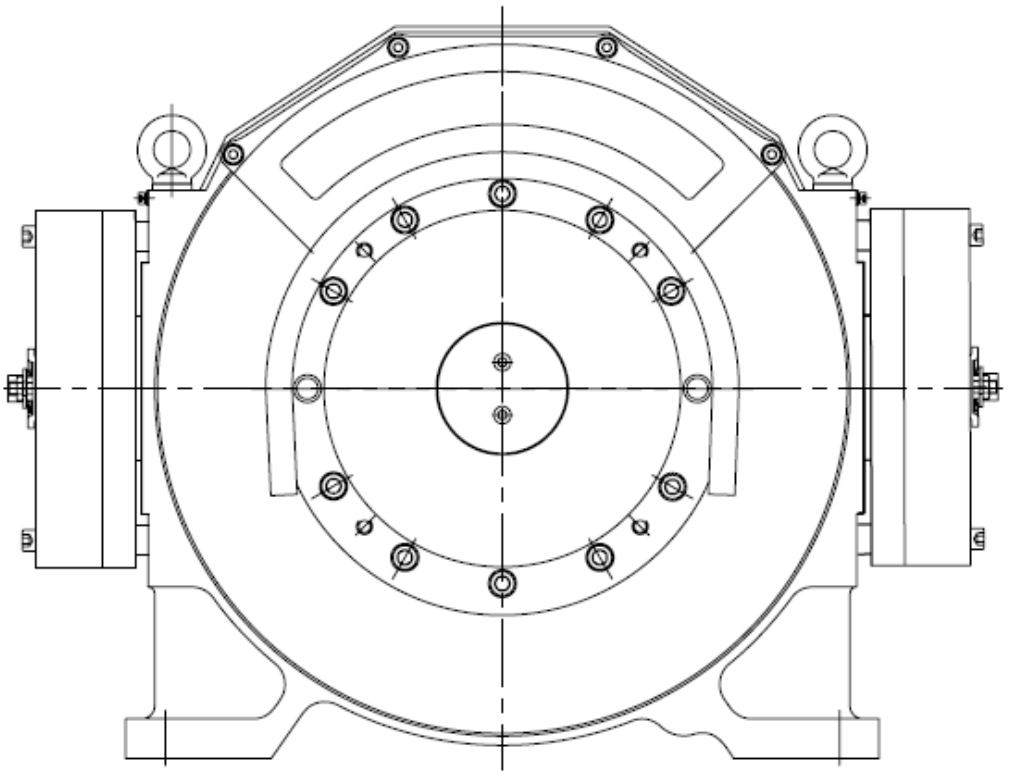
TPM1 Series

PMS Gearless Elevator Traction Machine

Complete Operation and Service Manual



SUZHOU TORIN DRIVE EQUIPMENT CO., LTD.

Manual No. TDI-003A-TPM1 **Rev 04 / April 2016**

Contents

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

- **Express Limited Warranty - What is Covered:**

Effective September 1, 2014, Torin Drive International, LLC ("TDI") expressly warrants that the machines it sells to you will be free from defects in material and workmanship for a period of 12 months from the date of delivery. This express limited warranty is in lieu of all other warranties or conditions, express or implied (statutory or otherwise), verbal or written.

- **Express Limited Warranty - What is Not Covered:**

This express limited warranty does not cover defects, failures, or conditions in the machines sold to you by TDI that are due to normal wear and tear; abuse; misuse; misapplication; improper installation; improper modification/adjustment/repair; inadequate maintenance; failure to follow the machine's use and safety instructions; or any other contributing factors unrelated to the machine's material and workmanship.

- **All Implied Warranties Disclaimed to the Fullest Extent Allowed by Applicable Law:**

TDI's express limited warranty is in lieu of all other warranties or conditions, express or implied (statutory or otherwise), verbal or written. To the fullest extent allowed by applicable law, TDI EXPLICITLY DISCLAIMS ALL IMPLIED WARRANTIES OR CONDITIONS, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND THE IMPLIED WARRANTY OF MERCHANTABILITY.

- **TDI Disclaims All Consequential Damages Relating to Its Express Limited Warranty:**

With the exception of the express limited warranty described above, to the fullest extent allowed by applicable law, TDI disclaims, and shall not be liable for direct, indirect, proximate, incidental, economic, and/or consequential damages relating in any way to the installation, use, maintenance, and operation of the machines it sells to you. 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 the installation, use, maintenance, and operation of the machines it sells to you. This disclaimer and exclusion of consequential damages shall apply even if the express warranty fails of its essential purpose.

TDI's liability shall be limited to the terms of this express limited warranty. TDI's Limitation of Liability also applies to any pre-sale consulting with you (including any preliminary technical data consultations or reports); any post-sale consulting with you; and any effort by TDI to repair the machines it sells to you pursuant to this express limited warranty. With the exception of the express limited warranty described above, you assume all risks associated with the machines that TDI sells to you. The implied warranty disclaimer and the liability disclaimer above are made to the fullest extent allowed by applicable law. In the event that some provision(s) of the above implied warranty disclaimer and/or the liability disclaimer are not permitted under applicable law, then all other provisions shall remain in full force and effect to the fullest extent permitted under applicable law.

- **No Other Express or Implied Warranty Applies:**

The express limited warranty described above is the sole and exclusive warranty, express or implied (statutory or otherwise), for the machines that TDI sells to you. No employee, agent, or representative of TDI is authorized to alter, modify, expand, or reduce the terms of TDI's express limited warranty or to make any other warranty on behalf of TDI.

- **Express Limited Warranty - How to Redeem:**

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.

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 by qualified elevator personnel only. 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**.

1.8 Product Specific Warnings

The TPM1 Machine MUST be balanced during hoisting. See Hoisting Methods in the Installation section for proper lifting procedures.

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

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

TPM1 machines can be lifted by using a combination of hooks, chains and slings designed to safely carry the weight of the machine. See Figure 1.

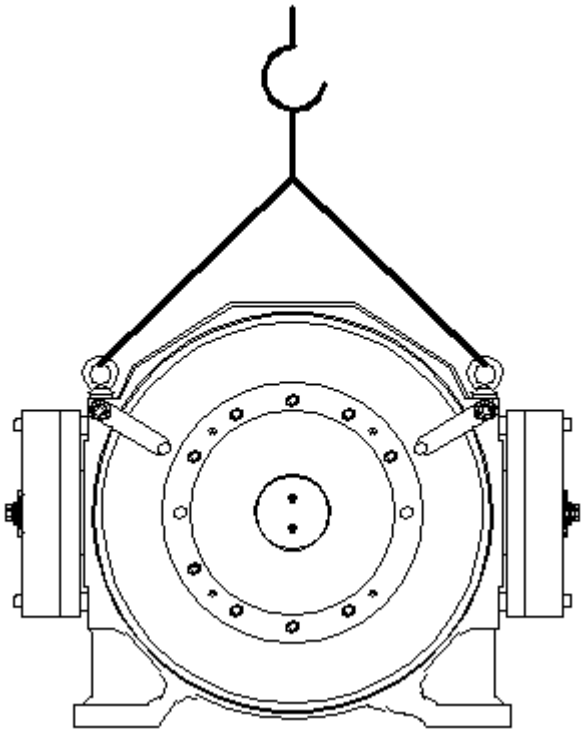


Figure 1: TPM1 Machine Recommended Hoisting Methods

3.0 Application

3.1 Overview

The TPM1 Machine is a synchronous permanent magnet gearless machine designed for elevators. Its configuration allows speeds up to 150 fpm (maximum) and an elevator capacity up to 2500 lbs with 2 to 1 roping and single wrap arrangement.

The TPM1 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 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 Machine Specifications

Maximum Shaft Load: 29.3 kN (6587 lbs)

Maximum Speed: 0.76 m/s (150 fpm)

Maximum Capacity: 1134 Kg (2500 lbs)

(50% Counterweight with 2 to 1 Roping and single wrap arrangement)

Designed for 180 starts per hour at 50% elevator duty cycle

Sheave Diameter: 340 mm (13.39 inches)

Rope Size: 8 mm (4 ropes)

Maximum Power: 6.7 hp

Motor Voltage: 290VAC (suitable for 460VAC inverter drives)

145VAC (suitable for 208-240VAC inverter drives)

Normal and Emergency Brake Model Number FZD12M:

Brake Stroke: 0.30mm-0.35mm

Pick Voltage/Current: 90VDC/1.2A

Hold Voltage/Current: 45VDC/0.6A

Table 1: Machine Duty Table

PM Gearless Machines For Single Wrap Applications

Torin Model Number		TPM1-2515-HV	TPM1-2515-LV
Roping		2:1	2:1
Elevator capacity	lbs	Up to 2500	Up to 2500
Elevator speed	fpm	150fpm	150fpm
Sheave dia./rope size/grooves	mm	340/8/4 grooves	340/8/4 grooves
Rated power	hp	6.7	6.7
Rated torque	ft-lbs	410	410
Acceleration torque	ft-lbs	820	820
Rated RPM	rpm	86	86
Rated amps	A	13.5	26.5
Rated voltage (+/-5%)	V	290	145
Rated frequency	Hz	14.3	14.3
Max. allowable amps	A	6 x I_N	6 x I_N
Max. shaft load	lbs	6587	6587

4.0 Machine Overview

The following is a list of major components of the TPM1 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.

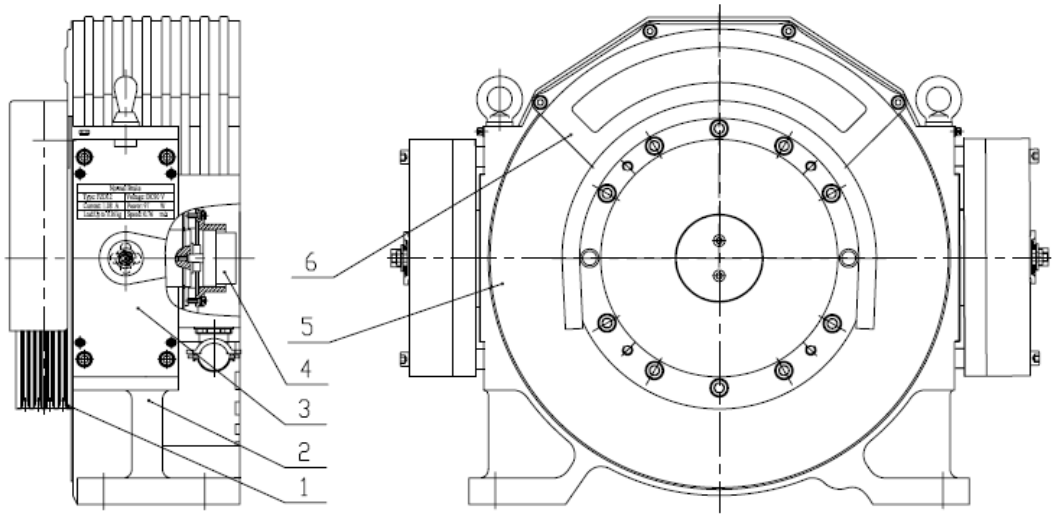


Figure 2: TPM1 Machine Assembly

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. **PMS Motor -** The part is used to provide the necessary torque and speed to move the elevator in operation.

3. **Brake -** The electromechanical device is used to prevent the elevator from moving when the car is at rest.

4. **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.

5. **Brake Drum** - The smooth surfaced drum is connected to the main shaft. When the brake is energized, the brake is released from the brake drum.

6. **Sheave cover -** Keeps the ropes out of touch after installing the ropes.

5.0 Installation

5.1 Motor Connection

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

WARNING! 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.

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

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 cable of emergency brake is EBK+ (positive pole), EBK-(negative pole), and the power cable of normal brake is NBK+ (positive pole), NBK-(negative pole).

