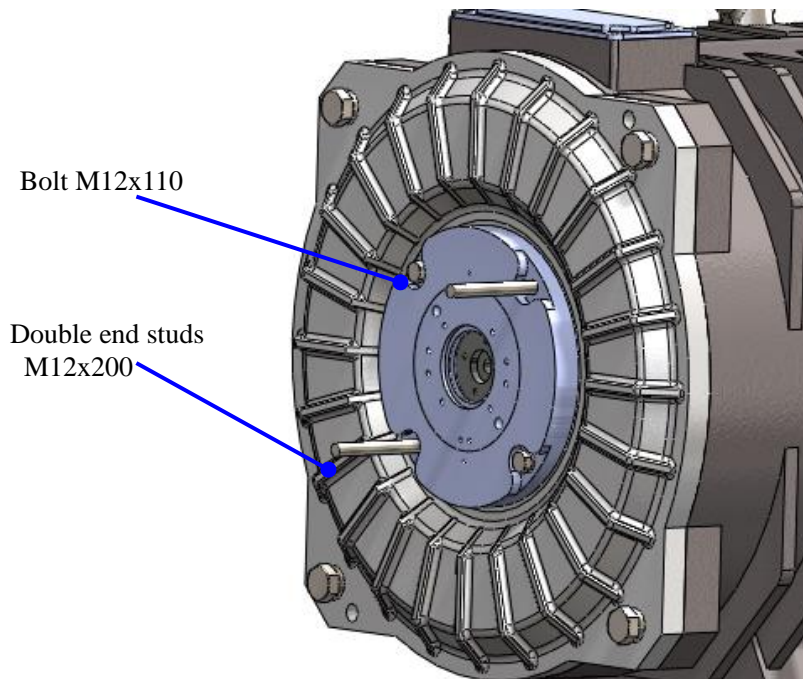


Figure 109: Install studs and secure outside cover

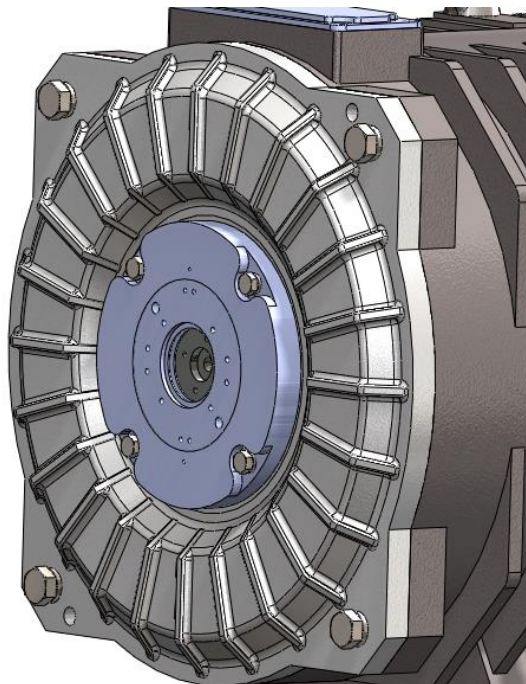


Figure 110: Outside cover secured

9. Install the connection shaft, encoder and encoder cover one by one. Refer to Section 8.1.2 Encoder Installation.
10. Reconnection the power to the machine to test.
11. Reinstall ropes and guards

8.5.1.2 TGL3 Rear Bearing Replacement

Required Tools & Materials:

Open end wrench (24mm)
Hex wrench (4mm, 6mm, 14mm)
Rubber hammer
Double end studs (Threaded rod) M16x300 (2 pieces)
Bearing heater
Bolt M16x120-8.8
Hoist chain
Rope

8.5.1.2.1 Bearing Removal

1. Cut off the power to the machine and remove the guards and ropes. Then take the machine to a level place where there is enough space to complete the bearing replacement work.
2. Remove the encoder. See Section 8.1.1 Encoder Removal. **NOTE: The encoder is a precision part and should be removed carefully.**
3. Remove the Bolt M5x16 (4 pieces) and lock washer (4 pieces), setting of encoder, Bolt M5x16 (4 pieces), and connection shaft in that order. See Figure 111.

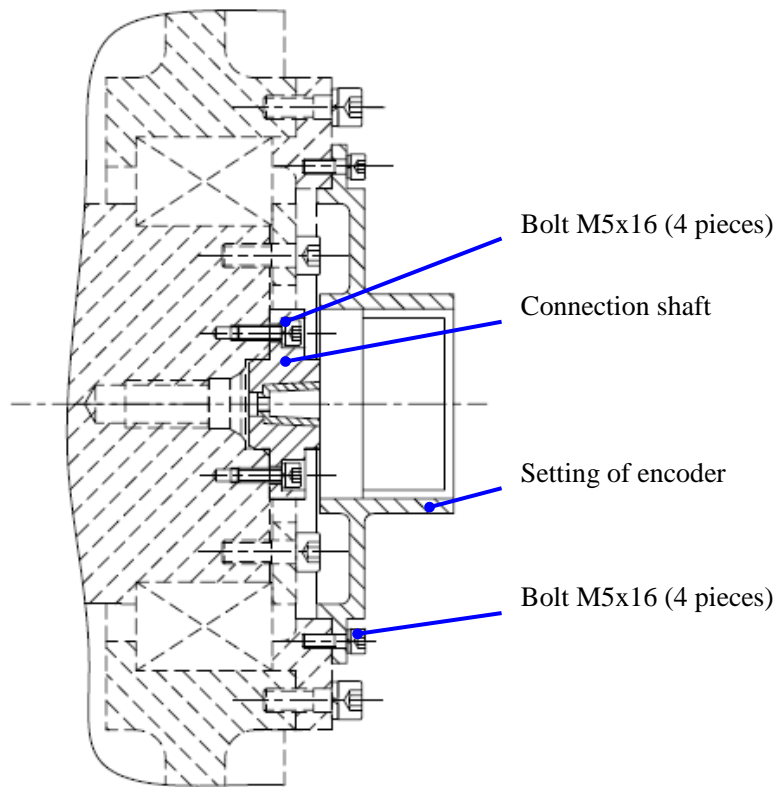


Figure 111: Remove encoder, setting of encoder and connection shaft

4. Remove the bolt M8x25 (4 pieces) and lock washer 8 (4 pieces) with the end wrench, then remove the outside cover. See Figure 112.

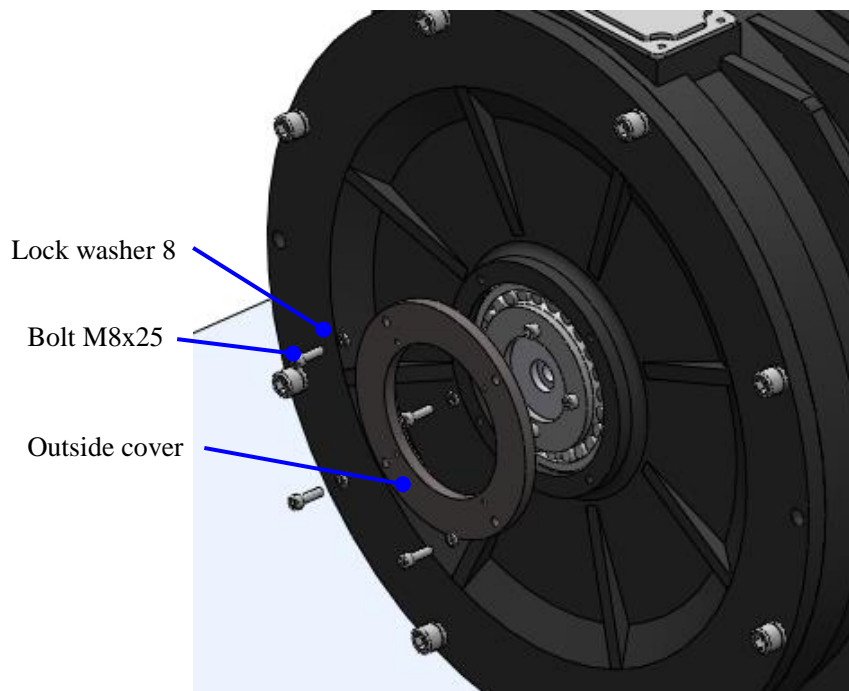


Figure 112: Remove Outside cover

5. Remove the bolt M8x25 (4 pieces) with the end wrench, then remove the Bearing cover 2. See Figure 113.

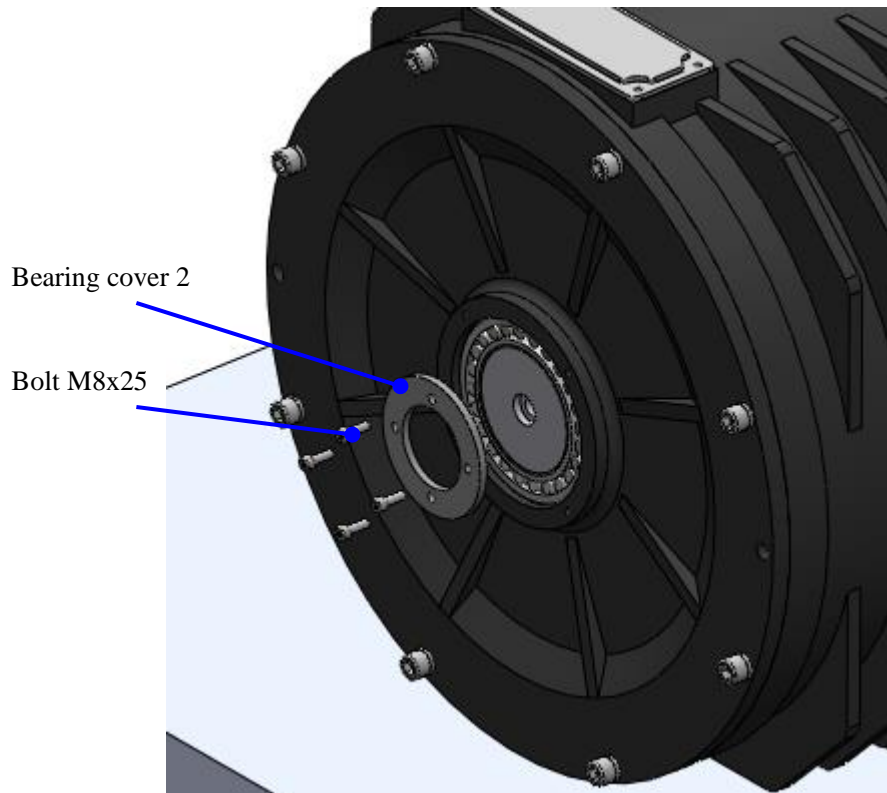


Figure 113: Remove Bearing cover2

6. Remove the bolt M16x50 (8 pieces) and lock washer16 (8 pieces) with the hex wrench, screw a pair of double end studs (M16x300) into the threaded holes opposite each other. See Figure 114.

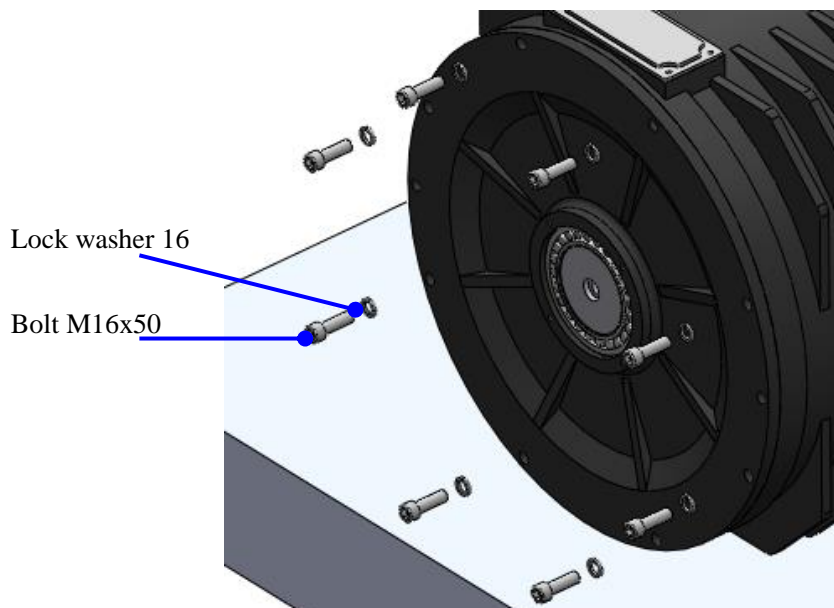


Figure 114: Remove M16x50 bolts

7. Screw a pair of bolts M16x120-8.8 into the Disassemble threaded holes in back cover, to back the back cover off. See Figure 115.

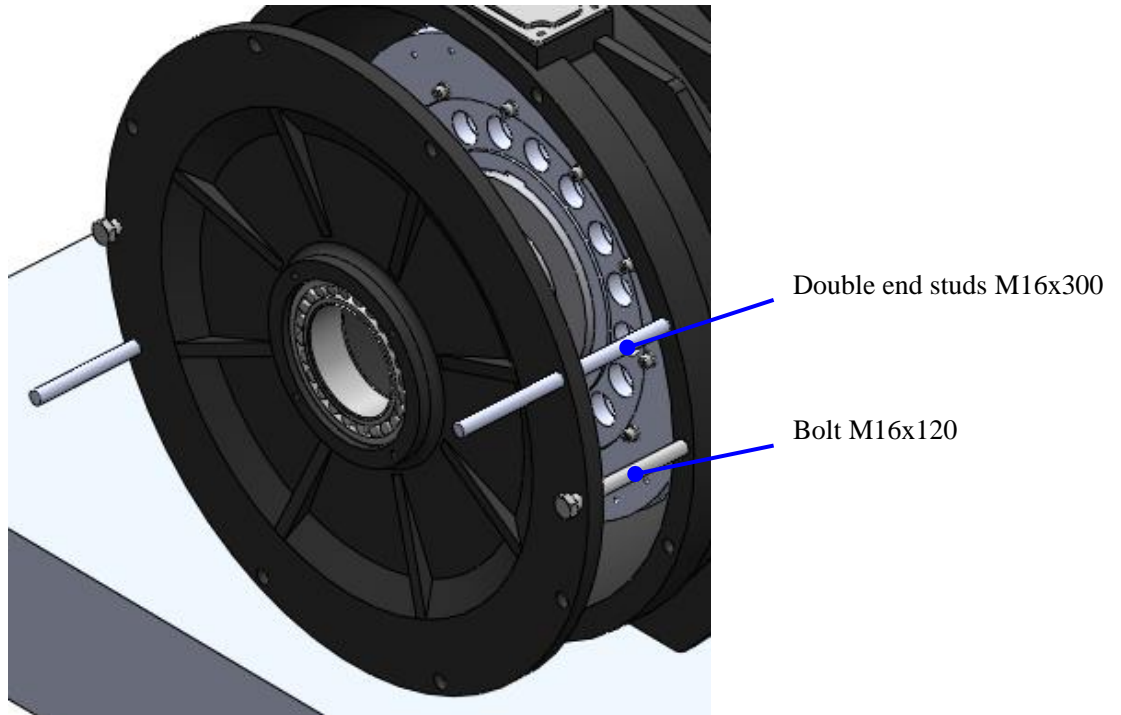


Figure 115: Install double end studs and M16x120 bolts

8. Use lifting equipment to suspend the back cover, then dismantle the double end studs (M16x300). Then remove the back cover and bearing (23024 CA-2CS2). A bearing puller may be needed to remove the back cover and bearing. See Figure 116.