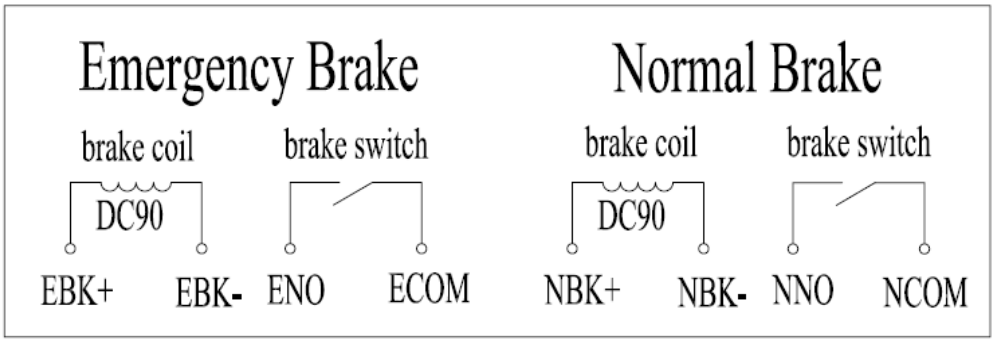


Figure 3: Normal and Emergency Brake Wiring

There are two microswitches installed in the brake 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).

5.3 Absolute Encoder Connection

These machines are supplied with Heidenhain Endat absolute encoder ECN413 with sub D 15-pin connector and 2 meters in length. The sine/cosine incremental resolution is 2048 pulses per revolution. The absolute encoder is rear mounted for TPM1 machines.

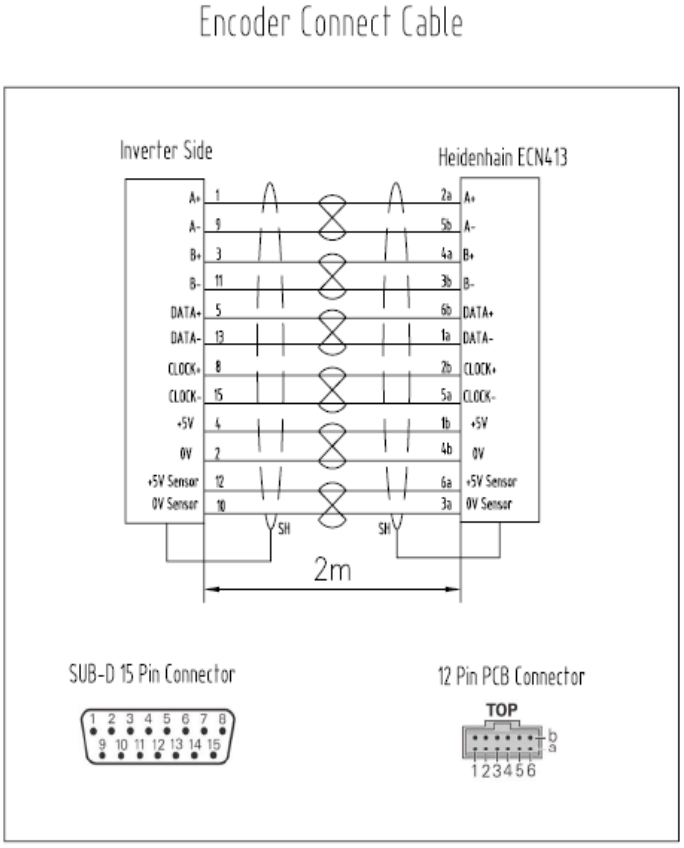


Figure 4: Encoder Wiring

6.0 Adjustments

6.1 Brake Stroke Adjustment

WARNING! 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.

WARNING! If the brake lining wears out, the brake stroke will increase. If the brake stroke is ≥1mm (0.04”), the brake may be disabled.

Required Tools & Materials:

Open end wrench: 21mm

Hex wrench: 8mm

Feeler gauges: 0.30mm, 0.35mm, 0.40mm.

Torque wrench to measure 40 Nm (29.5 ft-lb)

1. Remove the elevator from service.
2. Check the gap “A” (brake stroke) at points 1, 2, 3, and 4 with the feeler gauge. Maximum Gap “A” after wear should be <0.4mm (0.016”), otherwise the gap must be readjusted. See Figures 5 and 6.

CAUTION! Check and adjust the points 2 and 4, then the points 1 and 3.

3. Go to Step 4 only if the gap is bigger than specified. Otherwise the stroke is good.
4. Loosen the bolt M10 using hex wrench (8mm) about 1 turn.
5. Then adjust the guide bushing slowly using the open end wrench (21mm). If the gap is too big, turn the guide bushing (the pitch of guide bushing is 2mm so it will not have to be turned much) counter-clockwise to reduce it. Otherwise, turn the guide bushing clockwise to increase.
6. Then tighten the bolts M10 diagonally using the torque wrench to 40 Nm (29.5 ft-lb)
7. Test the clearance again to make sure the gap “A” is between 0.30~0.35mm.
8. Adjust the other point where the gap is out of spec using the same method.

Notice: as shown, the positions 1,2,3,4 are between the screw M10x110 and the adjusting screw M6x60.

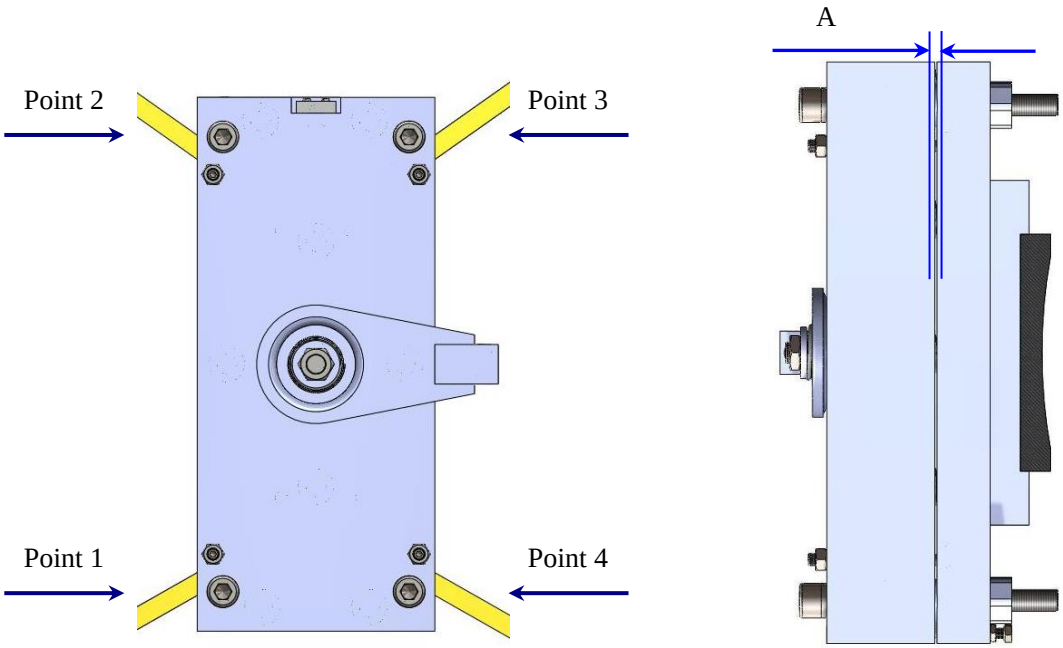


Figure 5: Brake Stroke Adjustment Points

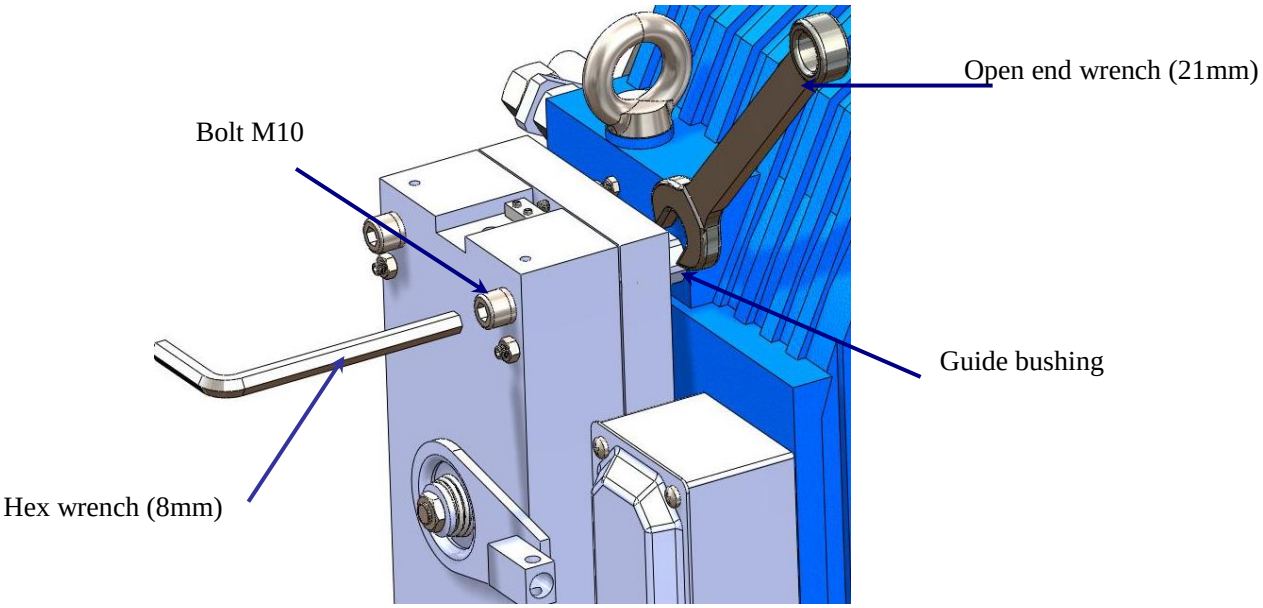


Figure 6: Brake Stroke Adjustment

6.2 Brake Noise Adjustment

WARNING! 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

Loctite 271

6.2.1 Brake Noise Adjustment Procedure

If the brake noise is too big, the brake absorb pad height should be readjusted. Generally, brake noise adjustment has been performed at the factory and there is no need to be adjusted.

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

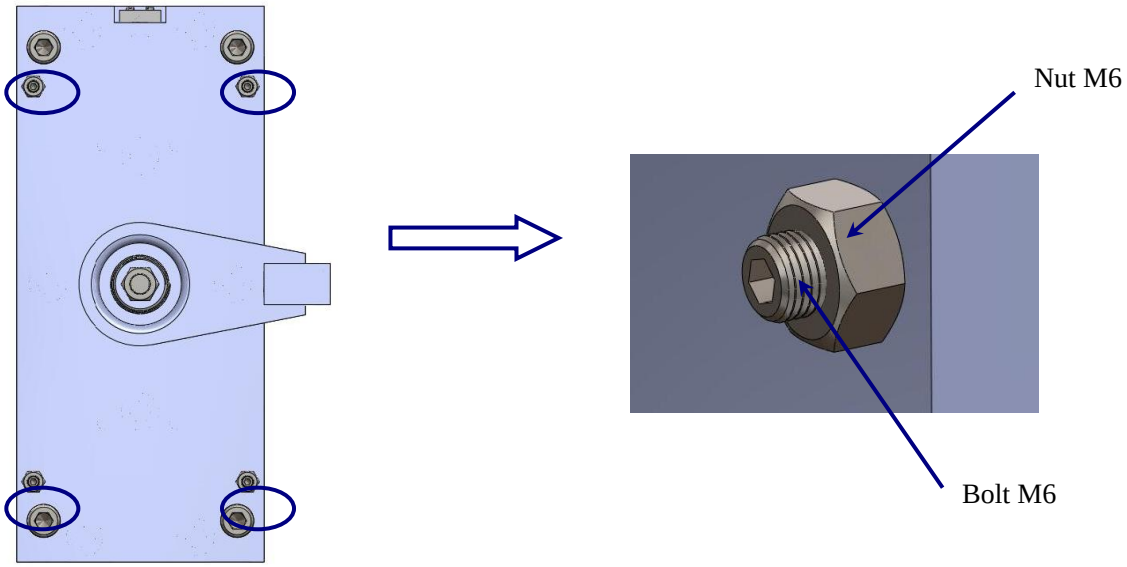


Figure 7: Brake Noise Adjustment

6.3 Brake Switch Adjustment

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

See Section 8.5.3, Brake Switch Adjustment if needed.

7.0 Maintenance

WARNING! 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

WARNING! 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 ≥1mm (0.4"), 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 installation in the first 6 months. Every 1 year afterwards.

Benchmark Criteria

The brake stroke "A" should <0.40mm (0.016"). See Section 6.1.1 Brake Stroke Adjustment.

7.2 Brake Lining Wear Check

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

Suggest check cycle

Every 1 year

Benchmark Criteria

The brake lining wear must be <2mm.

Use beam callipers to check the distance “A” (eyeable guide bushing) between the anchor disc and the machine frame at the side, it must >8mm. Generally, the distance “A” is about 10mm and has been adjusted in the factory.

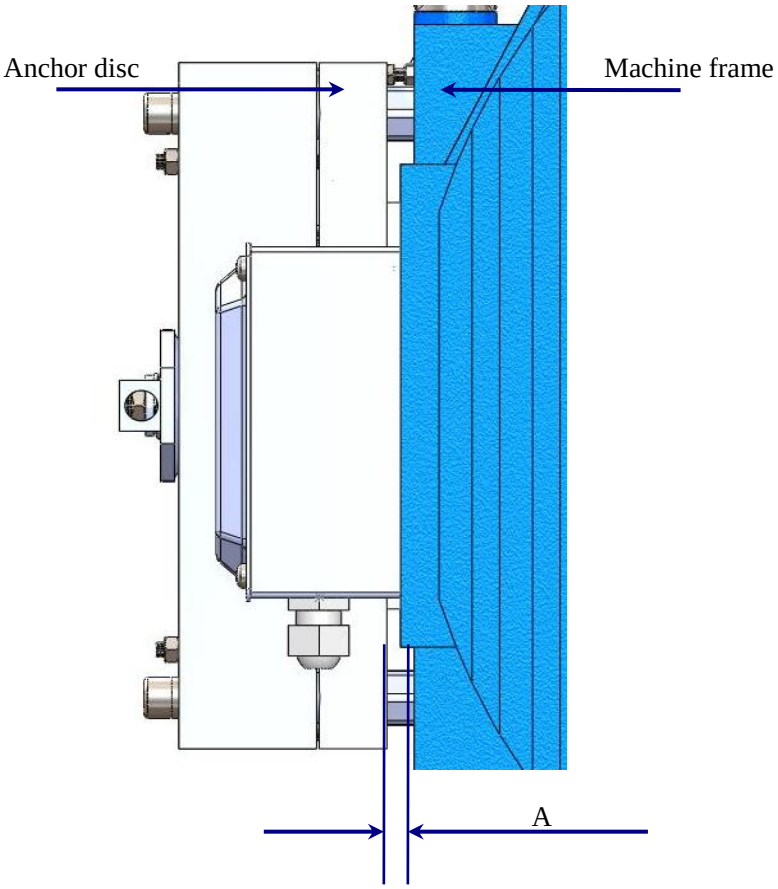


Figure 8: Brake Wear Check

8.0 Replacement

WARNING! 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.

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

8.1 Encoder Replacement

Required Tools & Materials:

Encoder (ECN413)

Phillips screwdriver

Hex wrench (2mm, 4mm, and 8mm)

Torque Wrench (Need to measure 9 in-lb and 44 in-lb)

Socket Allen Wrench, 2mm and 4mm (for torque wrench)

8.1.1 Encoder Removal

1. Remove encoder cover using the Phillips screwdriver. See Figures 9 and 10.

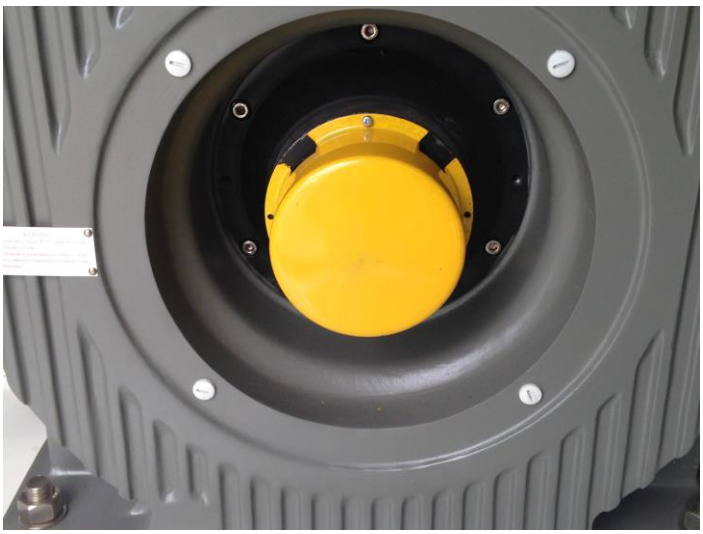


Figure 9: Remove encoder cover

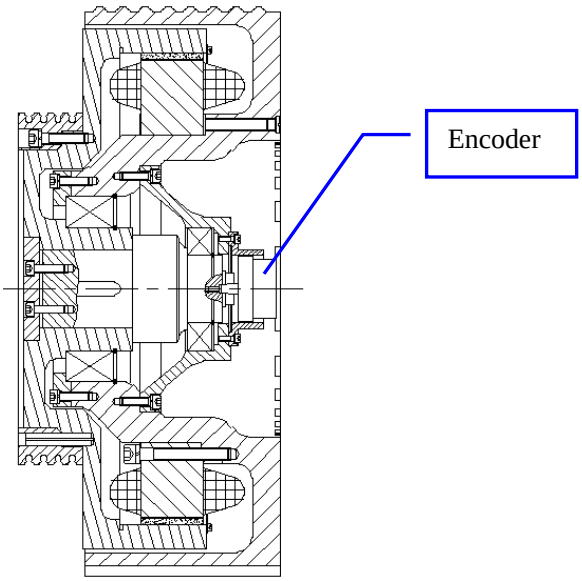


Figure 10: Encoder location

2. Remove the encoder end cover of encoder using inner hex wrench 4mm. See Figure 11.

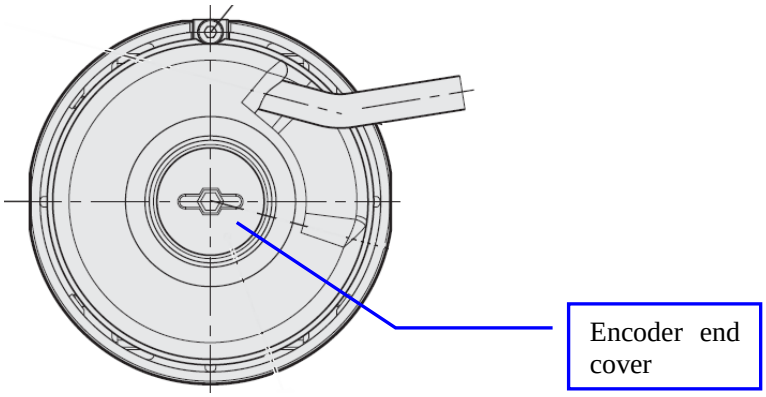


Figure 11: Remove Encoder end cover

3. Loosen (do not remove) the Expansion screw M2.5 by Inner hex wrench 2mm. See Figure 12.

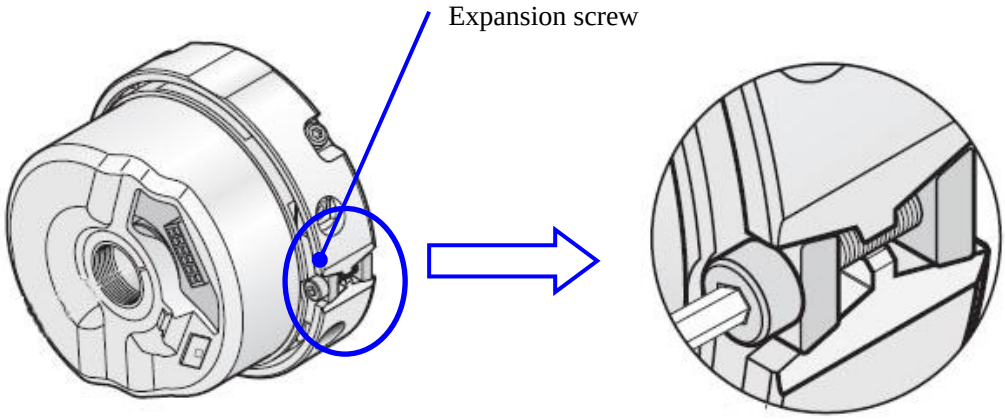


Figure 12: Loosen M2.5 bolt

4. Rotate counterclockwise the bolt M5x50 1-2 turns with hex wrench 4mm, install the bolt M10 against the encoder with hex wrench 8mm. See Figures 13 and 14.

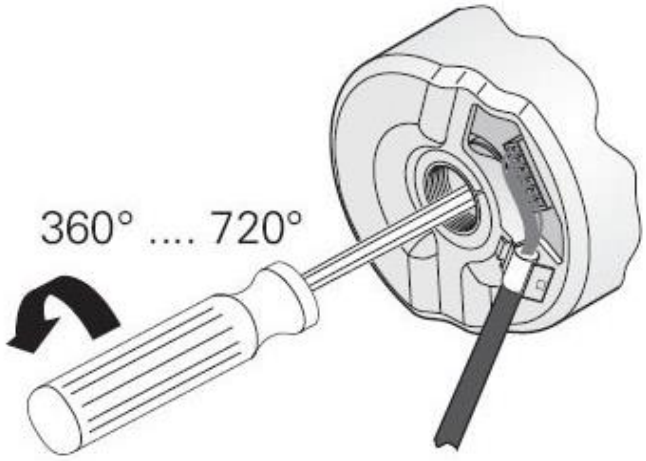


Figure 13: Loosen M5 bolt.