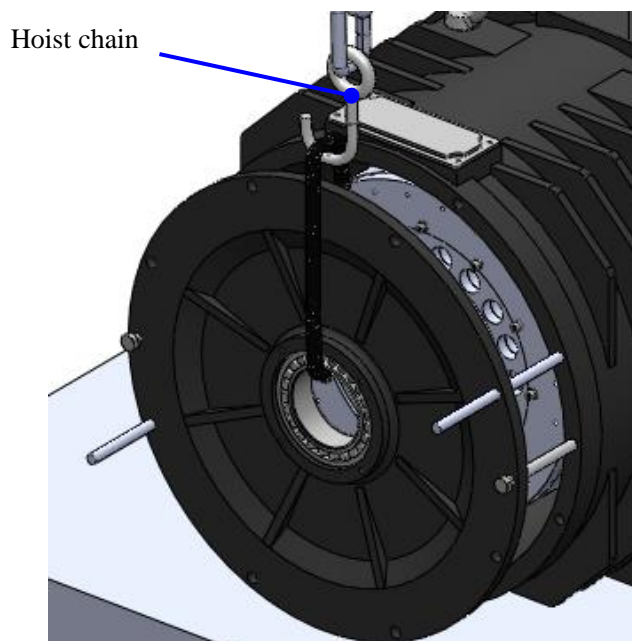


Figure 116: Remove back cover and bearing

8.5.1.2.2 Bearing installation

1. Use a lifting equipment to suspend the back cover. Then use a pair of double end studs M16x300 tightened into the threaded holes in the machine body. Then knock the back cover in position with a rubber hammer. See Figures 117 and 118.

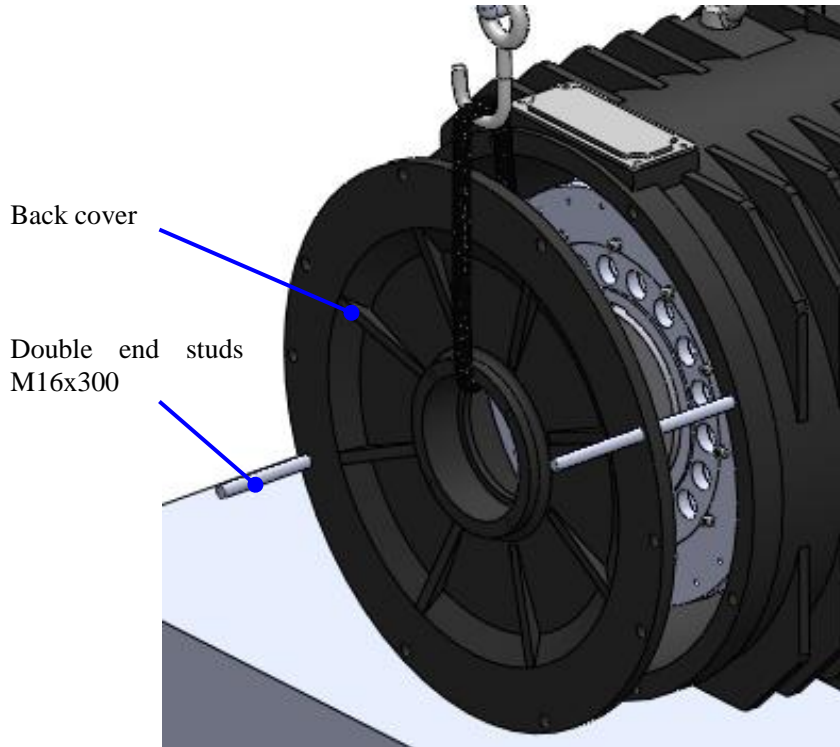


Figure 117: Install back cover

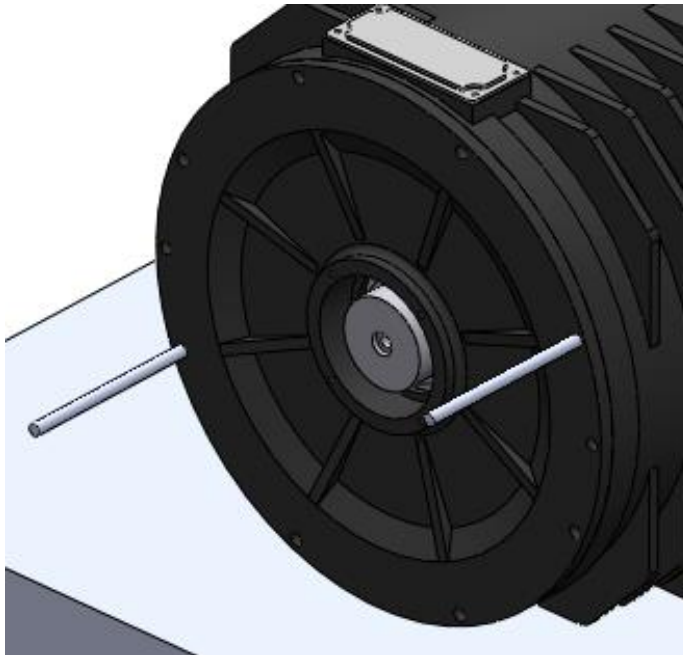


Figure 118: Back cover in position

- Secure the back cover and the machine body with the bolt M16x50 (8 pieces) and lock washer16 (8 pieces). Remove the double end studs M16x300 at the same time. See Figure 119.

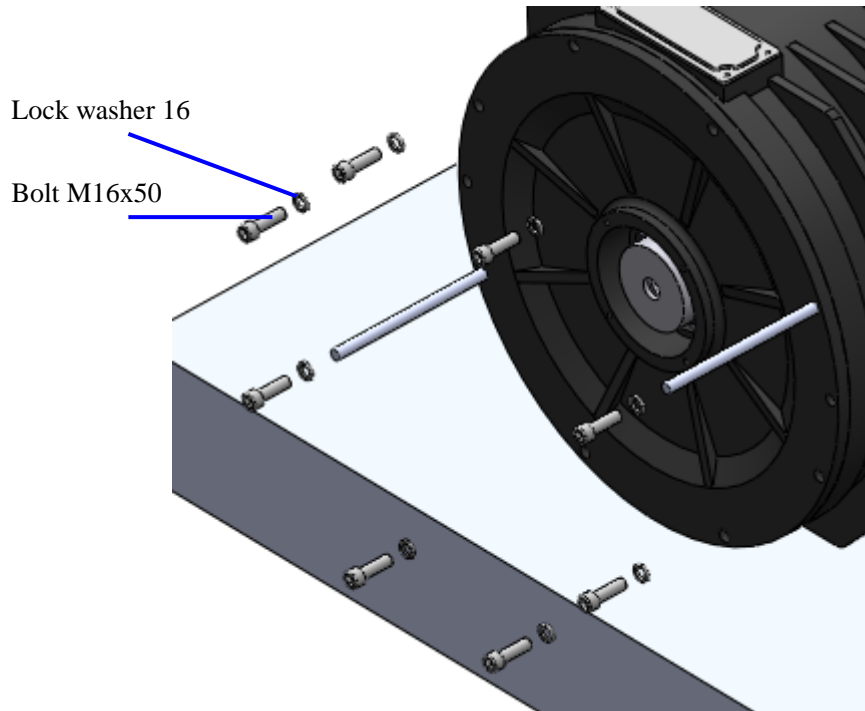


Figure 119: Secure back cover

- Install bearing (23024 CA-2CS2) in the main shaft. Figure 120.

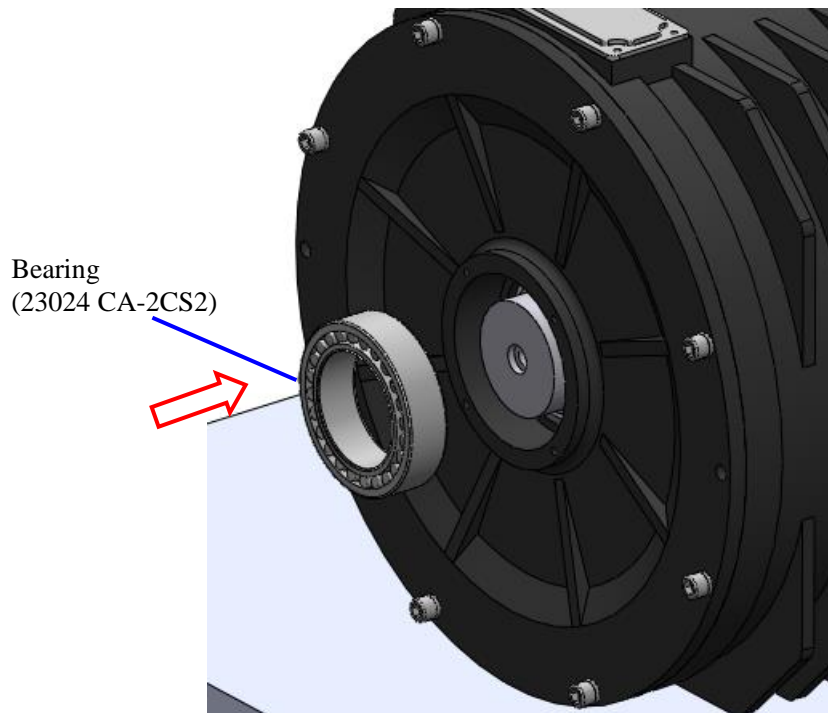


Figure 120: Install bearing

4. Install Bearing cover 2 on the main shaft, and then tighten the bolt M8x25 (4 pieces) with hex wrench (6mm). See Figure 121.

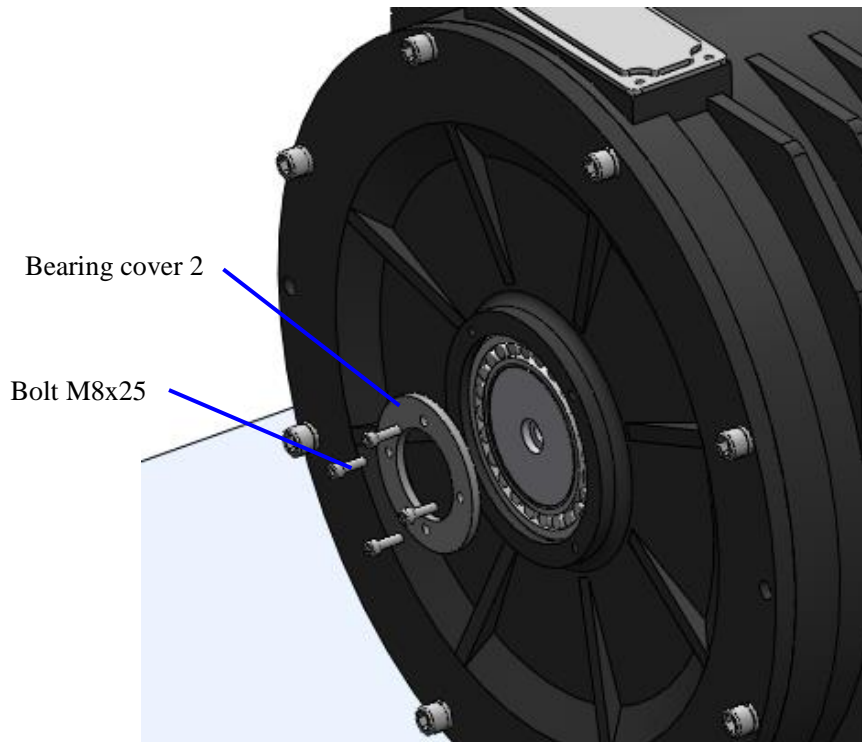


Figure 121: Install Bearing cover 2

5. Install the Outside cover on the back cover, and then tighten the bolt M8x25 (4 pieces) with spring washer 8 with hex wrench (6mm). See Figure 122.

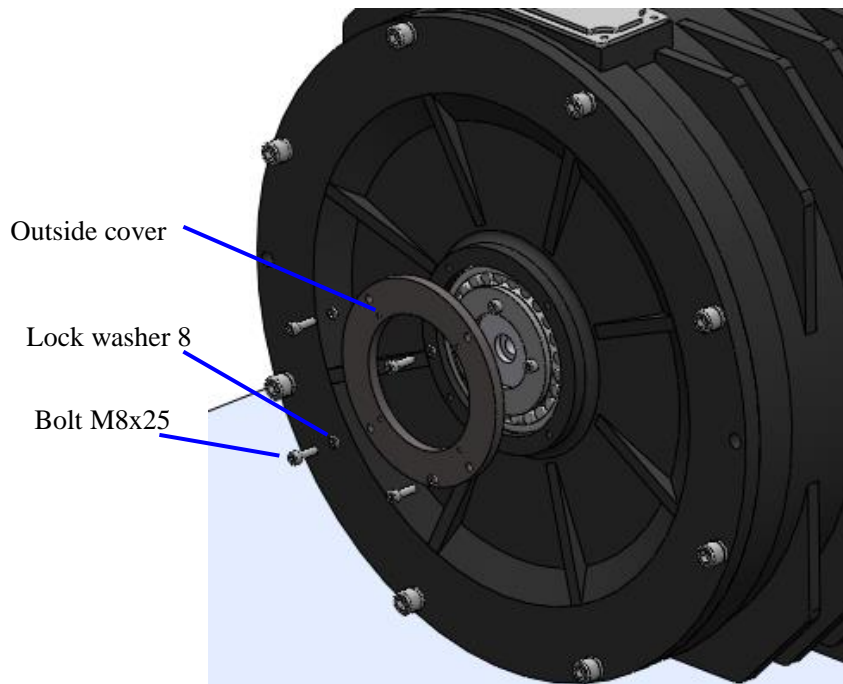


Figure 122: Install Cover 5

6. Install the connection shaft, encoder and encoder cover one by one. See Section 8.1.2 Encoder Installation.
7. Reconnect power to the machine to test.
8. Reinstall ropes and guards.