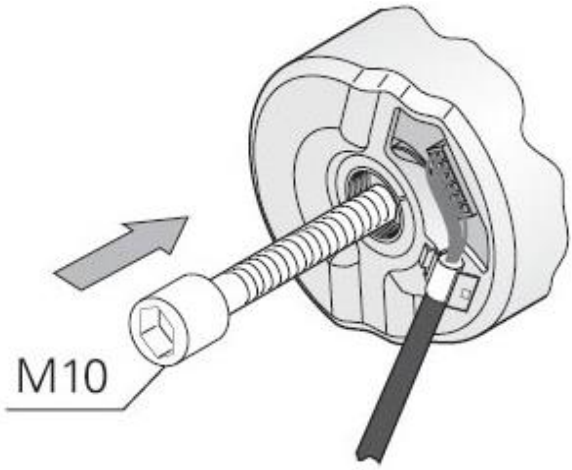


Figure 14: Use M10 bolt to loosen the encoder

5. Turn the M10 bolt against the M5x50 bolt to push the encoder from the shaft. Remove both bolts and the encoder. **Note: Steps 4 and 5 may have to be repeated until the encoder can be freely removed. (The M5 bolt must remain in the encoder so the M10 bolt can push against it.)**

6. Remove the encoder.

8.1.2 Encoder installation

1. Remove end cover of the new encoder using a hex wrench (4mm). See Figure 15.

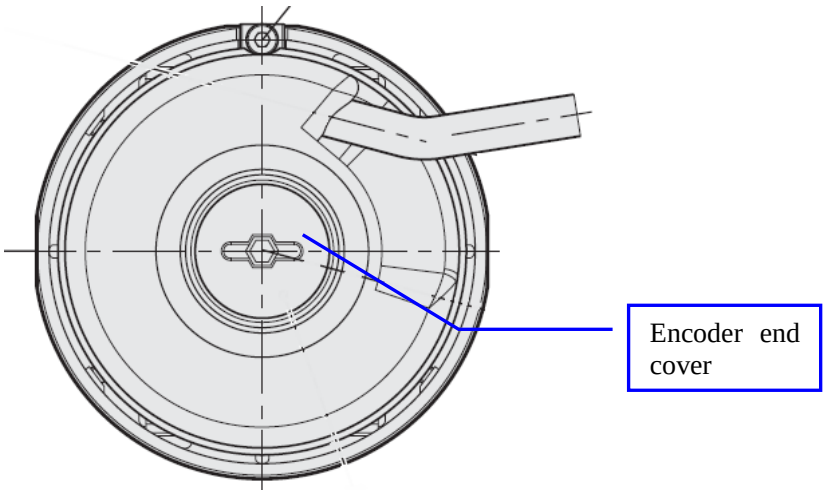


Figure 15: Remove Encoder end cover

2. Reconnect the encoder cable for the ECN1313 only. See Figure 16.

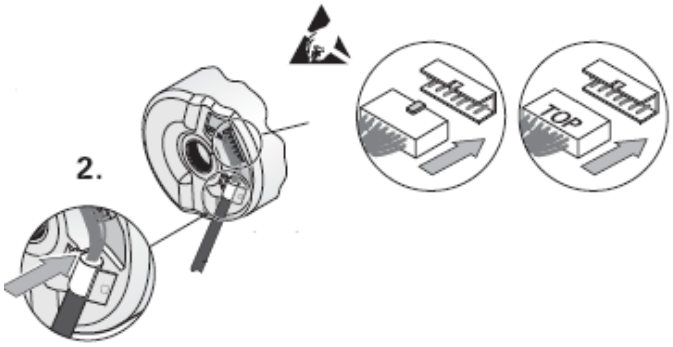


Figure 16: Reconnect ECN1313 encoder cable

3. Install the encoder on the encoder shaft. Use the bolt M5 to secure the encoder to the encoder shaft using a hex wrench (4mm). Use 4mm socket Allen and torque wrench to tighten the bolt to 44 in-lb. (5 Nm). See Figure 17.

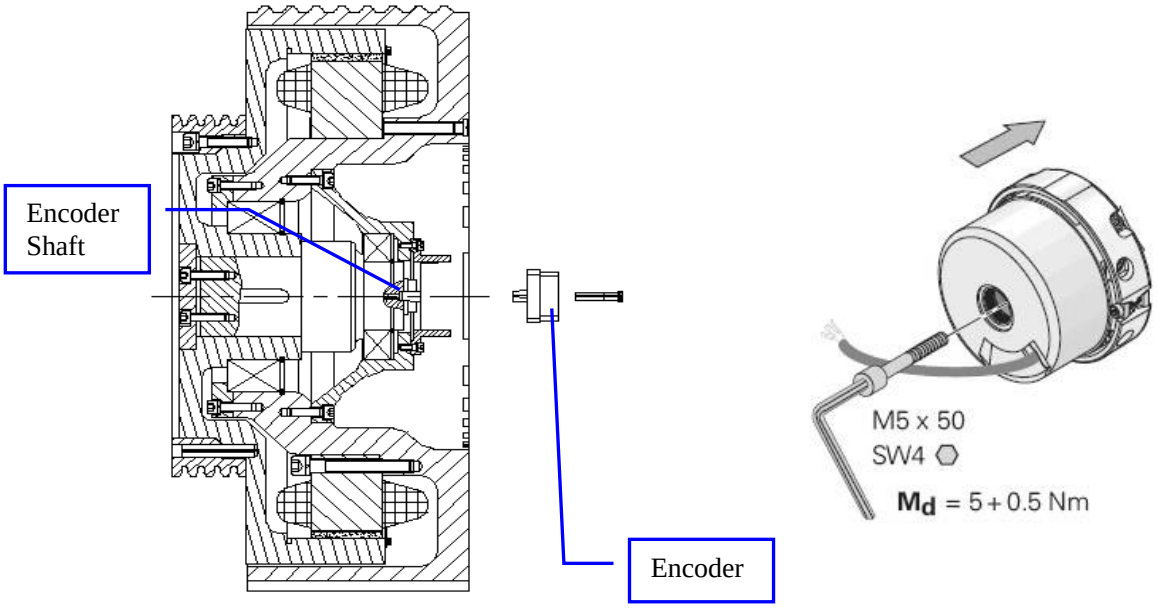


Figure 17: Attach the encoder

4. Install the end cover, and then tighten it. Use 4mm socket Allen and torque wrench to tighten the bolt to 44 in-lb. (5 Nm). See Figure 18.
5. Tighten the M2.5 with hex wrench (2mm) to 9 in-lbs. (1.25 Nm).

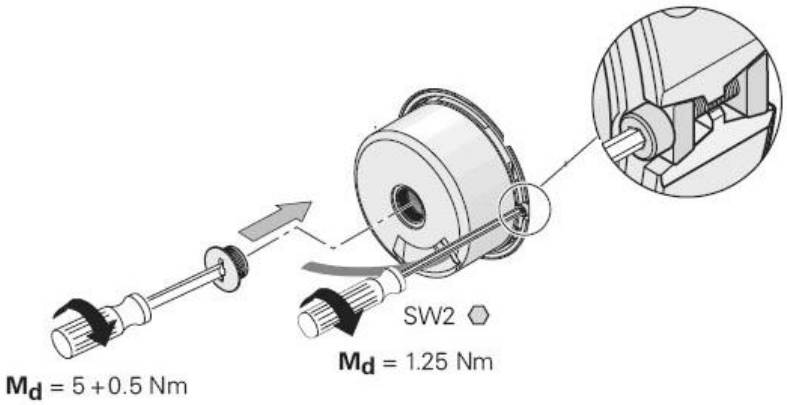


Figure 18: Final installation

6. Reinstall the encoder cover.
7. Power supply for the machine, and test the machine.
8. **Make sure that correct torque specified by the encoder manufacturer is observed when tightening these bolts.**
9. Align the encoder per controller instructions.

8.2 Brake Replacement

WARNING! 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 (21mm)

Hex wrench (8mm)

Torque wrench (need to measure 65 ft-lbs.)

Straight head screw driver

Phillips head screw driver

Feeler gauges

Clean cotton fabric

Loctite 243

Double end guide bolt (Threaded rod) M10x2x160

8.2.1 Brake removal

1. Remove the car from service and remove power to the machine.
2. Disconnect the brake cable from the junction box next to the emergency brake.
3. Remove two bolts M10x110 which are opposite each other with hex wrench (8mm). See Figure 19.
4. Then install two double end guide bolt (M10x2x160) into the holes.
5. Remove other 2 bolts M10x110 evenly, slide off the brake.

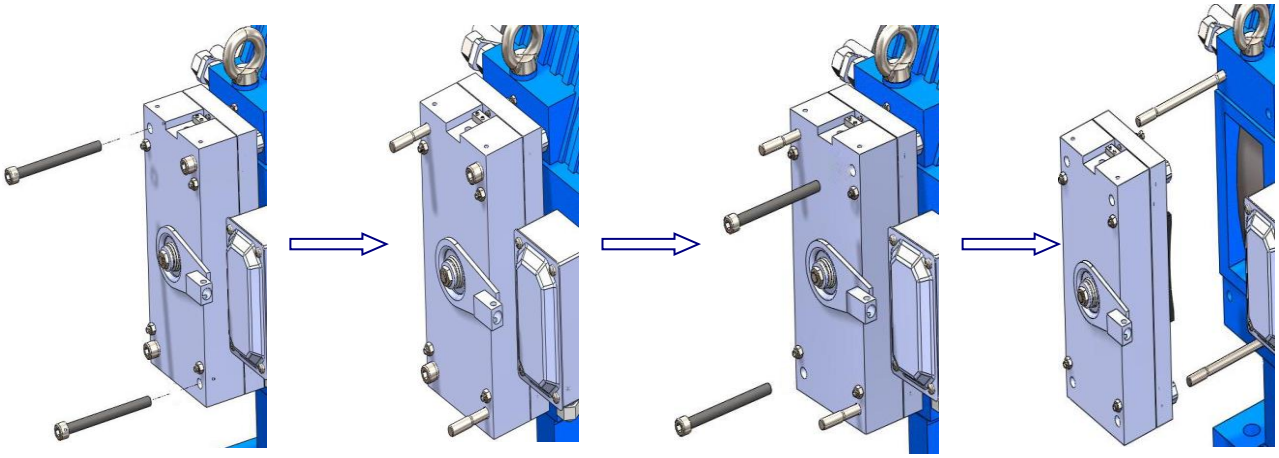


Figure 19: Brake removal

8.2.2 Brake installation

1. Clean the brake lining and the head face of the contact frame with cleaner (alcohol based).
2. Install the double end guide bolts (M10x2x160) into opposite holes of the brake frame as show in Figure 20. Then position the new brake on the guide bolts.
3. Tighten two bolts M10x110 with Loctite 243 diagonally and evenly to 65 ft-lb.
4. Remove the double end guide bolts (M10x2x160), tighten the other two bolts M10x110 with Loctite 243 evenly.
5. Re-connect the brake cable.

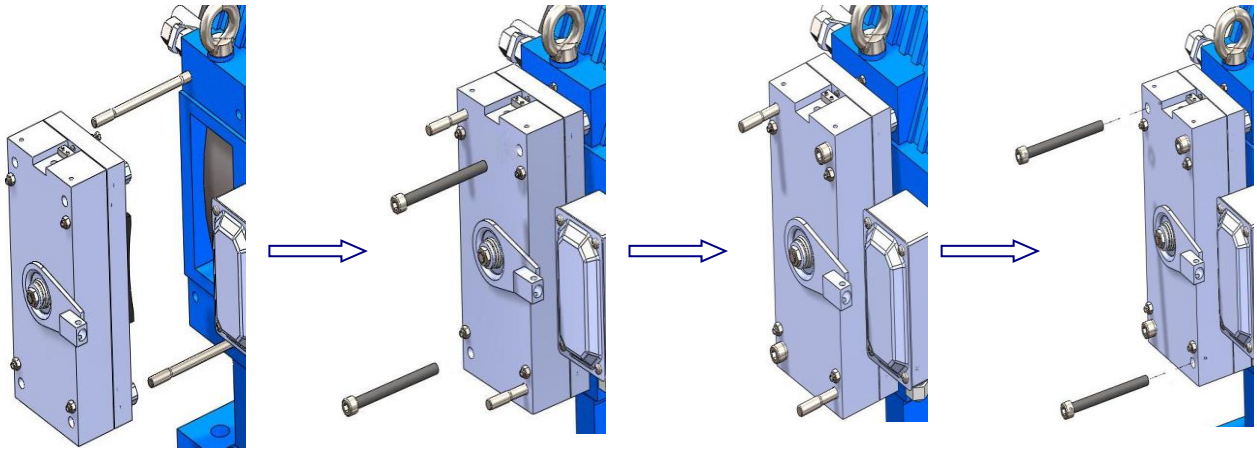


Figure 20: Brake installation

8.2.3 Brake adjustment

After installing the brake, the brake gap must be readjusted. Please refer to the "Brake Stroke Adjustment" Section 6.1.1.

8.2.4 Test brake

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

8.3 Brake Lining Replacement

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

Measure the distance between the brake and the machine base, if the distance is less than 10mm, then the brake shoe should be replaced. Check and adjust every three months. See Figure 21.