8.5.2 Front Bearing Replacement

8.5.2.1 TGL1/2/2A Front Bearing Replacement

Required Tools & Materials:

Open end wrench (18mm)
Hex wrench (10mm, 14mm)
Rubber hammer
Clean cloth
Cleanser
Bearing heater
Bearing grease (OEM or Shell Gadus S3 V220 C)
Sealant
Bolt M12x120 (2 pieces)
Double end studs (Threaded rod) M12x220
Double end studs (Threaded rod) M16x200
Hoisting equipment
Hoist chain

8.5.2.1.1 Bearing removal

1. Remove the brake (Refer to Section 8.2.1.1 Brake removal).
2. Remove sheave (Refer to Section 8.4.1.1 Sheave removal). Take off the key on main shaft.
3. Remove the bolts M12x130 (6 pieces) with lock washer¹² with hex wrench (10mm), and take off the outer cover. See Figure 123.

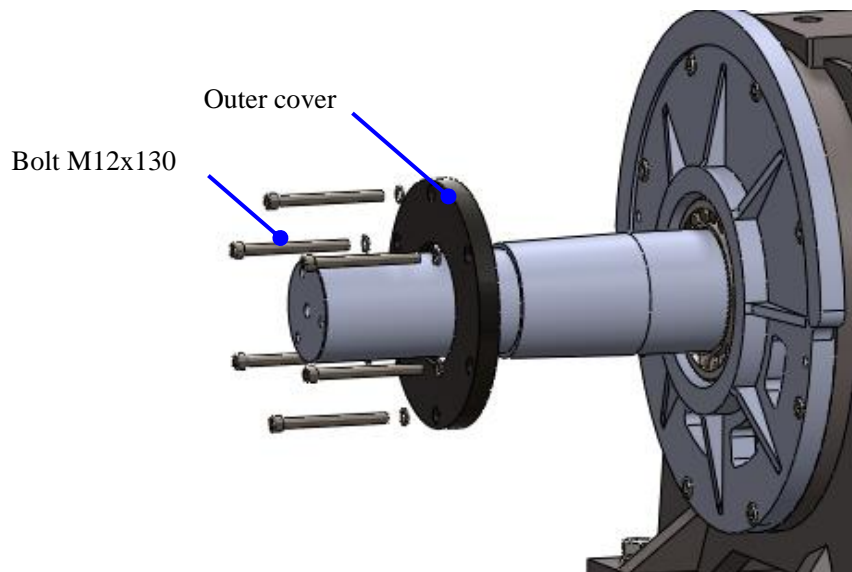


Figure 123: Remove outer cover

4. Replace the oil seal SC $\phi 140 \times \phi 170 \times 12$ (KOK) if necessary.
5. Make a mark in the front cover and machine body. Remove 8 hex screws M16x50 and lock washer16 with hex wrench (14mm). See Figure 124.

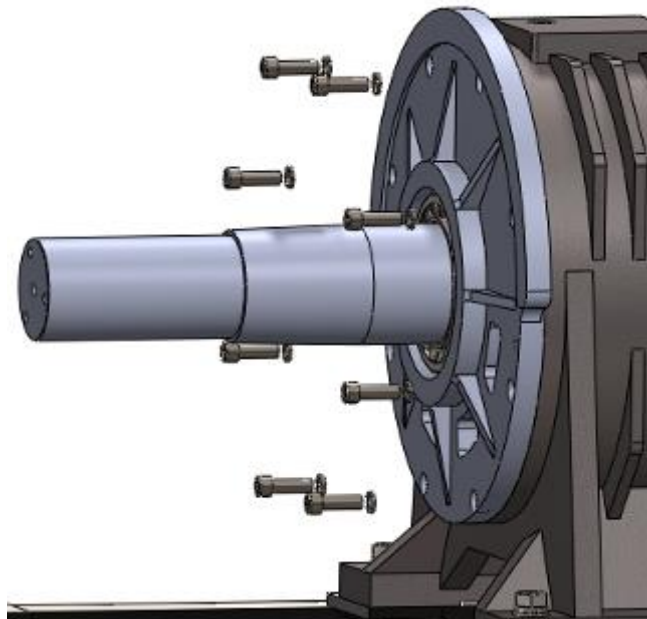


Figure 124: Remove M16x50 bolts and lock washers

6. Use a pair of double end studs M16x200 tightened into the threaded holes in the machine body. Screw the bolts M12x120 into the M12 hole of front cover opposite each other. Tighten the bolt M12x120 (2 pieces) evenly and slowly with end wrench (18mm) until the front cover comes out of the bearing. See Figures 125 and 126.

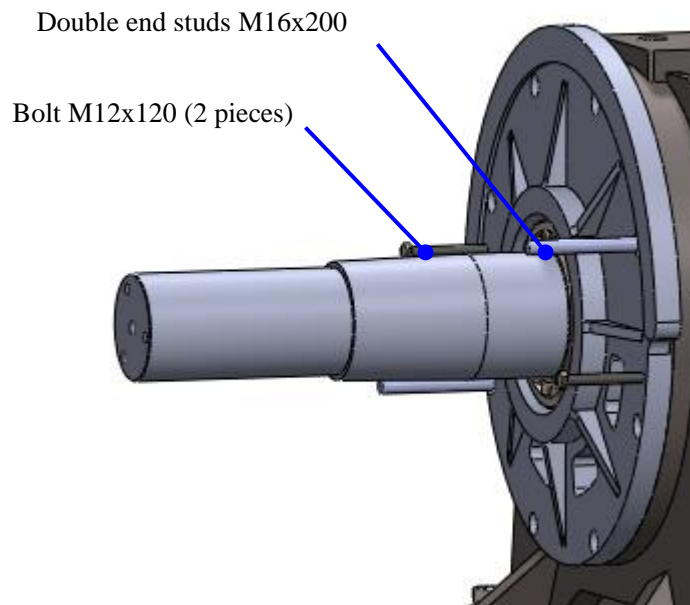


Figure 125: Install double end studs and M12 bolts

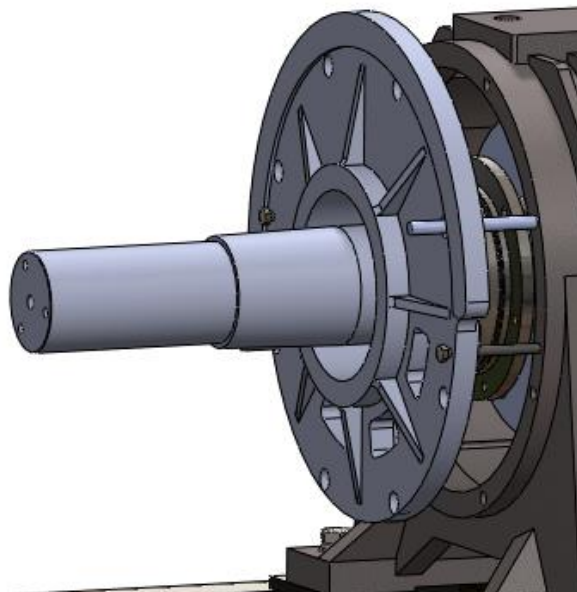


Figure 126: Tighten M12 bolts to separate front cover

7. Hoist out the front cover with hoisting equipment, take off the double end studs M160x200 and the bolt M12x120 (2 pieces). See Figure 127.

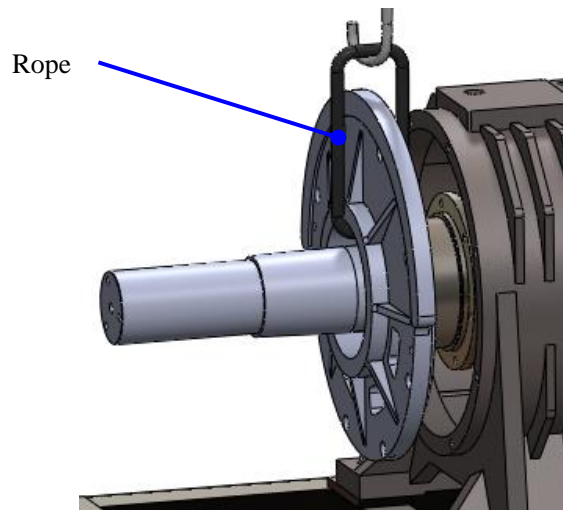


Figure 127: Hoist front cover

8. Pull out the bearing with a bearing puller. (Cutting the bearing off is permissible.) See Figure 128.

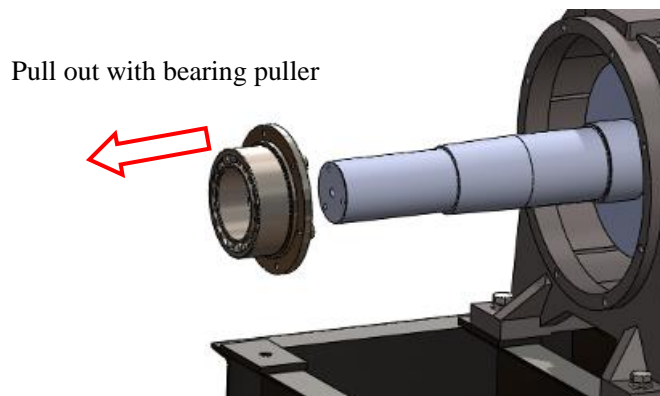


Figure 128: Remove bearing

9. Take off the inner cover and clean it. See Figure 129.

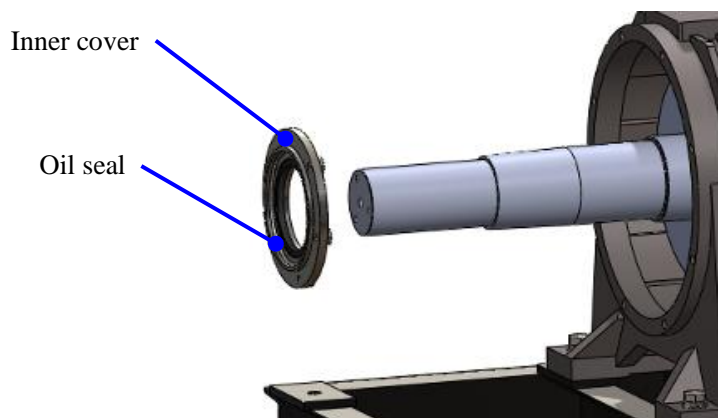


Figure 129: Remove and clean inner cover

10. Replace the oil seal SC Ø155xØ175x12 if necessary.

8.5.2.1.2 Bearing installation

1. Clean the main shaft, put the proper bearing grease (OEM or Shell Gadus S3 V220 C) on the inner cover, then install it on the main shaft. See Figure 130.

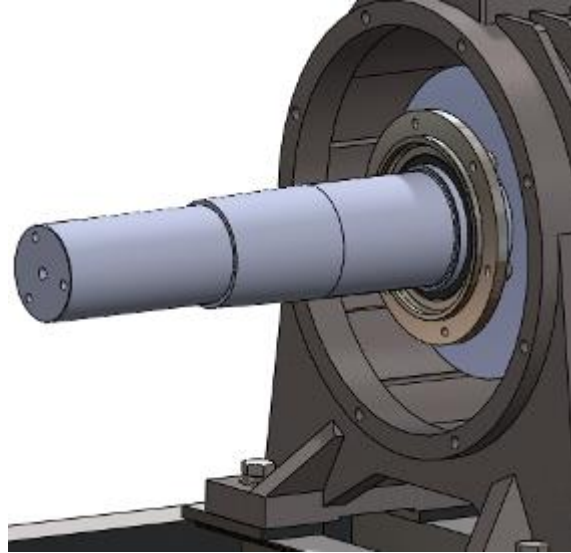


Figure 130: Install inner cover

2. Heat the bearing (23128CAME4) to $80\pm 15^{\circ}\text{C}$ ($159\pm 59^{\circ}\text{F}$) with the bearing heater, then quickly install it on the main shaft. When the bearing has cooled to room temperature, fully pack the bearing with grease (OEM or Shell Gadus S3 V220 C) See Figure 131.

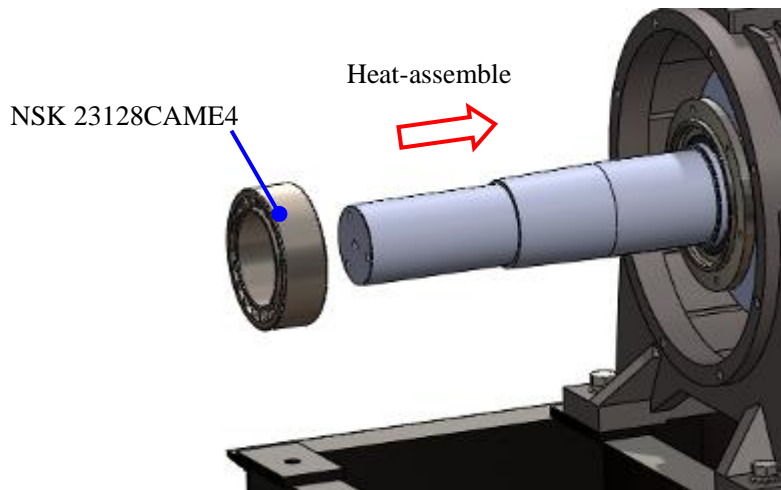


Figure 131: Install bearing

3. Coat sealant (SILICONE FLANGE SEALANT 1598, TONSAN or equivalent) on the inner cover face. See Figure 132.

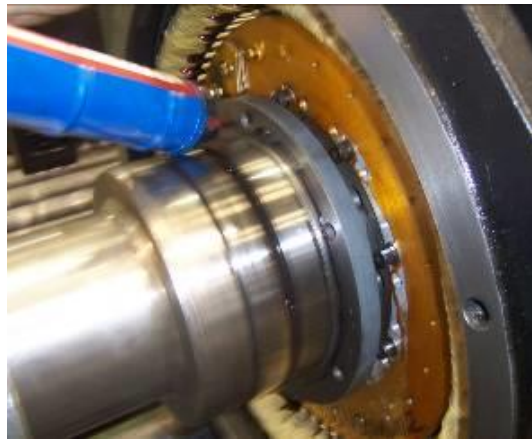


Figure 132: Apply sealant

4. Screw the double end studs M12x220 to the inner cover. See Figure 133.

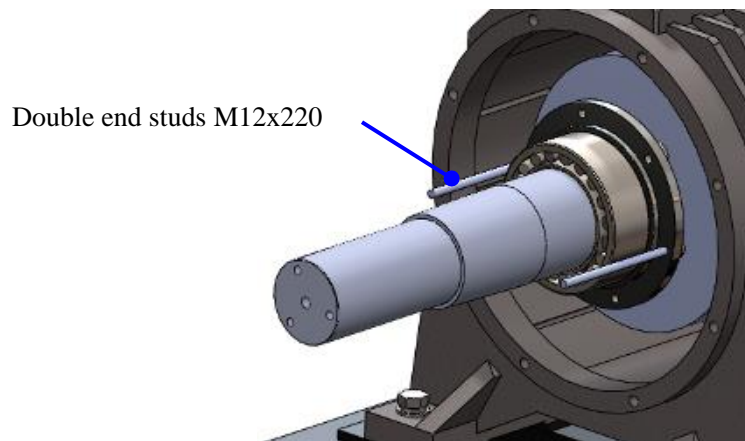


Figure 133: Install double end studs

5. Clean the Front cover and hoist it with the hoisting equipment, then fit the Front cover on the bearing through the double end studs (take aim at the mark). See Figure 134.

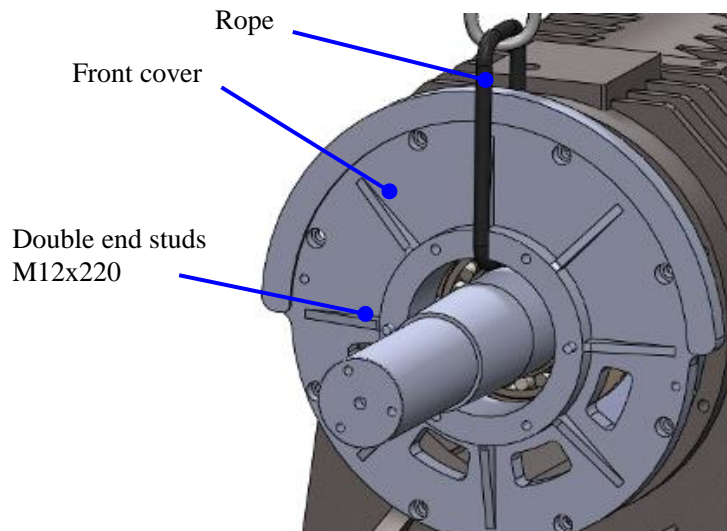


Figure 134: Hoist Front cover into position

6. Use a pair of double end studs M16x200 tightened into the threaded holes in the machine body. Take off the hoisting equipment. Hammer at the Front cover with the rubber hammer, and make the Front cover fit on the bearing well. Tighten 8 hex screws M16x50 with lock washer16 with hex screw (14mm). See Figures 135-137.

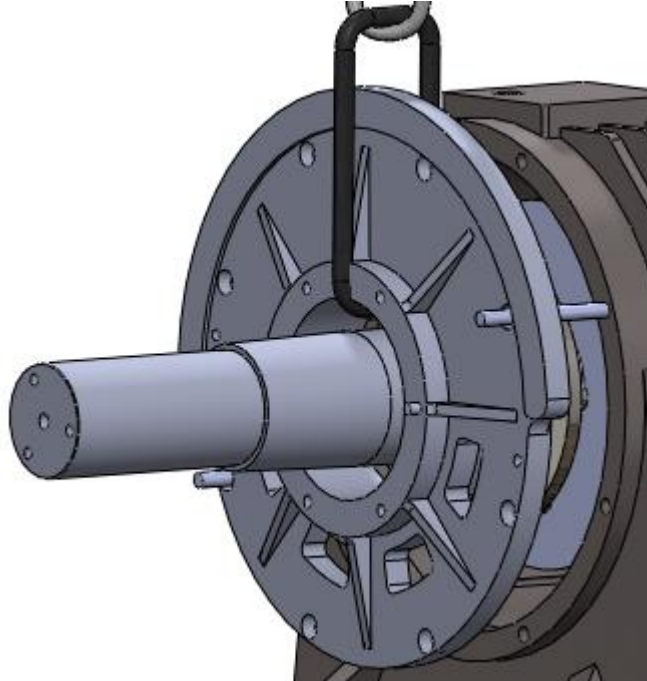


Figure 135: Front cover on double end studs

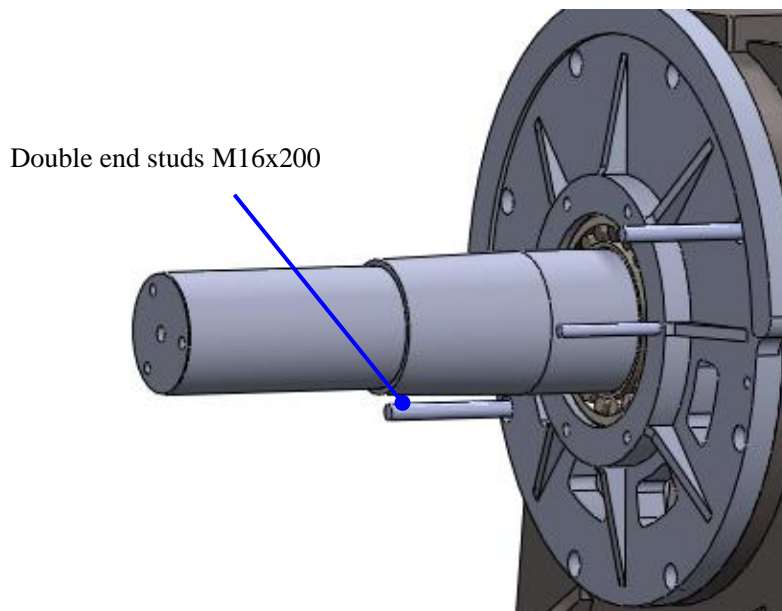


Figure 136: Front cover in position

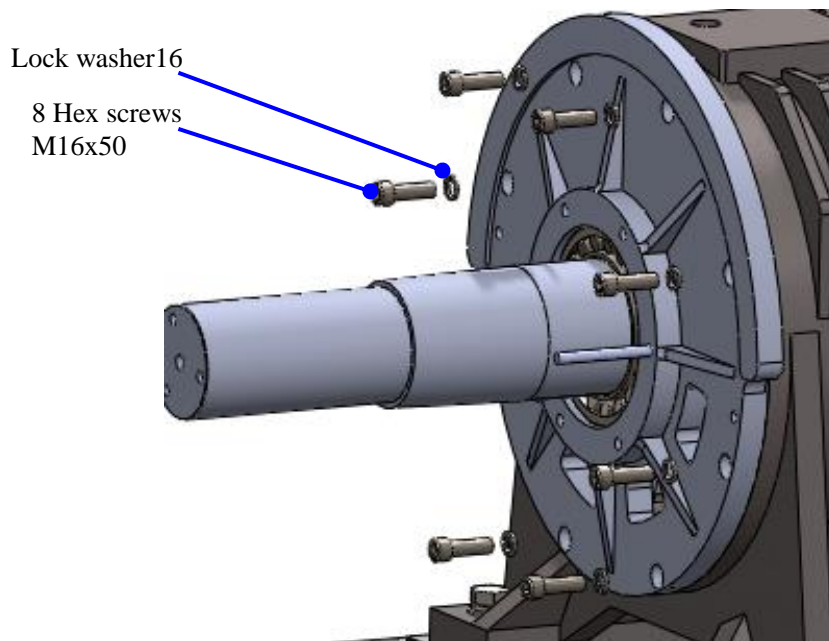


Figure 137: Secure Front cover

7. Clean the outer cover, coat sealant on the Front cover surface which mates with the Outer cover surface.
8. Then install the Outer cover on the Front cover through the double end studs; install hex screws M12x130 with lock washer12. See Figure 138.

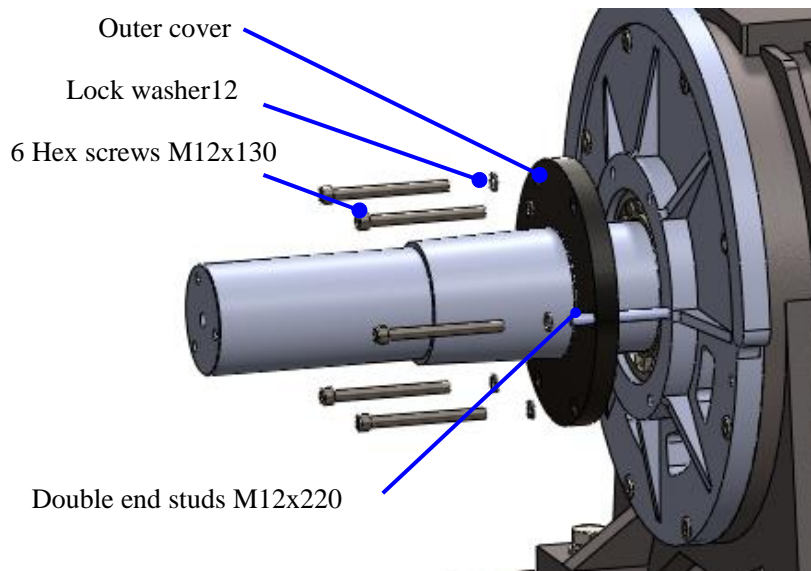


Figure 138: Install Outer cover

9. Take off the double end studs, and tighten the hex screw M12x130 with lock washer12.
10. Install the sheave (See Section 8.4.1.2 Sheave installation).
11. Install the brake (See Section 8.2.1.2 Brake installation).
12. Test the machine.
13. Reinstall ropes and guards.

8.5.2.2 TGL3 Front Bearing Replacement

Required Tools & Materials:

Open end wrench (18mm)

Hex wrench (10mm, 14mm)

Rubber hammer

Clean cloth

Cleanser

Bearing puller

Bearing heater

Bearing grease (OEM or Shell Gadus S3 V220 C)

Sealant

Bolt M12x250 (2 pieces)

Double end studs (Threaded rod) M16x300

Double end studs (Threaded rod) M12x320

Hoisting equipment

Rope

8.5.2.2.1 Bearing removal

1. Remove the brake (Refer to Section 8.2.2.1 Brake removal).
2. Remove sheave (Refer to Section 8.4.2.1 Sheave removal). Take off the key on main shaft.
3. Remove the bolts M12x200 (6 pieces) and lock washer¹² with hex wrench (10mm), and take off Cover 1. See Figure 139.

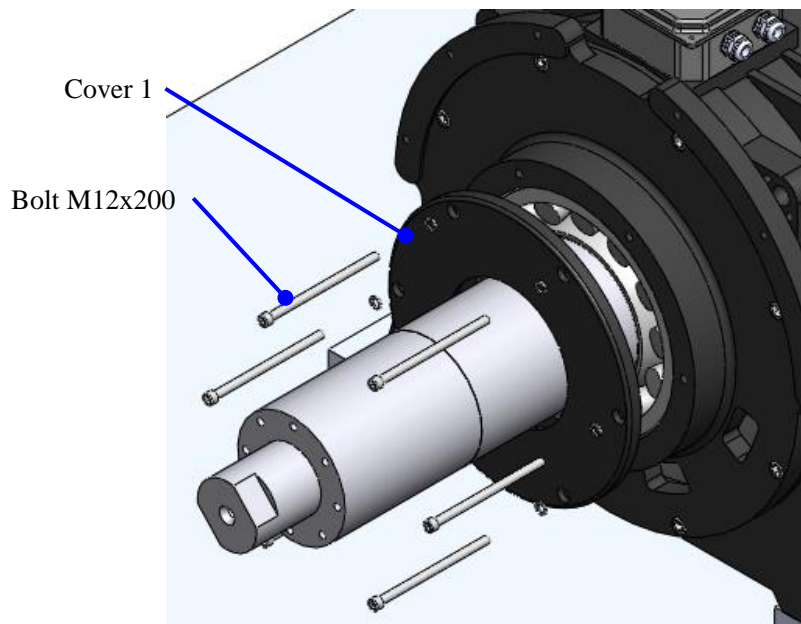


Figure 139: Remove Cover 1

4. Replace the oil seal SC Ø220xØ250x15 if necessary.
5. Make a mark in the front-cover and machine-base. Remove 8 hex screws M16x50 and lock washer16 with hex wrench (14mm). See Figure 140.

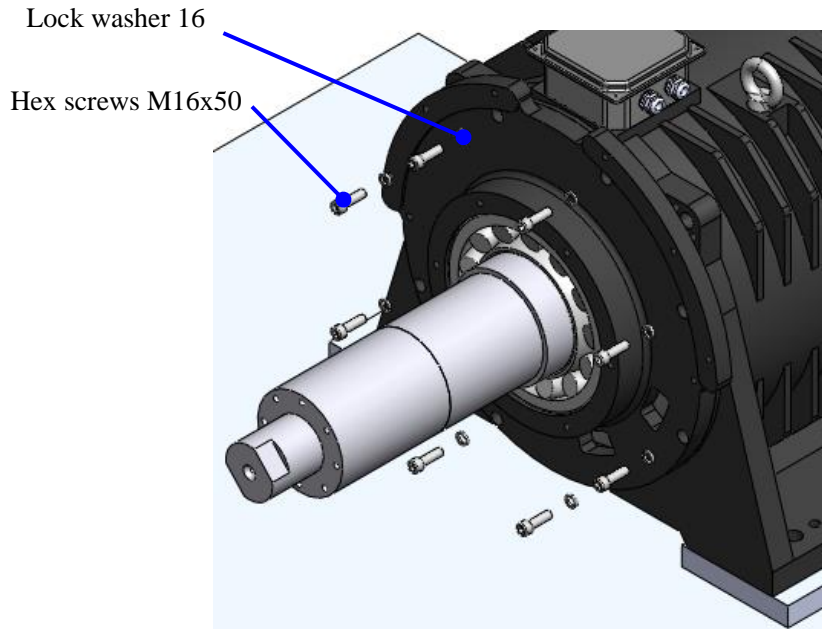


Figure 140: Remove M16x50 bolts and lock washers

6. Use a pair of double end studs M16x300 tightened into the threaded holes in the machine body. Screw the bolts M12x250 into the M12 hole of Front cover opposite each other. Tighten the bolts M12x250 (2 pieces) evenly and slowly with end wrench (18mm) until the Front cover separates from the bearing. See Figure 141.

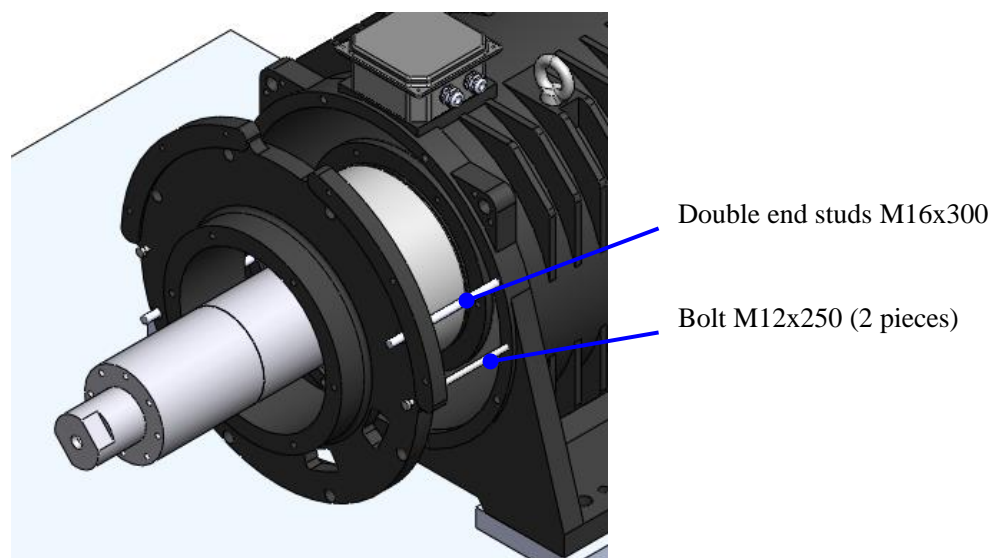


Figure 141: Separate the front cover

7. Hoist the Front cover with hoisting equipment; remove the double end studs M160x300 and the bolt M12x250 (2 pieces). See Figure 142.