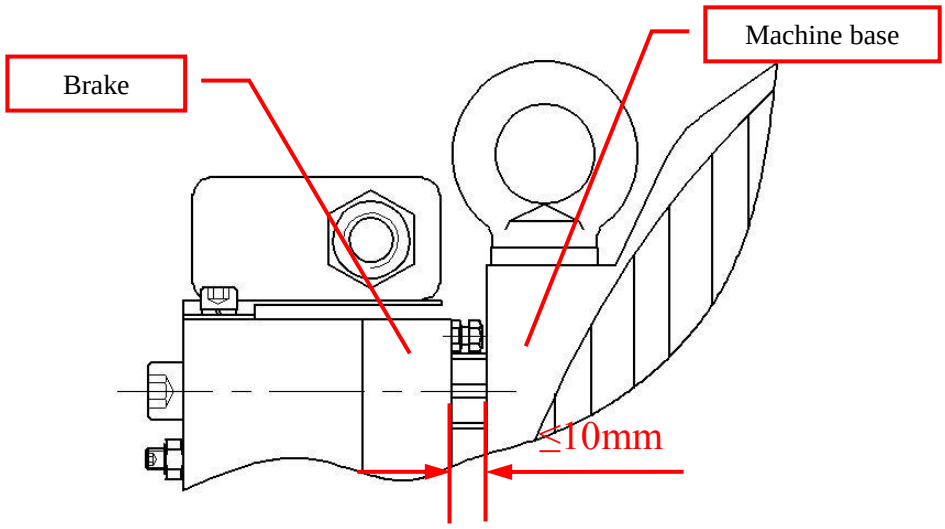


Figure 21: Brake check

Required Tools & Materials:

Open end wrench (21mm)

Hex wrench (8mm)

Torque wrench (need to measure 65 ft-lbs.)

Straight head screw driver

Phillips head screw driver

Feeler gauges

Clean cotton fabric

Loctite 243

Double end guide bolt (Threaded rod) M10x2x160

8.3.1 Brake Lining Removal

1. Remove the car from service and remove power to the machine.
2. Remove the brake. See Section 8.2.1 Brake Removal.
3. Remove the screws M6x26 (4) with the hex wrench 4mm, then remove the brake lining. See Figure 22.

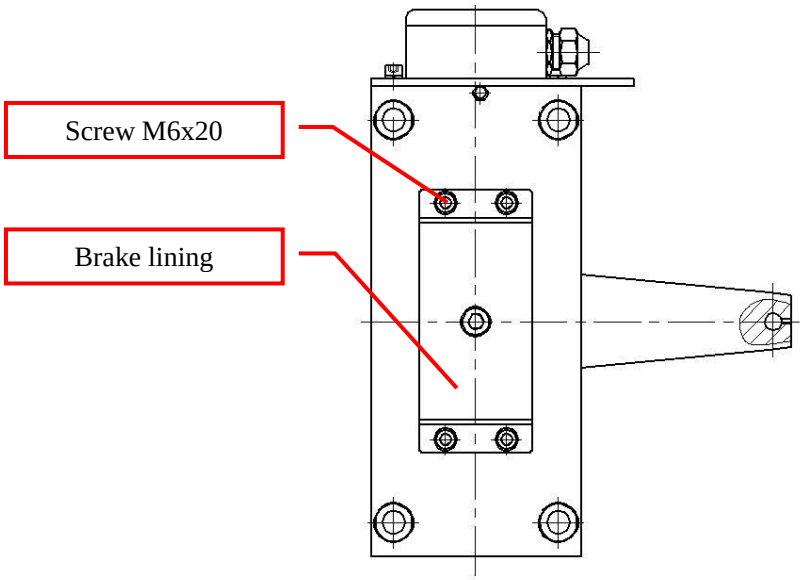


Figure 22: Remove brake lining

8.3.2 Brake lining installation

1. Clean the mating surfaces of the brake lining and brake with an alcohol based cleaner. See Figure 23.

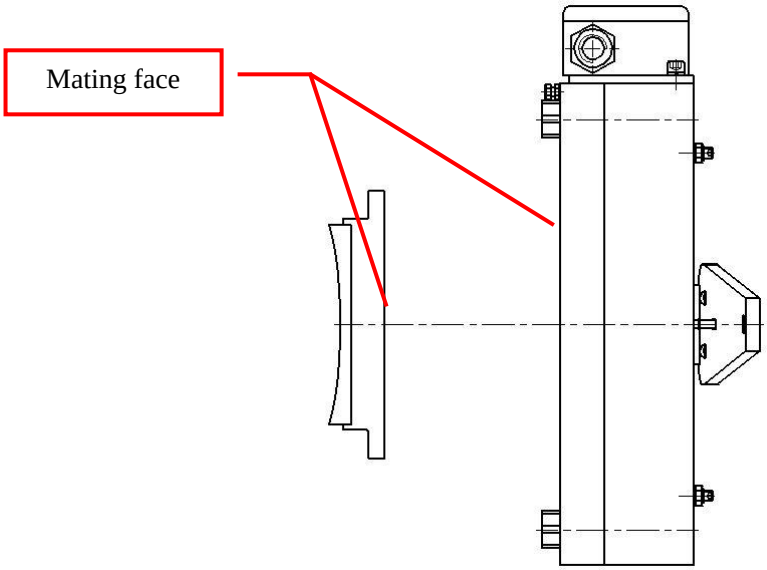


Figure 23: Clean mating surfaces

2. Secure the brake lining to the brake with the screws M6x20 (4) using Loctite 243. Tighten the screws to 6-8Nm (4.5-6 ft-lb). See Figure 24.

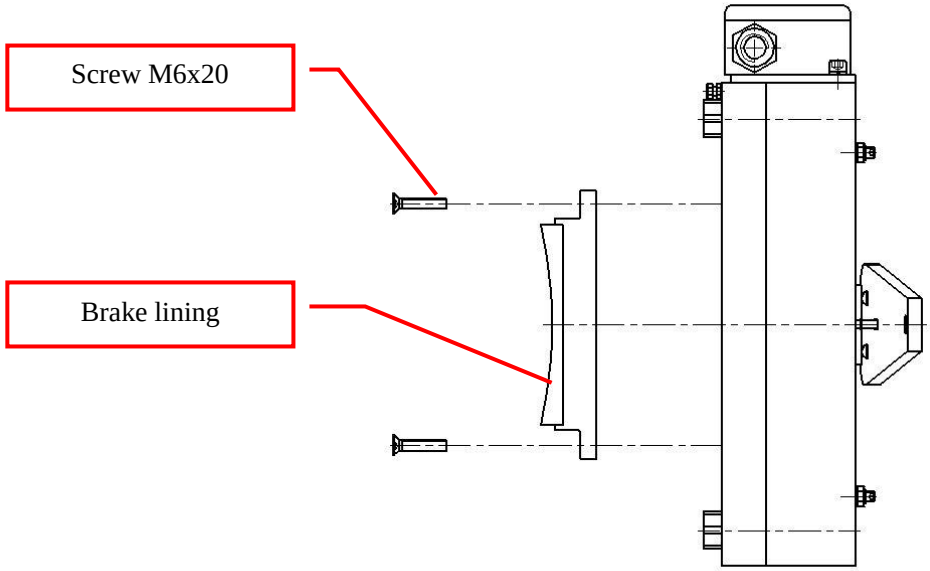


Figure 24: Install Brake lining

3. Reinstall the brake, adjust, and test. See Sections 8.2.2-8.2.4 Brake Installation, Brake Adjustment, and Brake Test.
4. Return car to service.

8.4 Brake Switch Replacement

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

Required Tools & Materials:

Brake switch

Scissors

Sealant (Loctite 480 or equivalent)

Phillips head screw driver

Straight head screw driver

Torque screw driver (Need to measure 1.8 in-lb)

Open end wrench (8mm) 2 pieces

Loctite 271

Cable ties

Multimeter

Feeler gauges (0.1mm, 0.2mm)

8.4.1 Brake Switch removal

1. Remove the bolts M5x20 and the washers (4 pieces) in the brake terminal box using the Phillips head screw driver, and remove the terminal box cover.
2. Cut off the cable ties which are used to secure the brake switch cable.
3. Remove the cable of the brake switch that needs to be replaced from the brake terminal using a straight head screw driver and then move it out from the hole in the machine body.
4. Remove the screws M2x10 with the Phillips head screw driver, then remove the defective switch. See Figure 25.

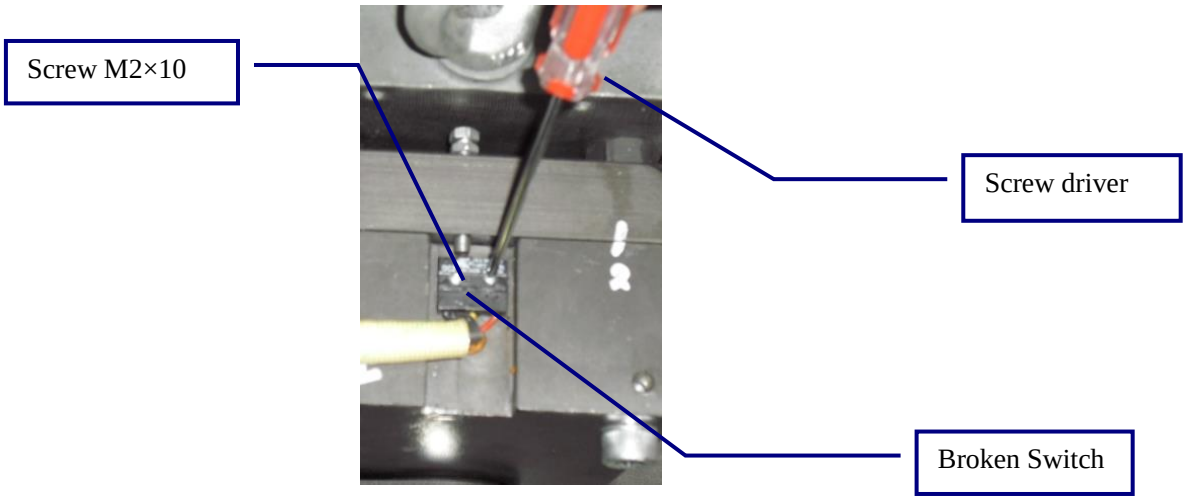


Figure 25: Brake Switch removal

8.4.2 Brake Switch installation

1. Clean the brake switch and brake body mating surfaces. See Figure 26.

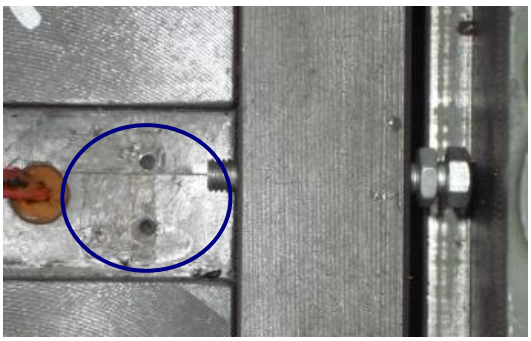


Figure 26: Clean surfaces

2. Apply a thin layer of sealant (Loctite 480 or equivalent) on brake switch mating surface. See Figure 27.

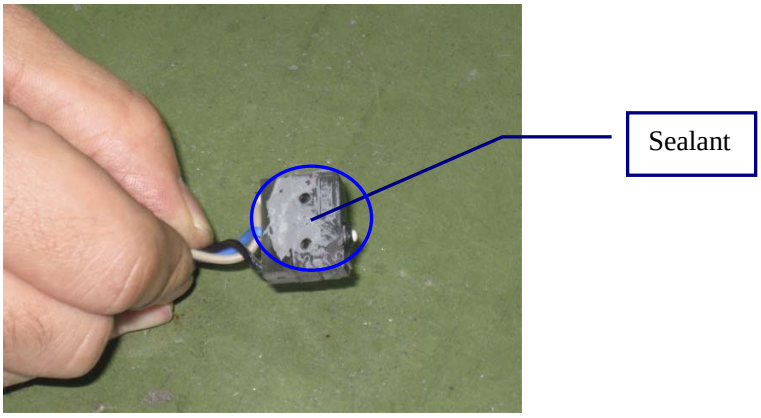


Figure 27: Apply Loctite 480

3. Install the brake switch on the brake body by tighten the screws M2x10 using a Phillips head screw driver. Use torque screw driver to tighten the bolt to 1.8 in-lb, then apply Loctite 480 or equivalent between the screw heads and the switch body. See Figure 28.