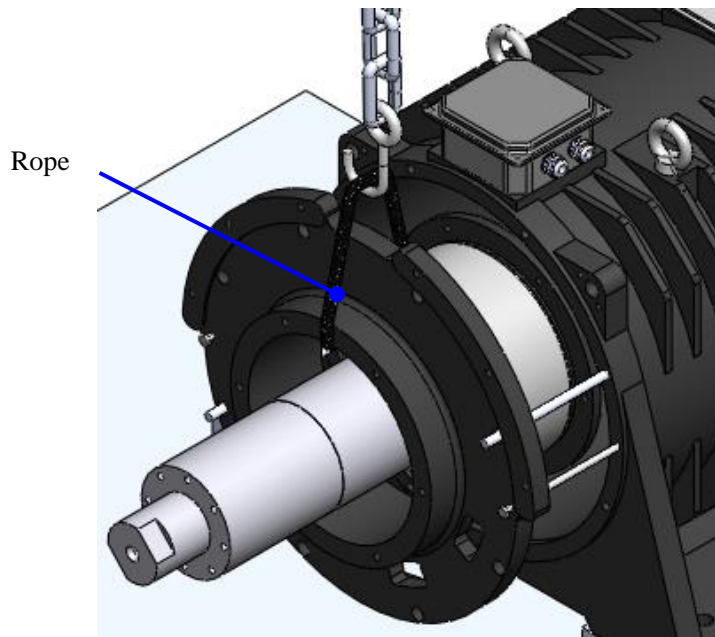


Figure 142: Hoist the Front cover

8. Pull out the bearing with the bearing puller. See Figure 143.

Pull out with pull-off device

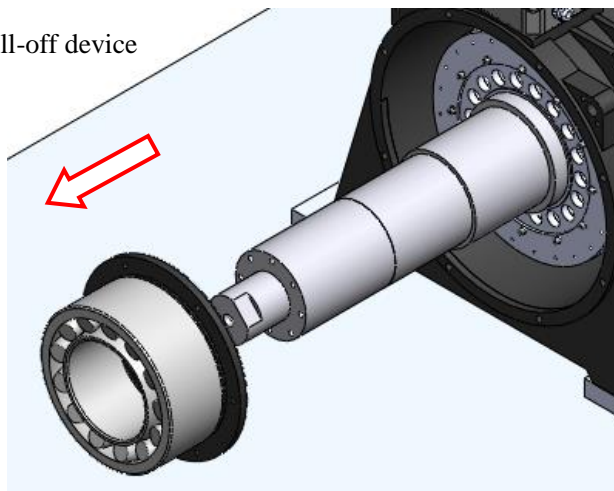


Figure 143: Remove bearing

9. Take off the inner cover and clean it. See Figure 144.

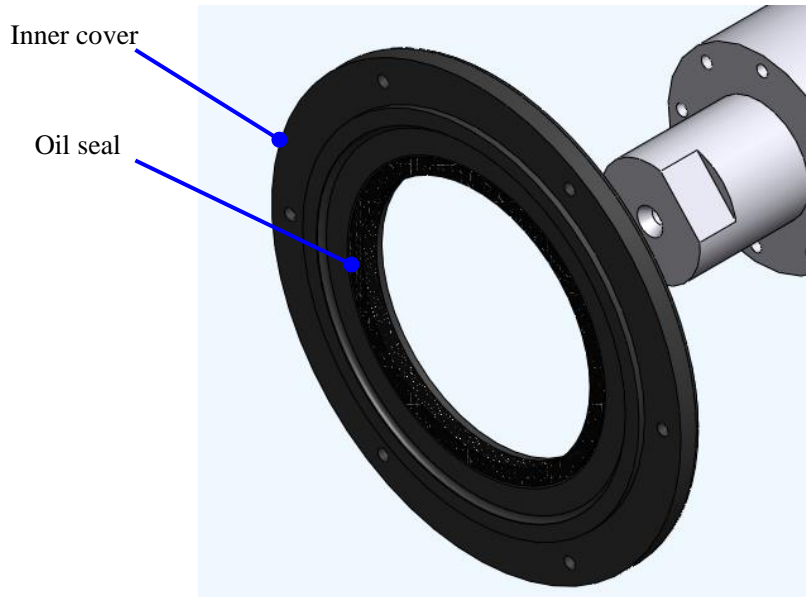


Figure 144: Remove Inner cover and clean

10. Replace the oil seal SC Ø250xØ280x15 if necessary.

8.5.4.2 Bearing installation

1. Clean the main shaft, put bearing grease (OEM or Shell Gadus S3 V220 C) in the Inner cover, then install it on the main shaft. See Figure 145.

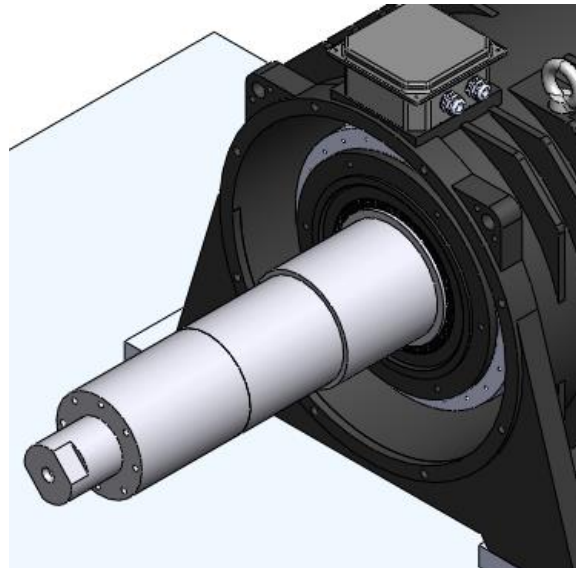


Figure 145: Install Inner cover

2. Heat the bearing (NSK 24144CAME4) to $80\pm 15^{\circ}\text{C}$ ($176\pm 59^{\circ}\text{F}$) with the bearing heater, then quickly install it on the main shaft. See Figure 146.

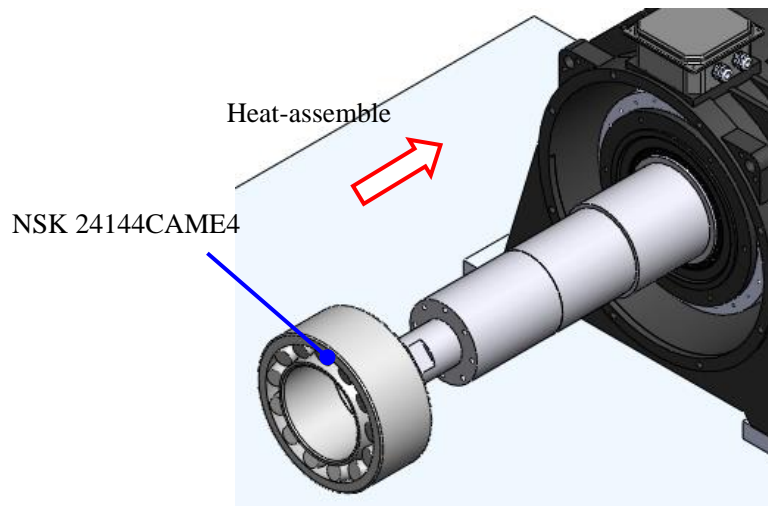


Figure 146: Install bearing

3. When the bearing has cooled fully pack it with grease (OEM or Shell Gadus S3 V220 C).
4. Apply sealant (SILICONE FLANGE SEALANT 1598, TONSAN or equivalent) on the inner cover face. See Figure 147.



Figure 147: Apply sealant

5. Screw the double end studs M12x320 to the inner cover. See Figure 148.

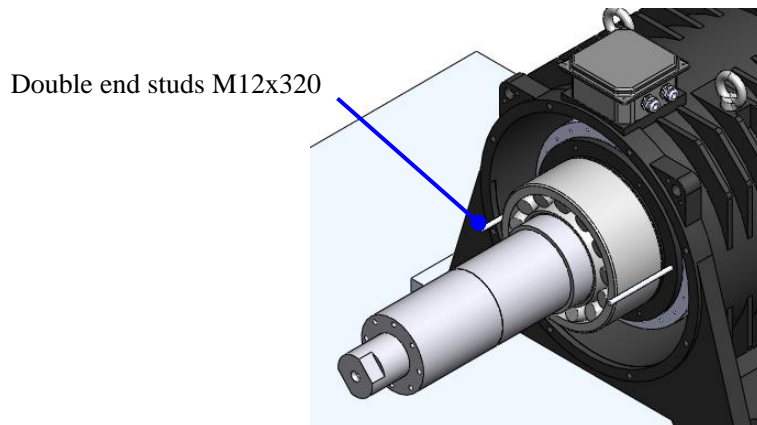


Figure 148: Attach double end studs

6. Clean the Front cover and hoist it with the hoisting equipment, then fit it on the shaft through the double end studs (take aim at the mark made on removal). See Figure 149.

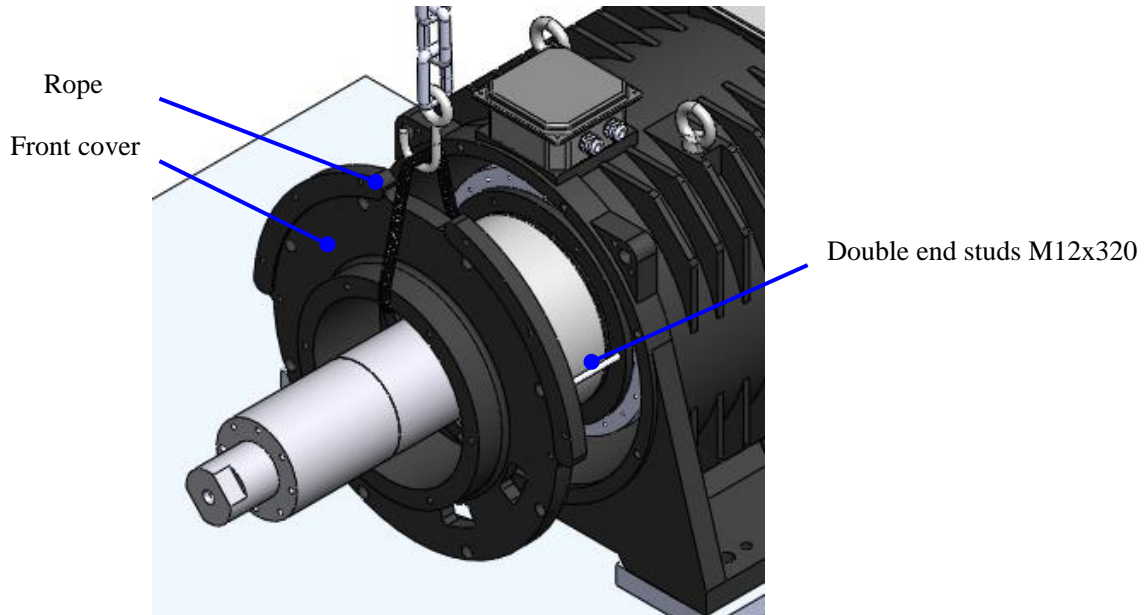


Figure 149: Hoist Front cover

7. Use a pair of double end studs M16x300 tightened into the threaded holes in the machine body and remove the hoisting equipment; hammer the Front cover with the rubber hammer, and make the Front Cover fit in the bearing well. Then tighten 8 hex screws M16x50 with lock washer 16 with hex wrench (14mm). See Figures 150-152.

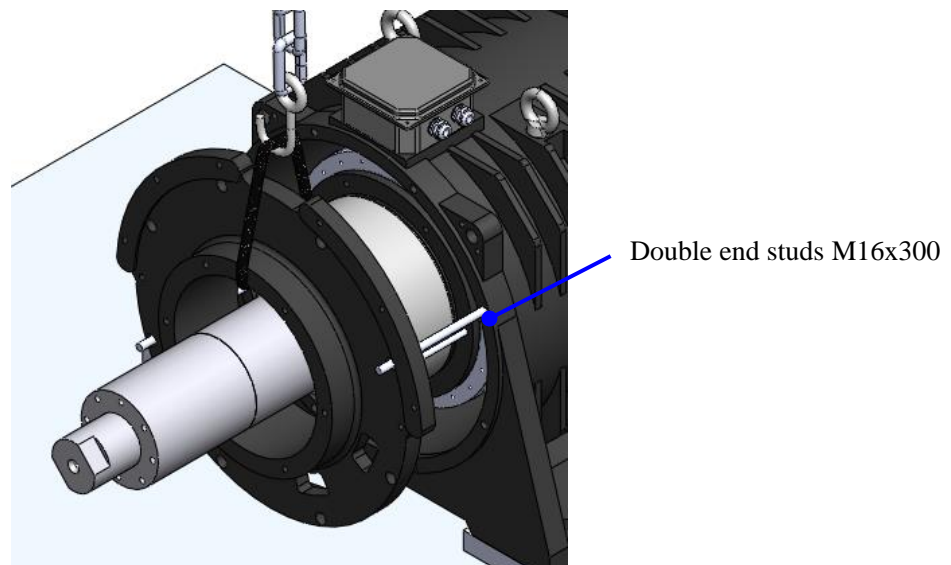


Figure 150: Install Double end studs

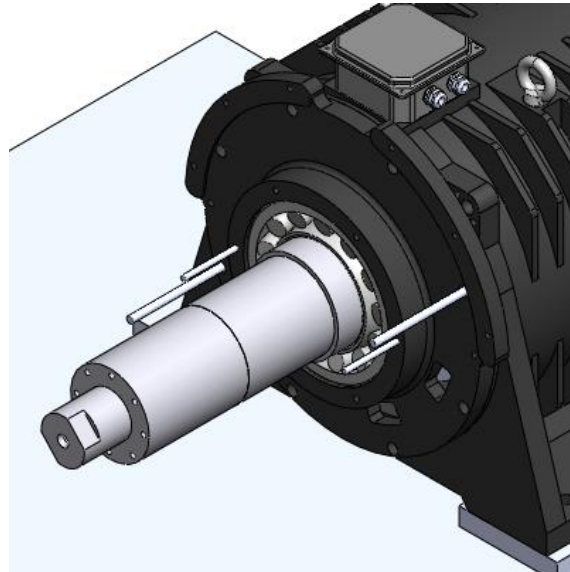


Figure 151: Hammer Front cover into place

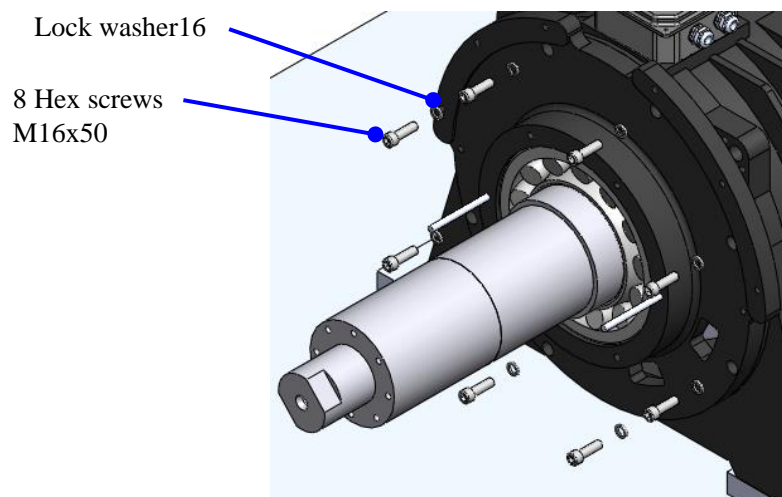


Figure 152: Install M16x50 Hex screws and lock washers

8. Clean the Outer cover, apply sealant on the Front cover surface which mates with the Outer cover surface.
9. Put bearing grease (OEM or Shell Gadus S3 V220 C) on the Outer cover.
10. Install it on the Front cover through the double end studs; tighten hex screws M12x200 with lock washer12. See Figure 153.

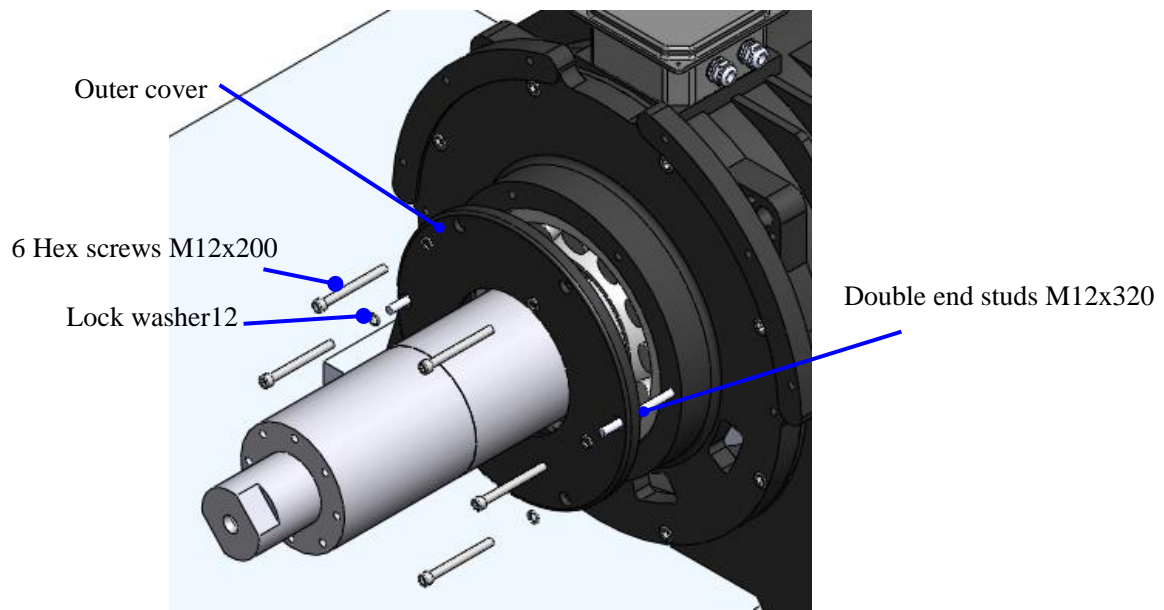


Figure 153: Attach Outer cover

11. Take off the double end studs, and tighten the hex screw M12x200 and lock washer 12.
12. Install the sheave (Refer to Section 8.4.2.2 Sheave installation).
13. Install the brake (Refer to Section 8.2.2.2 Brake installation).
14. Test the machine.
15. Install ropes and guards.

9.0 Troubleshooting chart

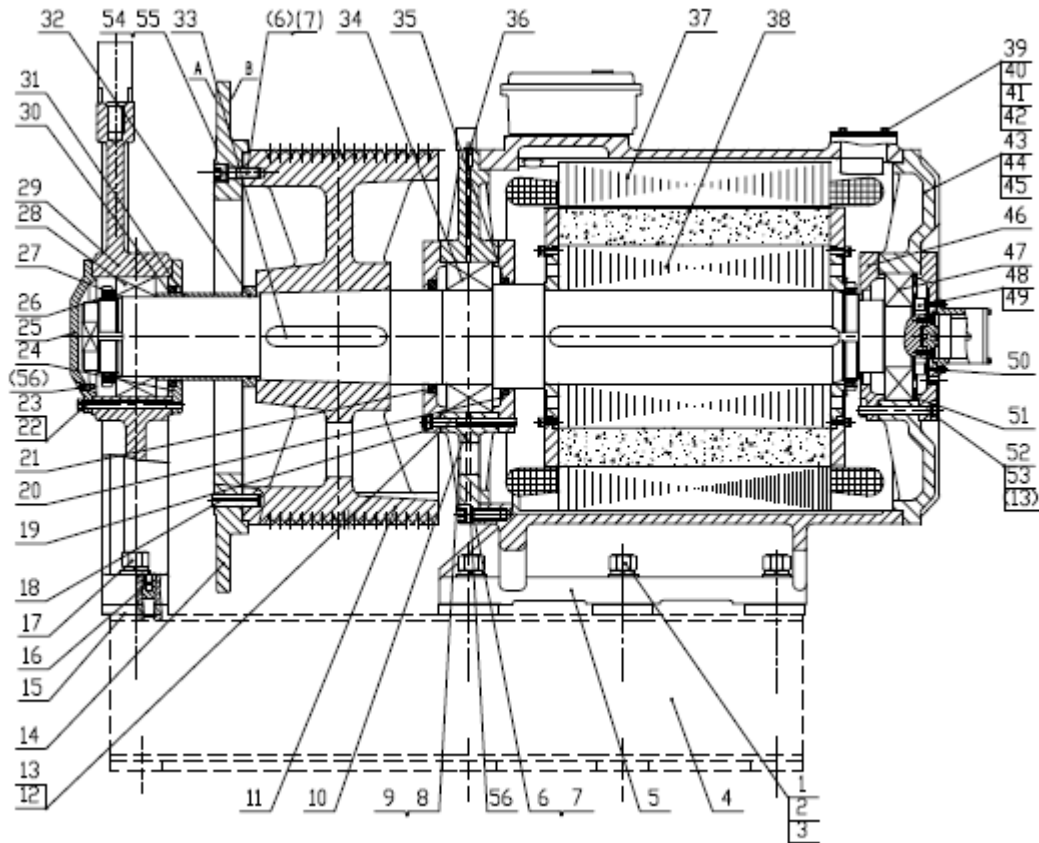


The proper maintenance of the gearless machines requires adequately trained qualified personnel and proper tools.

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.
	b. Bad inverter parameters	Make sure inverter parameters are correct
	c. Bad encoder feedbacks	Check grounding and shielding.
	d. 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 opening and closing noise	a. Incorrect noise absorber height	Perform brake opening noise procedure
	a. Incorrect brake stroke	Readjust the brake stroke to factory standard
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 Machine Assembly

10.1 TGL1/2 Machine Assembly



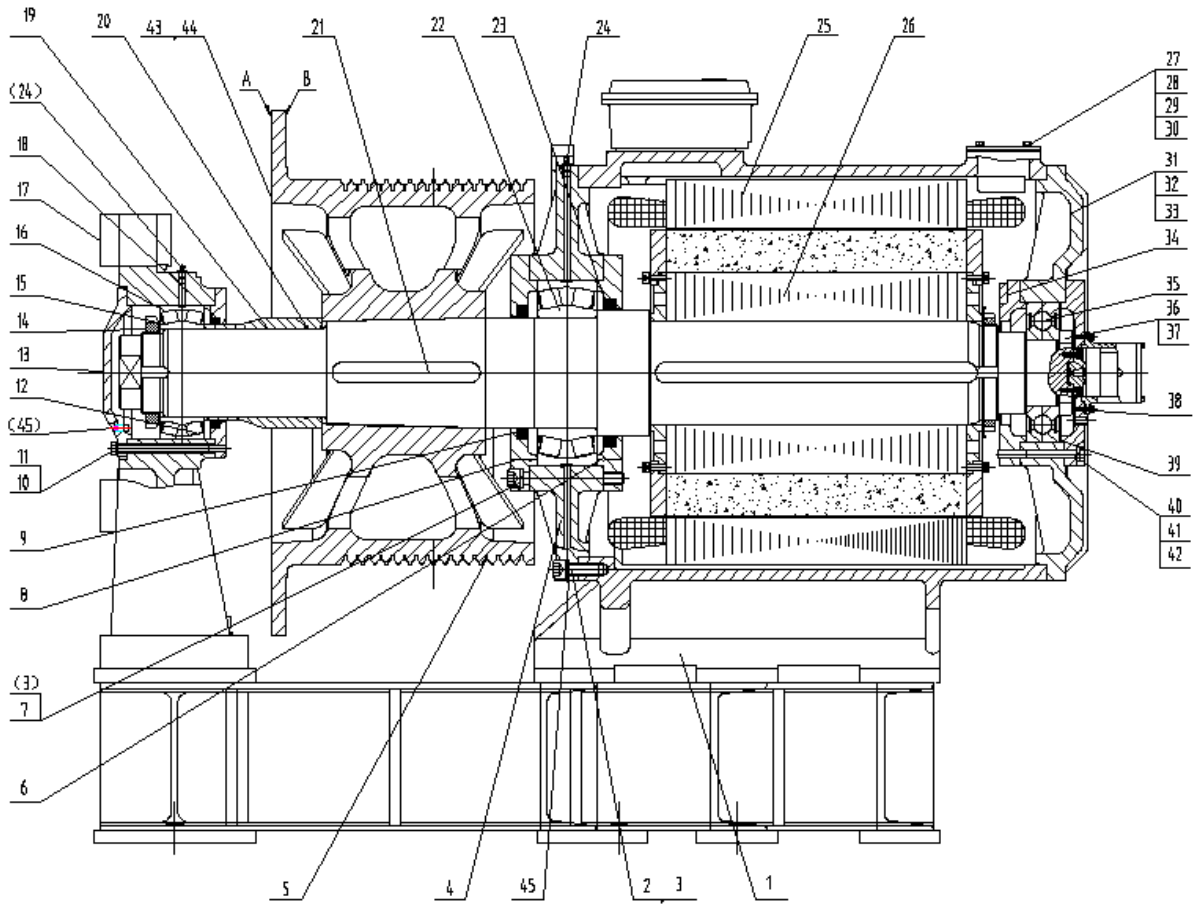
(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	Bolt M24×80
2	*	Lock washer 24
3	*	Washer 24
4	*	Machine frame
5	*	Machine body
6	*	screw M16×50
7	*	Lock washer 16
8	*	reticular cover
9	*	screw M5×10
10	*	Front-cover
11	*	Sheave
12	*	Bolt M12×130
13	*	Lock washer 12
14	*	Brake disc
15	PPS007	Pedestal shim
16	PTO008	Pedestal Pin 16x65
17	*	Bolt M24×85
18	*	spring dowel 16*70
19	*	Outer cover

20	*	Inner cover
21	PBR003	Front Main Oil seal SCØ140XØ170×12
22	*	Bolt M10×150
23	*	Lock washer 10
24	*	Pedestal rear cover
25	*	Pedestal front cover
26	*	Round nut M110×2
27	PPW006	Tap washer 110
28	PBR004	Pedestal Bearing NSK 24024CAME4
29	*	Pedestal
30	PBR005	Pedestal Rear Oil seal SCØ130XØ150×12
31	*	Steel cover
32	PBR020	Steel cover oil seal Ø125×3.1
33	*	Key 28X180
34	PBR006	Main Bearing NSK 23128CAME4S11
35	PBR007	Main Rear Oil seal SCØ155XØ175×12
36	*	Grease fitting M10×1
37	*	Stator
38	*	Rotor
39	*	Top Cover
40	*	Rubber gasket
41	*	Bolt M6×20
42	*	Lock washer 6
43	*	Back cover
44	*	Bolt M20×70
45	*	Lock washer 20
46	*	Inside cover
47	PBR008	Rear Bearing NSK 6318DDU
48	*	Circle nut M80×2
49	*	Lock washer 80
50	PEN003	Encoder
51	*	Wavy gasket D190
52	*	Outside cover
53	*	Bolt M12×110
54	*	Rivet 3×6
55	*	Sheave nameplate
56	*	screw M10×20