Figure 28: Secure brake switch

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

8.4.3 Brake Switch adjustment

1. Use the open end wrench 8mm to loosen the lock nut M4 and the activation bolt. See Figure 29.

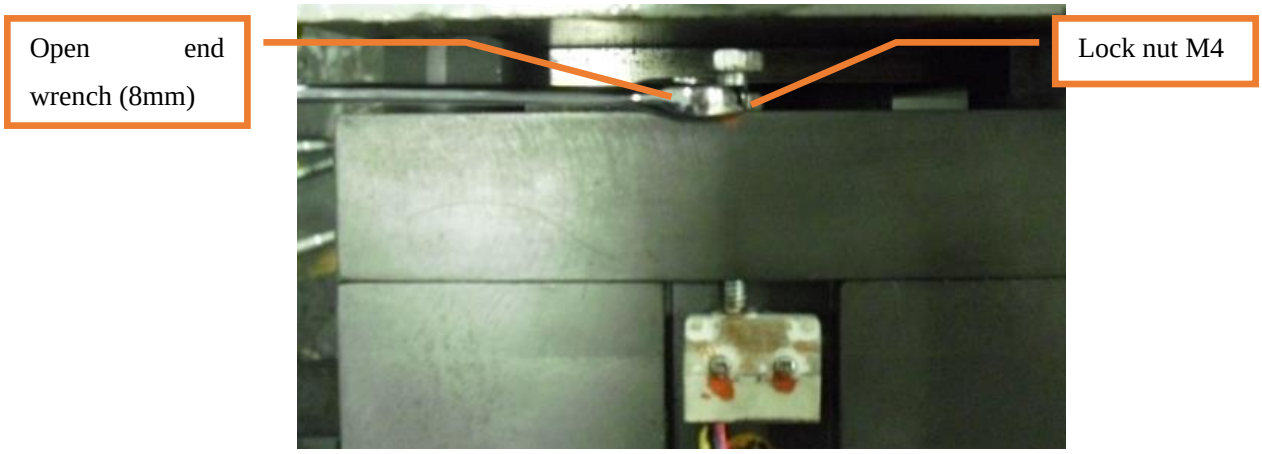


Figure 29: Loosen lock nut

2. Apply one drop of Loctite 271 or equivalent on the bolt thread for anti-vibration purpose. See Figure 30.

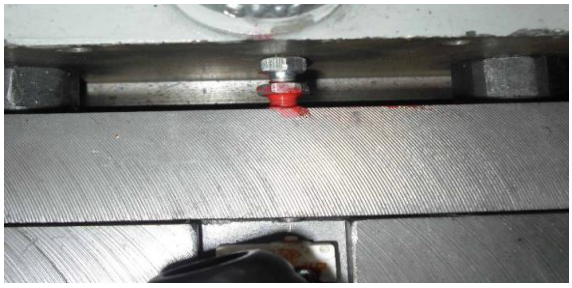


Figure 30: Apply Loctite 271

3. Adjust the bolt M4x50 with open end wrench (8mm) clockwise slowly until you hear the switch close.
4. Then adjust bolt M4 counterclockwise about 90° (0.17mm).
5. Use open end wrench 8mm to hold the bolt M4x50 steady and then use another open end wrench 8mm to tighten the lock nut M4. See Figure 31.

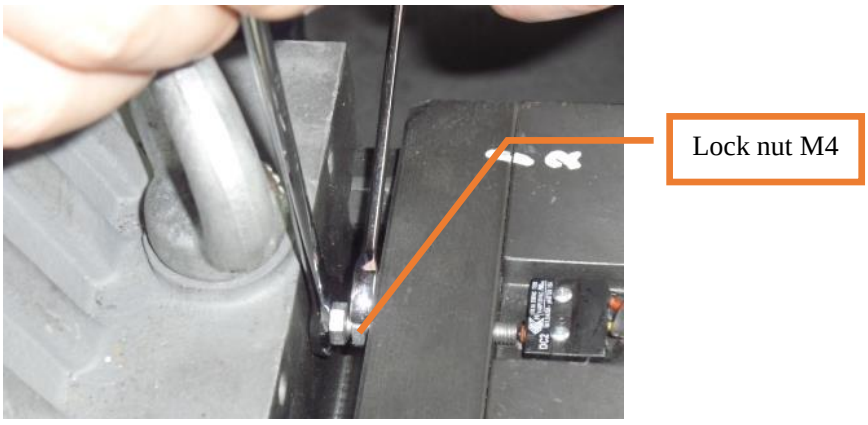


Figure 31: Tighten lock nut

6. Use feeler gauges to make sure the new switch is functional by inserting feeler gauges between the bolt M4x50 and the switch. The switch should not activate when inserting 0.10mm (0.004'') feeler gauge and it should activate when inserting 0.20mm (0.008'') feeler gauge. Otherwise, readjust the activation bolt until it works and then repeat step 5 above. See Figure 32.

   Note: make sure the feel gauge is vertical when inserting to the gap between bolt and switch.

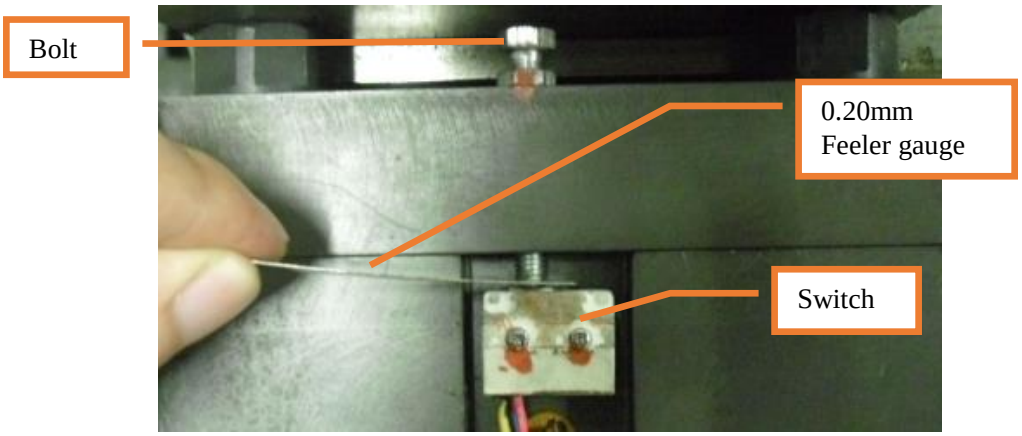


Figure 32: Using feeler gauges

8.5 Drive sheave replacement

8.5.1 Drive sheave removal

1. Remove the guard by removing the screws M8x16, lock washers 8 and flat washers 8 with inner hexagon spanner (6mm). See Figure 33.

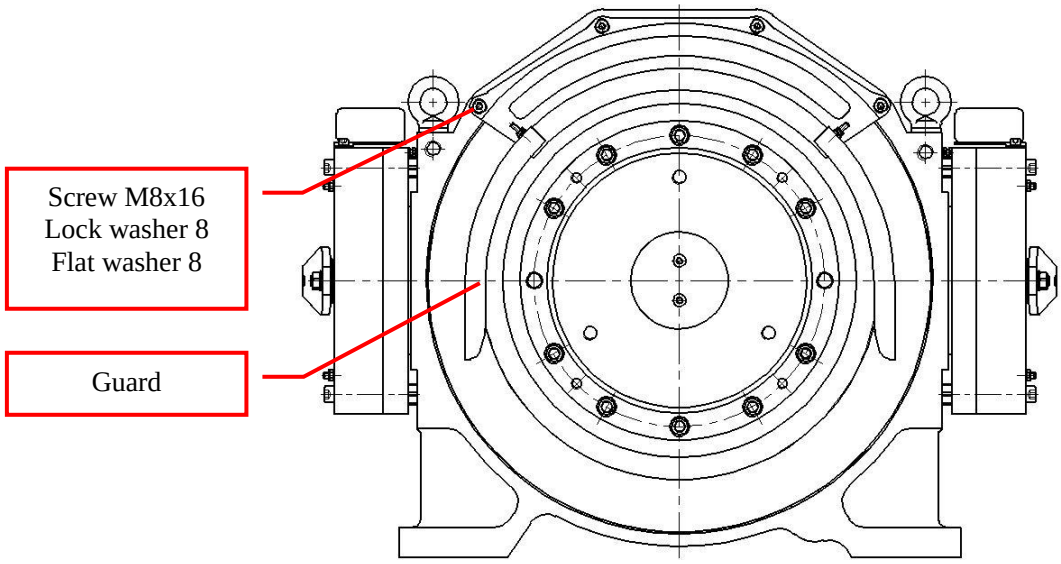


Figure 33: Remove the Guard

2. Remove rope retainer by removing the nuts M16 and lock washers 16 with open-ended wrench (24mm). Loosen the thin nuts M16, and then remove the screws M16×70 with inner hexagon spanner (8mm). See Figure 34.

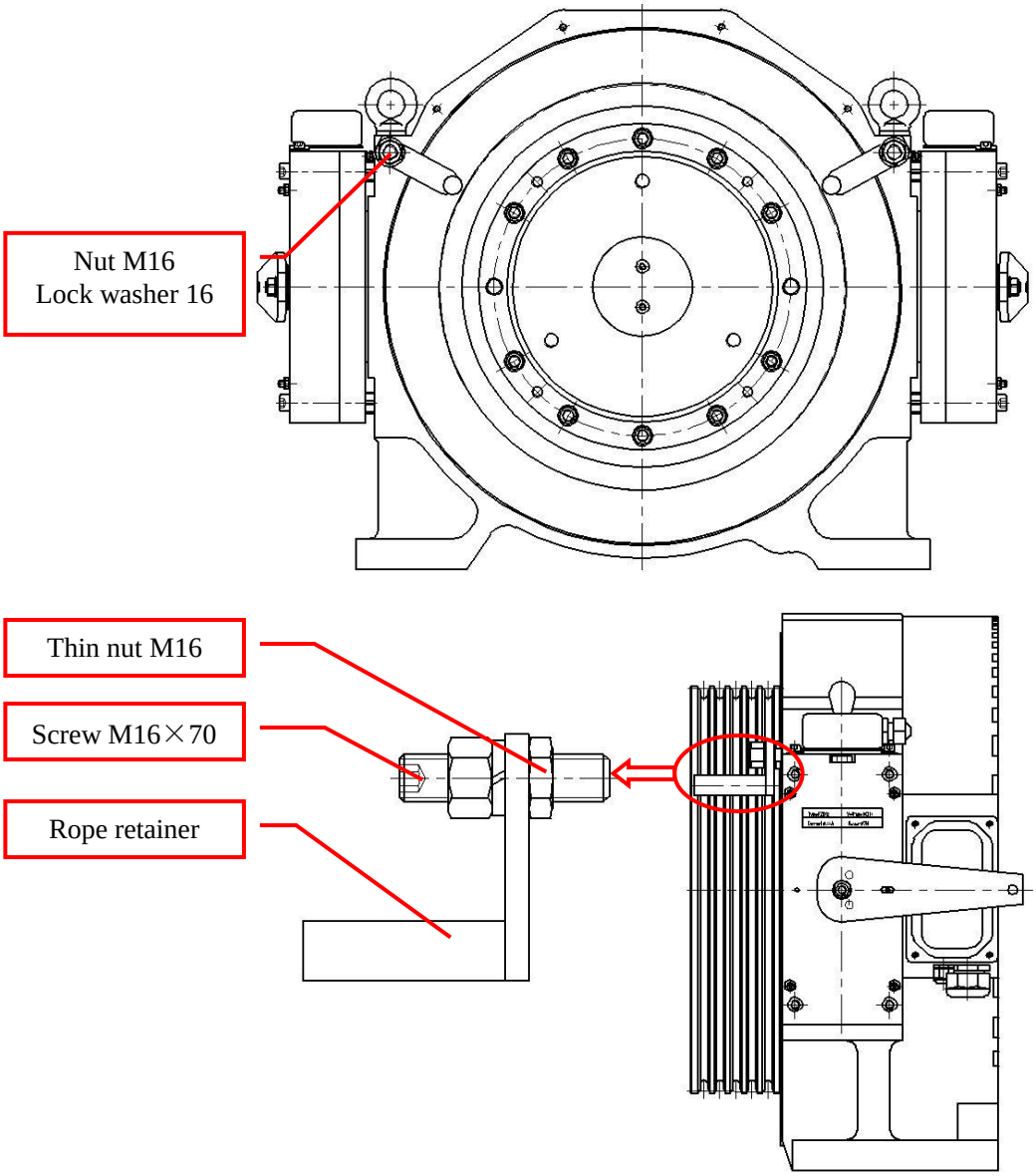


Figure 34: Remove Rope Retainer

3. Remove the screws M12×50 and lock washers 12 with inner hexagon wrench (10mm). See Figure 35.

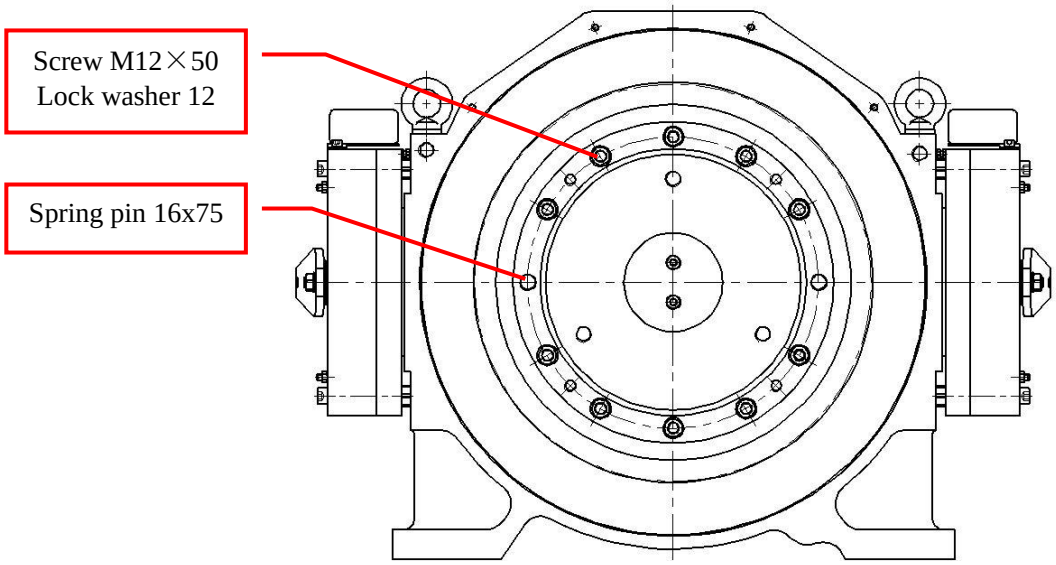


Figure 35: Remove Screws M12

4. Screw two bolts M12×90 into the corresponding threaded holes of the Drive Sheave, then tighten the bolts slowly until the Drive Sheave is pushed loose, and then remove the it and spring pins 16×75 (2pcs). See Figure 36.

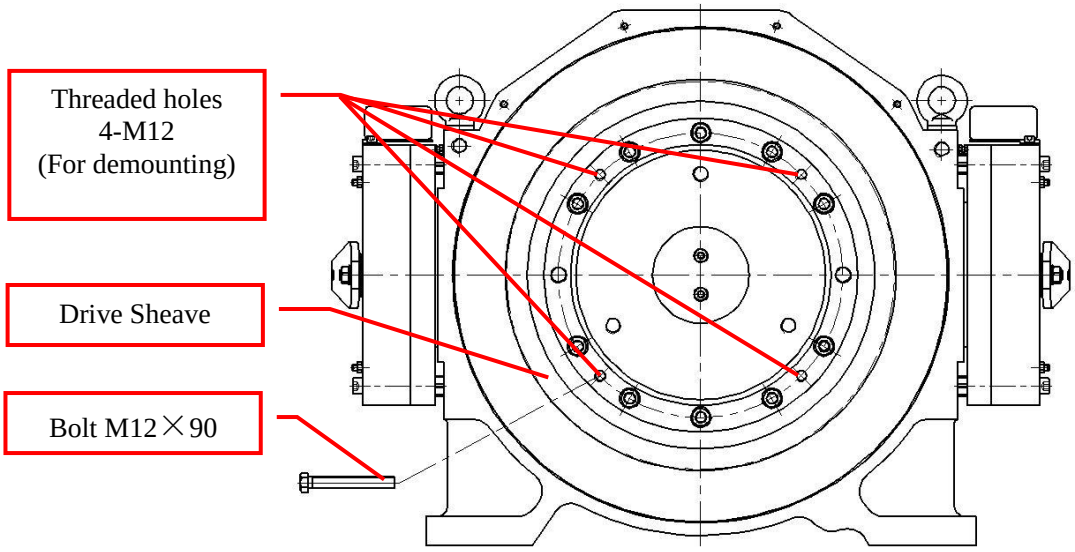


Figure 36: Use M12x90 bolts to loosen the drive sheave

8.5.2 Drive sheave installation

1. Hoist the traction machine with lifting equipment and place it on the equal height blocks (Make sure to protect the other parts of the traction machine). Clean the mating face of the brake wheel, and install two double ended rods M12×160 into two diagonal threaded holes of the brake wheel. See Figure 37.

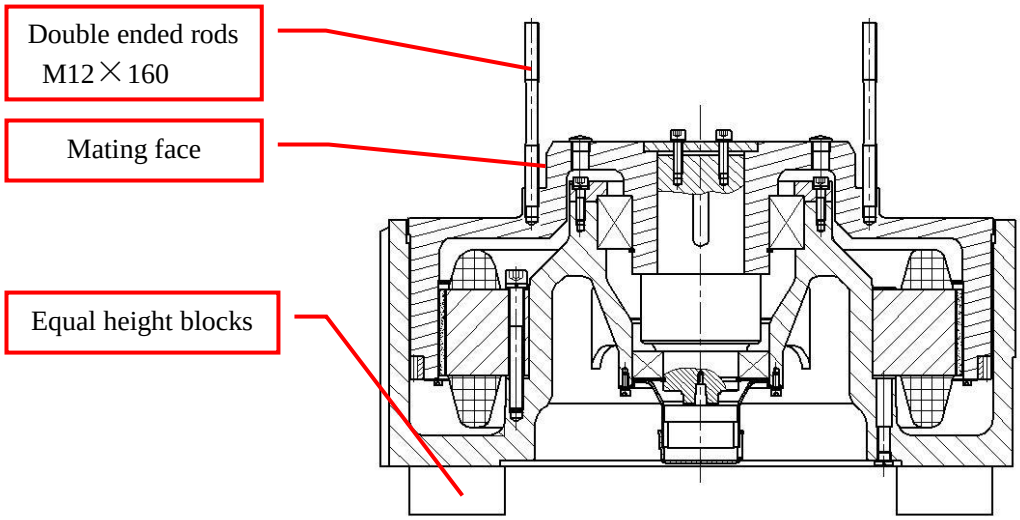


Figure 37: Install M12x160 screws

2. Check and clean the new drive sheave and heat it to 80° C (176° F). Hoist the drive sheave and slide it on the brake wheel using the two M12x160 double ended studs as guides. **(Note: ensure the pin holes of the traction wheel align with the pin holes of the brake wheel.)** Install the spring pins 16×75 into the pin holes. The end face of the pin should be higher 2-3mm than the end face of the traction wheel. See Figure 38.

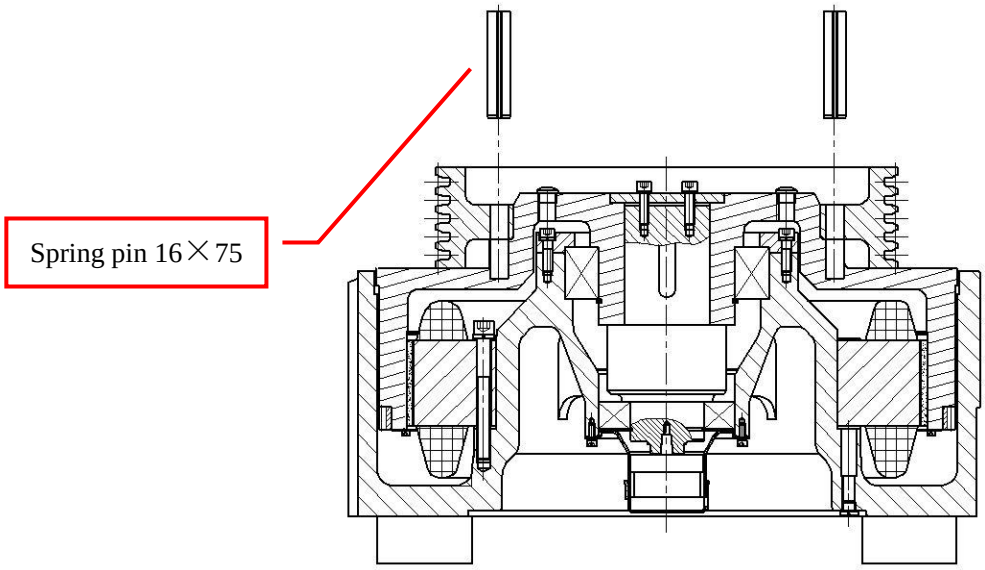


Figure 38: Install Drive Sheave and spring pins

3. Remove the double ended studs M12×160, then screw in ten screws M12×50 and lock washers 12 to fasten the traction wheel (the screws should be tightened diagonally). Tighten the screws again after the drive sheave has cooled to room temperature. The tightening torque is 70Nm (56 ft lb). See Figure 39.

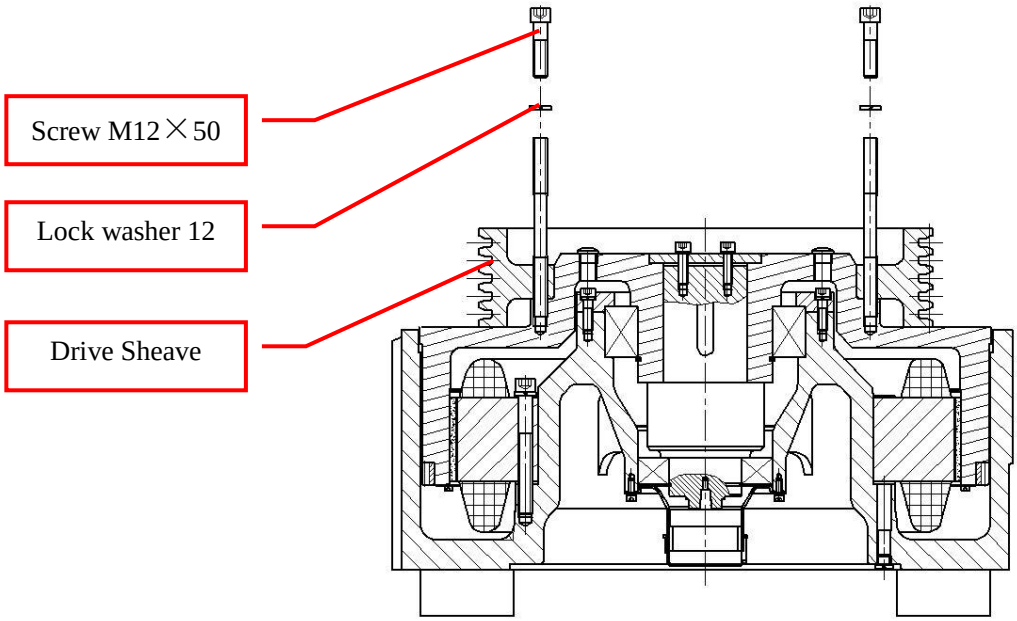


Figure 39: Secure the Drive Sheave

4. Lift the traction machine with lifting equipment to a vertical position, then open the brakes. Rotate the drive sheave one lap while checking the radial runout of the drive sheave rope groove with dial indicator. The radial runout should be less than 0.15mm. Also make sure that the rotor rotates smoothly, bearing has no noise and there is no interference between rotor and stator.