10.2 TGL2A Machine Assembly

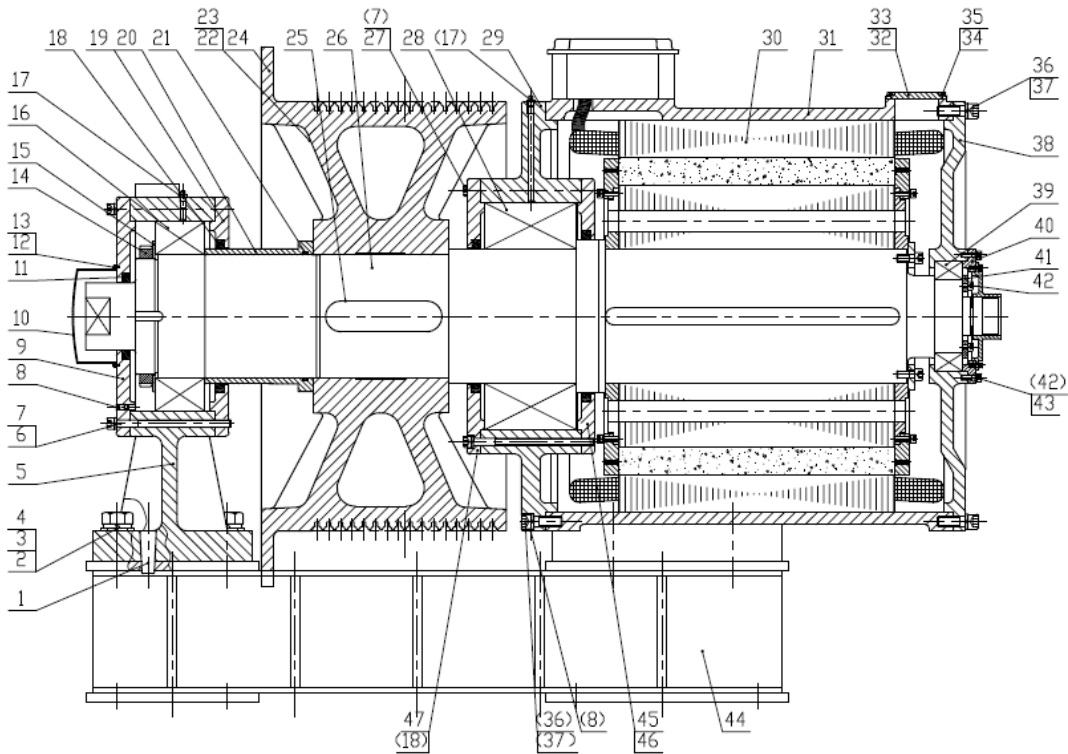


(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	Machine body
2	*	Bolt M16x45
3	*	Washer 16
4	*	Washer 16
5	*	Sheave
6	*	Inner cover
7	*	Bolt M16x140
8	*	Outer cover
9	PBR040	Front Main rear oil seal SCØ150xØ180x14
10	*	Bolt M10x150
11	*	Washer 10
12	*	Cover 2
13	*	Cover 1
14	*	Round nut M110x2
15	PPW006	Tap Washer 110
16	PBR041	Pedestal Bearing 24040CAME4Ø120xØ180x60
17	*	Pedestal body
18	PBR005	Pedestal rear oil seal SCØ130xØ150x12
19	*	Steel cover
20	PBR020	Steel cover oil seal Ø125x3.1
21	*	Key 28x200
22	PBR043	Main bearing 23130CAME4Ø150x Ø 250x80

23	PBR044	Main rear oil seal SC170 200 16
24	*	Grease fitting M10x1
25	*	Stator assembly
26	*	Rotor assembly
27	*	Top cover
28	*	Rubber gasket
29	*	Bolt M6x20
30	*	Washer 6
31	*	Back cover
32	*	Bolt M20x70
33	*	Washer 20
34	*	Inside cover
35	PBR008	Rear bearing 6318DDU Ø90xØ190x43
36	*	Round nut M80x2
37	*	Tap Washer 80
38	PEN003	Encoder assembly
39	*	Wavy spring D190 Ø154.5XØ187.5x5
40	*	Outside cover
41	*	Bolt M12x110
42	*	Washer 12
43	*	Rivet 3x6
44	*	Sheave nameplate
45	*	Screw M10x20

10.3 TGL3 Machine Assembly



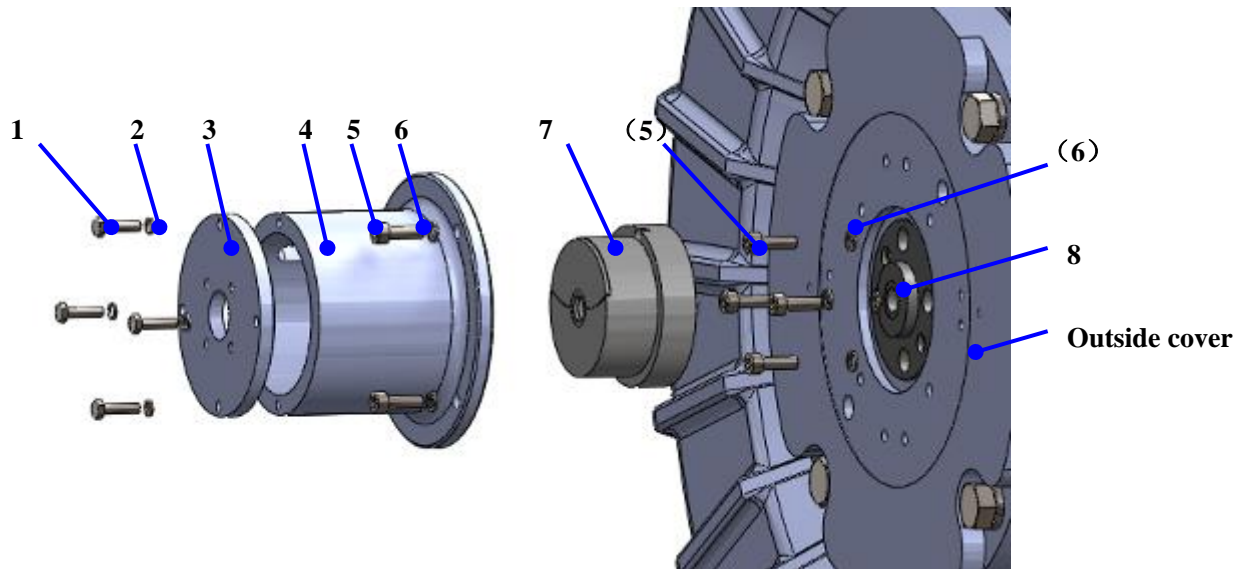
(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	PTO009	Pedestal pin 20x70
2	*	Bolt M30x100
3	*	Washer 30
4	*	Washer 30
5	*	Pedestal body
6	*	Bolt M12x190
7	*	Washer 12
8	*	Screw M10x1
9	*	Cover 1
10	*	Shield
11	PBR021	Pedestal front oil seal 0185C SCØ110xØ140x12
12	*	Bolt M3x8
13	*	Washer 3
14	*	Round nut M190x3
15	*	Tap Washer 190
16	PBR022	Pedestal Bearing 23040CAME4Ø200xØ310x82
17	*	Grease fitting M10x1
18	PBR023	Pedestal rear oil seal 8640 SCØ220xØ250x15
19	*	Cover 2
20	*	Steel cover
21	PBR024	Steel cover oil seal Ø210x5.7
22	*	Sheave nameplate
23	*	Rivet 3x6
24	*	Sheave

25	*	Key
26	*	Rotor assembly
27	*	Bolt M12x200
28	PBR025	Main bearing 24144CAME4Ø220xØ370x150
29	*	Front cover
30	*	Stator assembly
31	*	Machine body
32	*	Top cover
33	*	Rubber gasket
34	*	Bolt M6x20
35	*	Washer 6
36	*	bolt M16x50
37	*	Washer 16
38	*	Back cover
39	PBR026	Rear bearing 23024 CA-2CS2Ø120xØ180x46
40	*	Outside cover
41	*	Bearing cover 2
42	*	Bolt M8x25
43	*	Washer 8
44	*	Machine frame
45	*	Inner cover
46	PBR027	Oil seal 8650 SC Ø250xØ280x15
47	*	Outer cover

11.0 Encoder Assembly

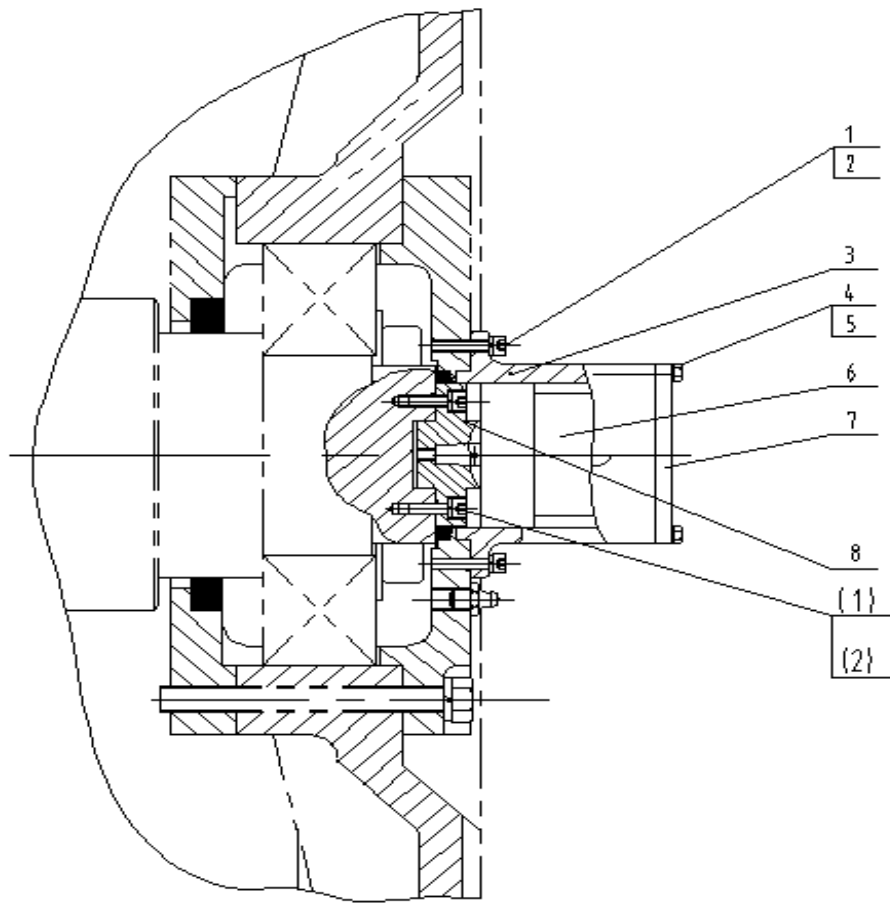
11.1 TGL1/2 Encoder Assembly



(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	bolt M4×16
2	*	lock washer 5
3	*	encoder cover
4	*	setting of encoder
5	*	screw M5×15
6	*	lock washer 5
7	PEN003	Haidenhain Absolute Encoder
8	*	connection shaft

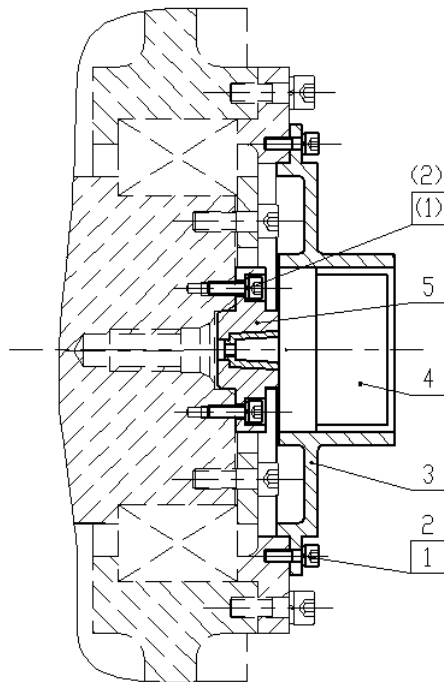
11.2 TGL2A Encoder Assembly



(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	bolt M5×15
2	*	Washer 5
3	*	setting of encoder
4	*	bolt M4×16
5	*	Washer 4
6	PEN003	Encoder
7	*	Cover
8	*	connection shaft

11.3 TGL3 Encoder Assembly

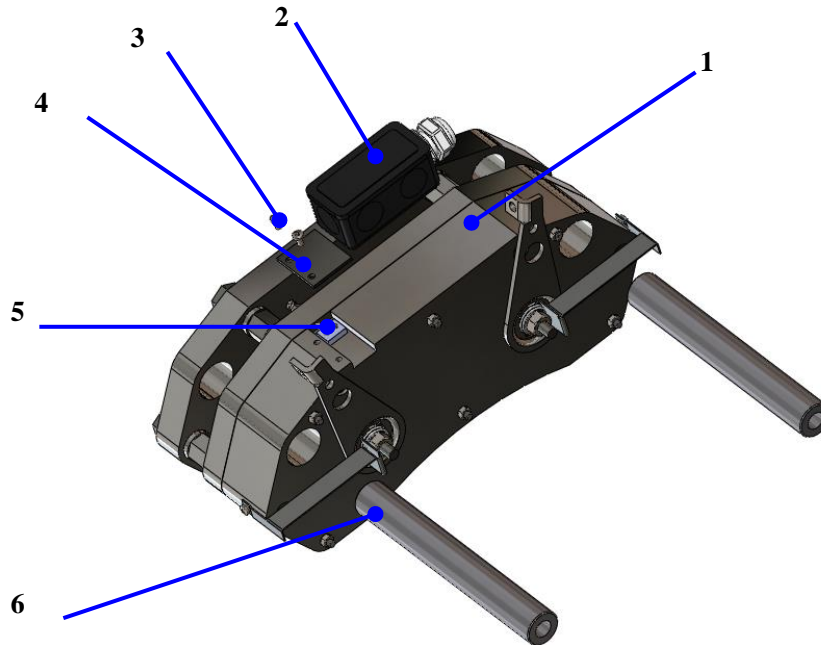


(*) Indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	Bolt M5x16
2	*	Lock Washer 5
3	*	Setting of encoder
4	PEN003	Encoder
5	*	Connection shaft

12.0 Brake Assembly

12.1 TGL1/2/2A/3 Brake Assembly

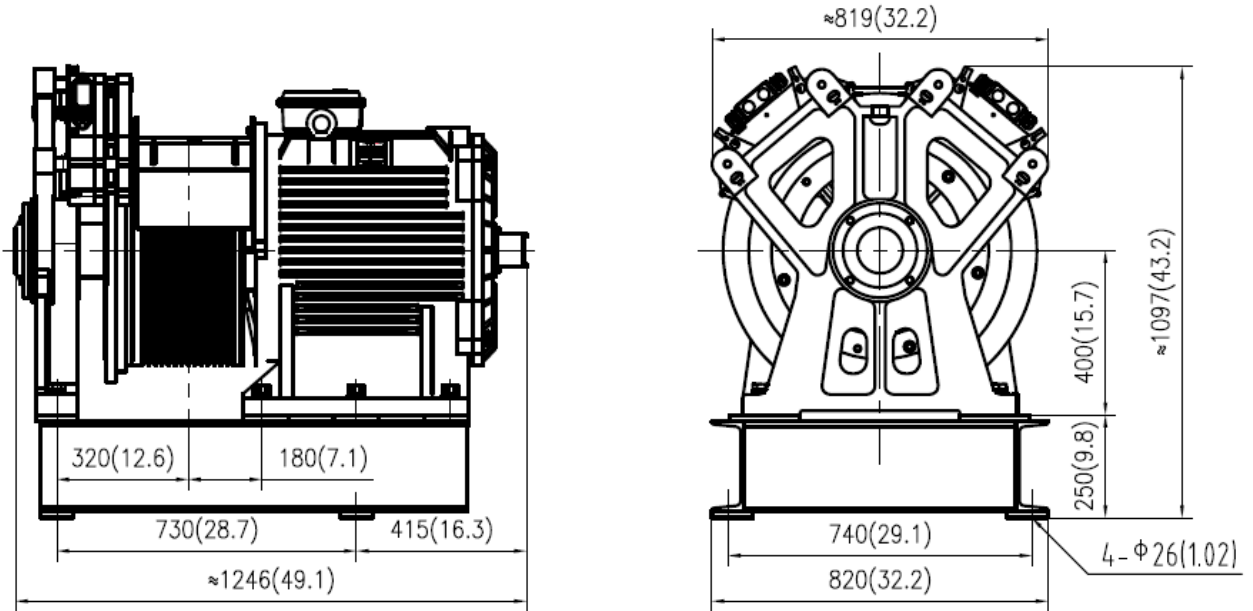


(*) Indicates a non-stock item

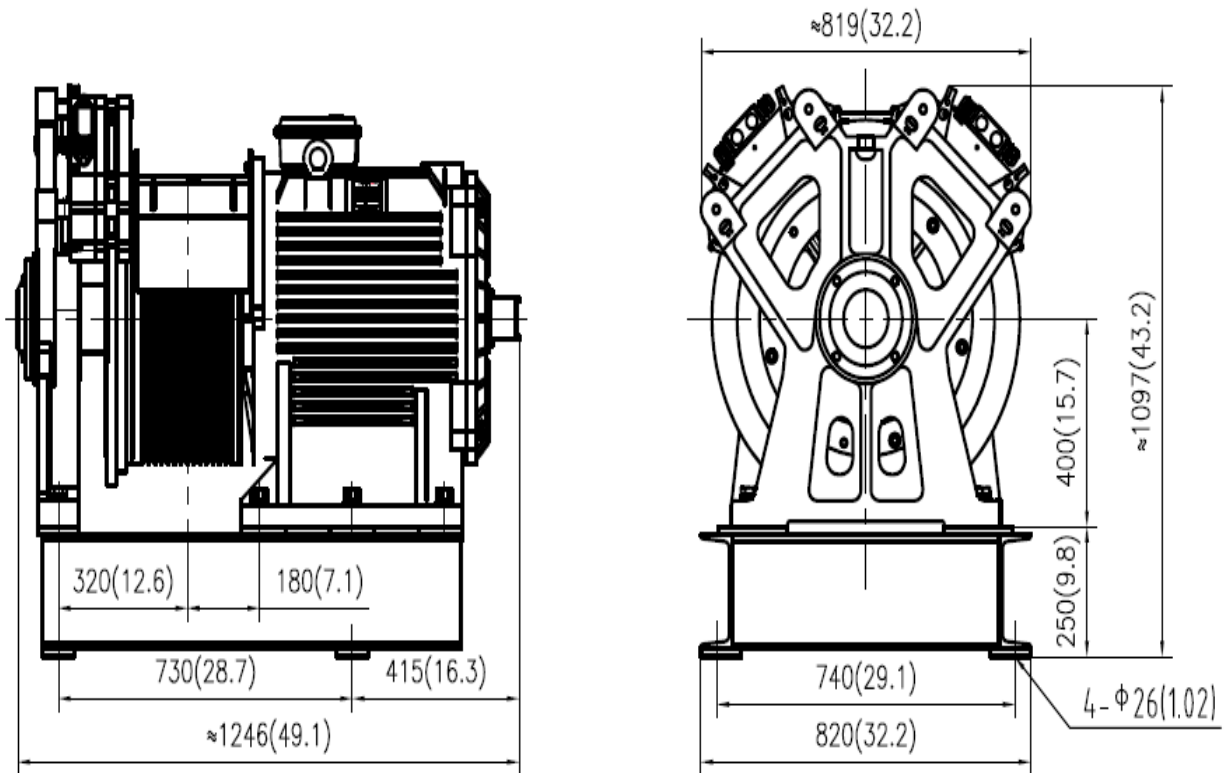
No.	Torin Drive Part No.	Description
1	*	Brake body
2	*	Brake terminal box components
3	*	Screw M5×10
4	*	Cover plate
5	PSW007	TGL brake switch and (2) Bolt M5×10
6	*	Guide pole
	PBK015	Normal/Emergency Brake Assembly for TGL1
	PBK016	Normal/Emergency Brake Assembly for TGL2
	PBK017	Normal/Emergency Brake Assembly for TGL2A/3

MECHANICAL DIMENSIONS

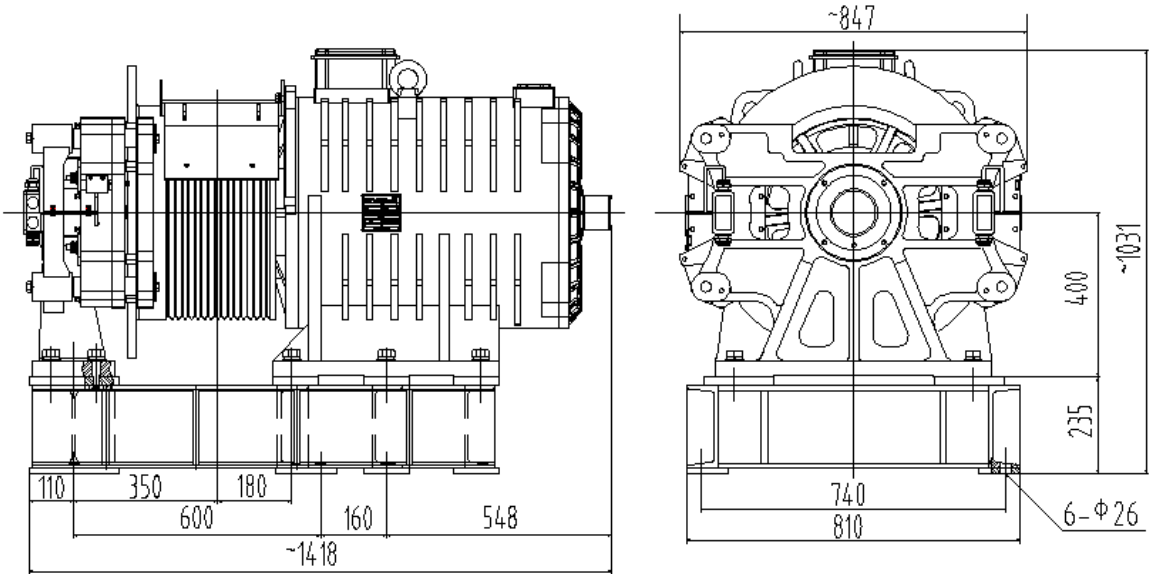
TGL1



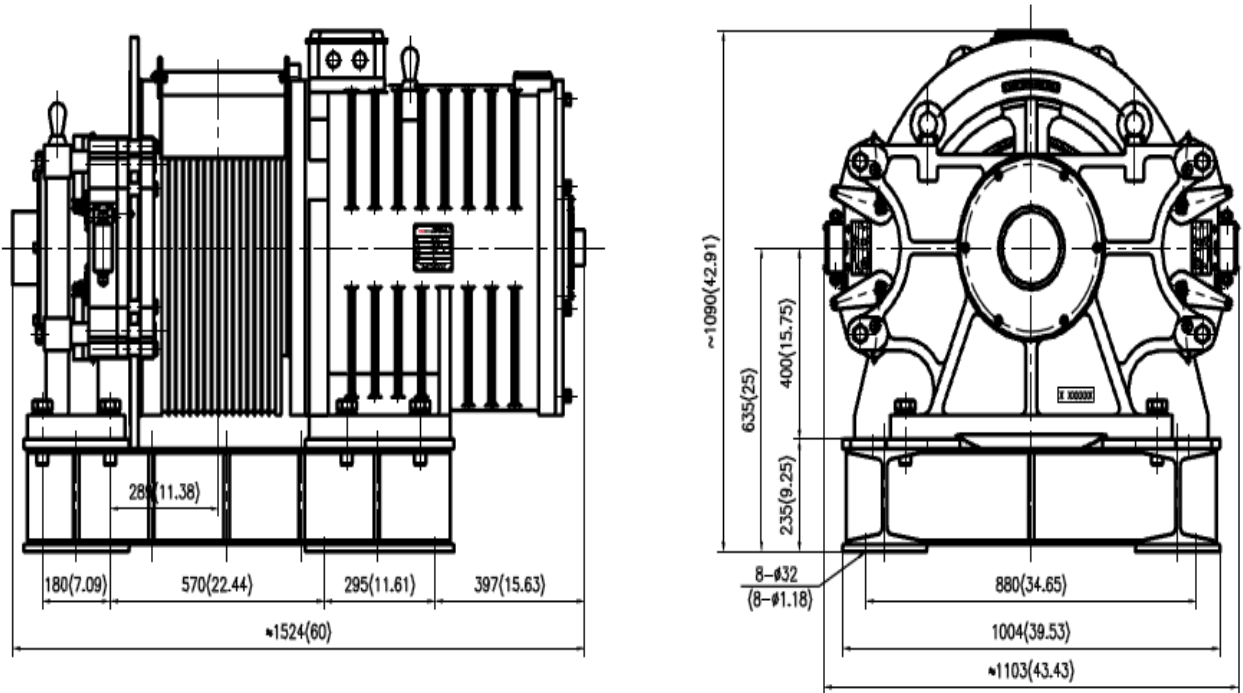
TGL2



TGL2A



TGL3



Annex 1: The Installation of Secondary Traction Sheave and Guide Wheel

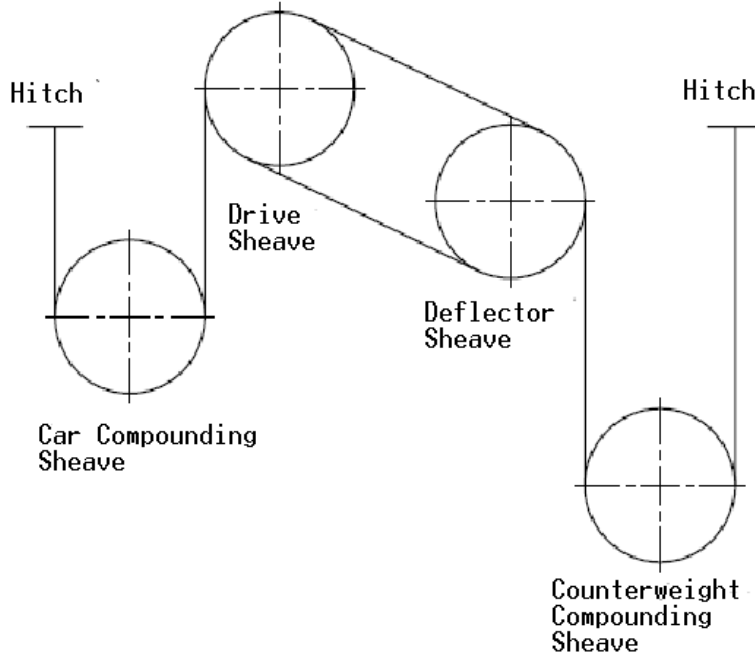


Figure 153: Wire Rope Compound Wound

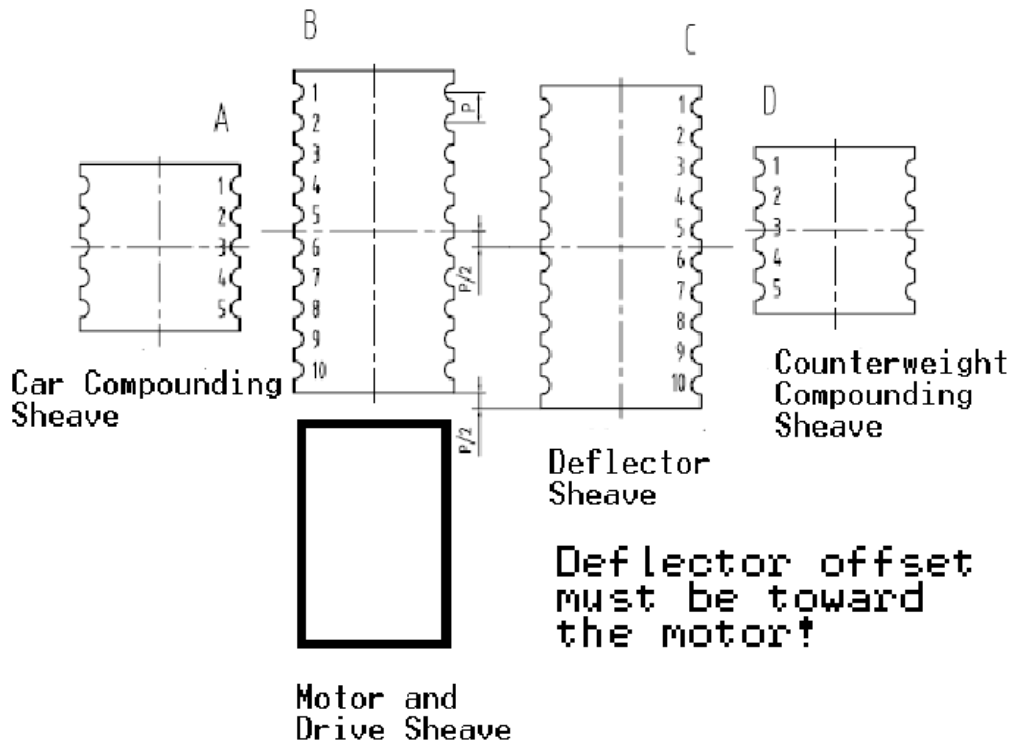
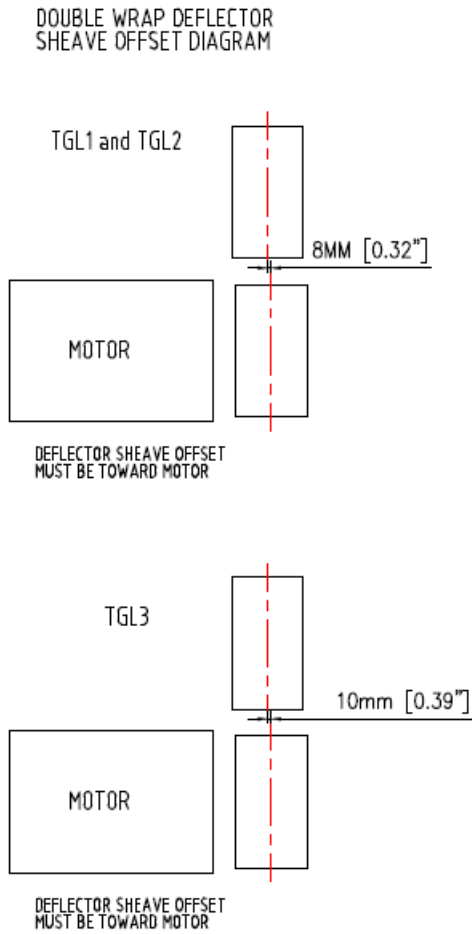


Figure 154: Slot Position of Each Wheel

Annex 2: Double Wrap Deflector Sheave Offset Diagram



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