5. Reinstall the guard onto the traction machine, and then install the screws M8x16, lock washers 8 and flat washers 8 to secure the rope guard. See Figure 40.

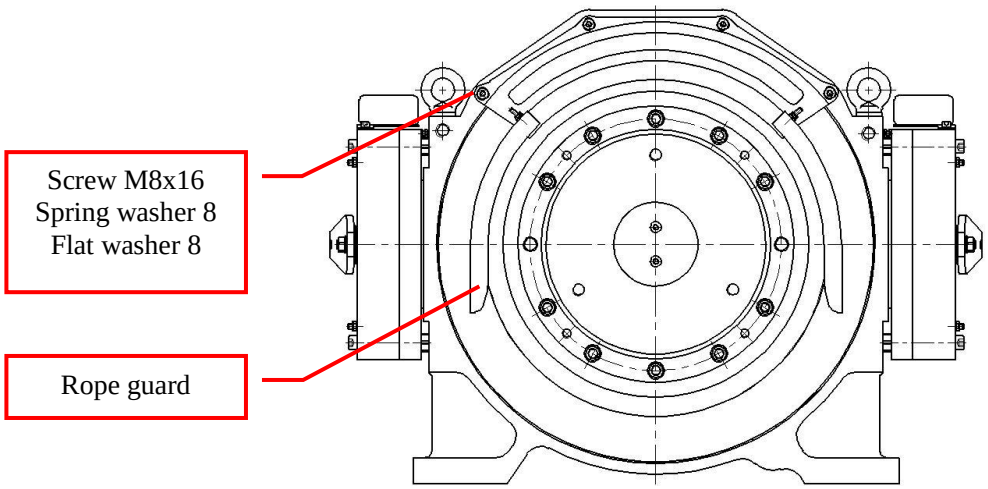


Figure 40: Install the rope guard

6. Reinstall the rope retainers by installing the thin nut M16 onto the screw M16×70, then screw the screw M16x70 into the corresponding threaded hole of the machine base (screw in about 20mm), and then tighten the thin nut M16 with open-ended wrench (24mm). Install the rope retainer onto the screw M16×70, and screw on the nut M16 and lock washer 16 to secure the rope retainer. See Figures 41 and 42.

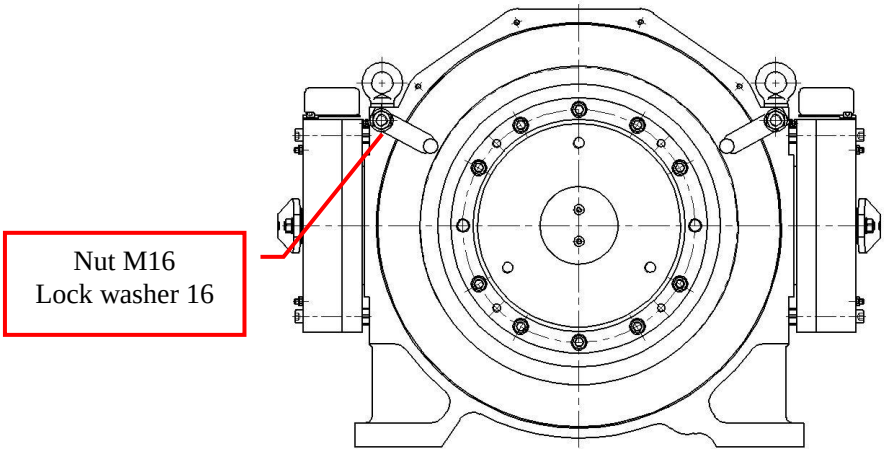


Figure 41: Reinstall Rope retainers

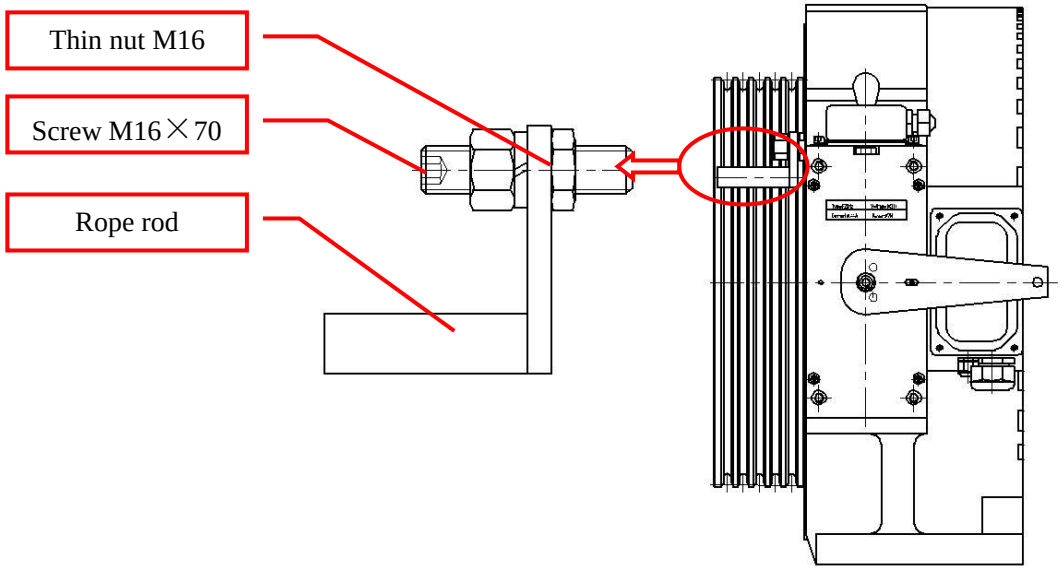


Figure 42: Rope retainer assembly

7. Turn on the power and test the machine.

8.6 Bearing replacement

8.6.1 Bearing 6213-2RS replacement

8.6.1.1 Bearing removal

1. Remove the encoder. See Section 8.1.1 Encoder removal.
2. Screw out the screws M5x12 and spring washers 5 with hex wrench (4mm), then remove the encoder sleeve and wave washer 120. See Figure 43.

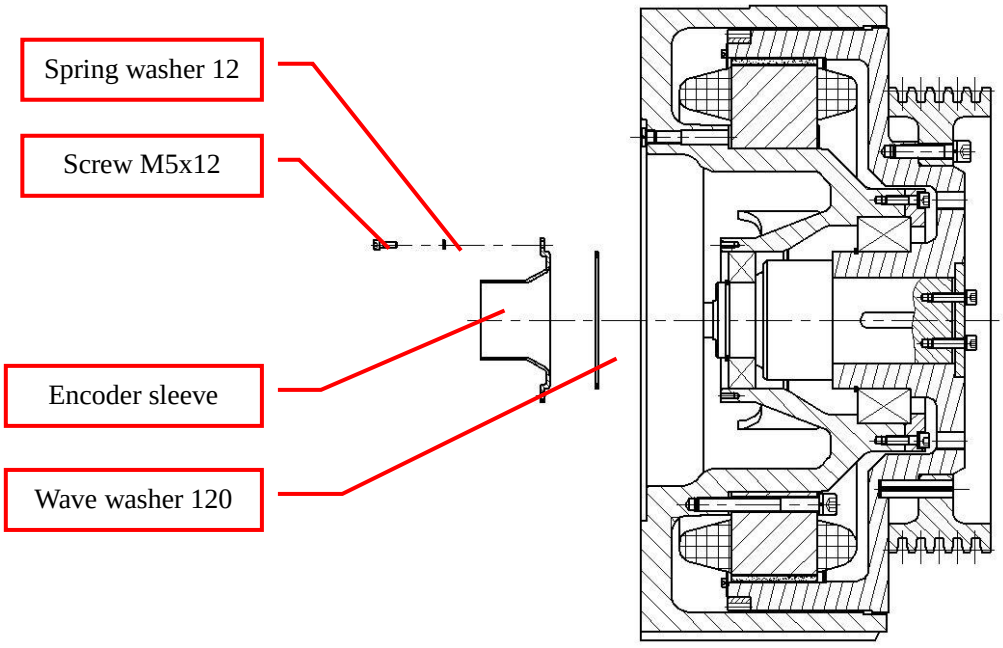


Figure 43: Remove encoder sleeve and wave washer

3. Remove the snap ring 65 with snap ring pliers. See Figure 44.

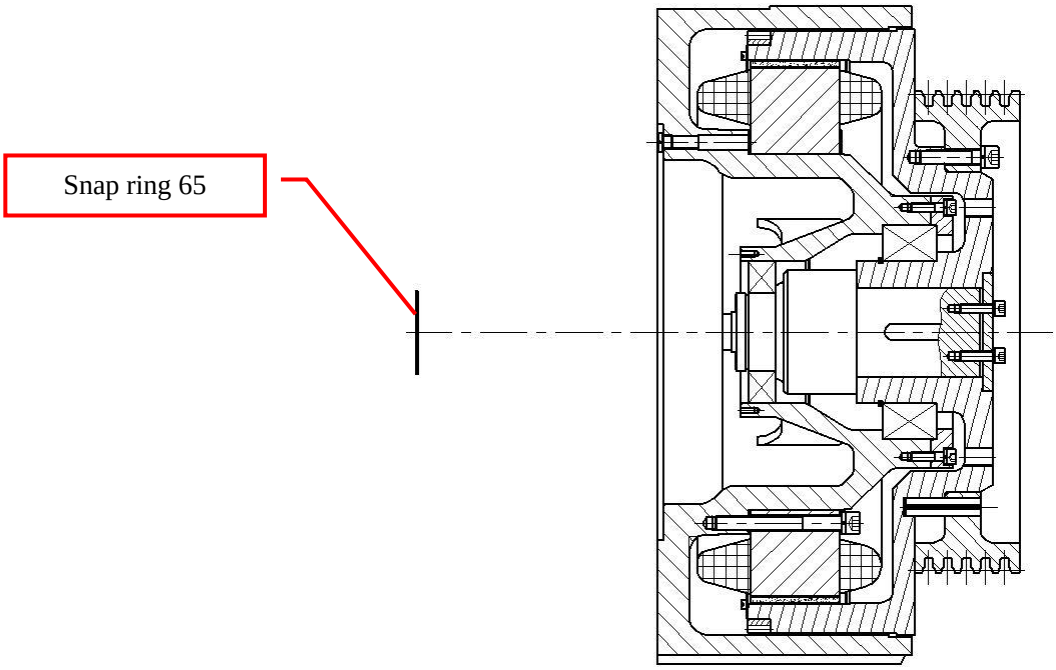


Figure 44: Remove snap ring

4. Screw out the screws M8x30 and lock washers 8 with hex wrench (6mm), then remove the pressing cover. See Figure 45.

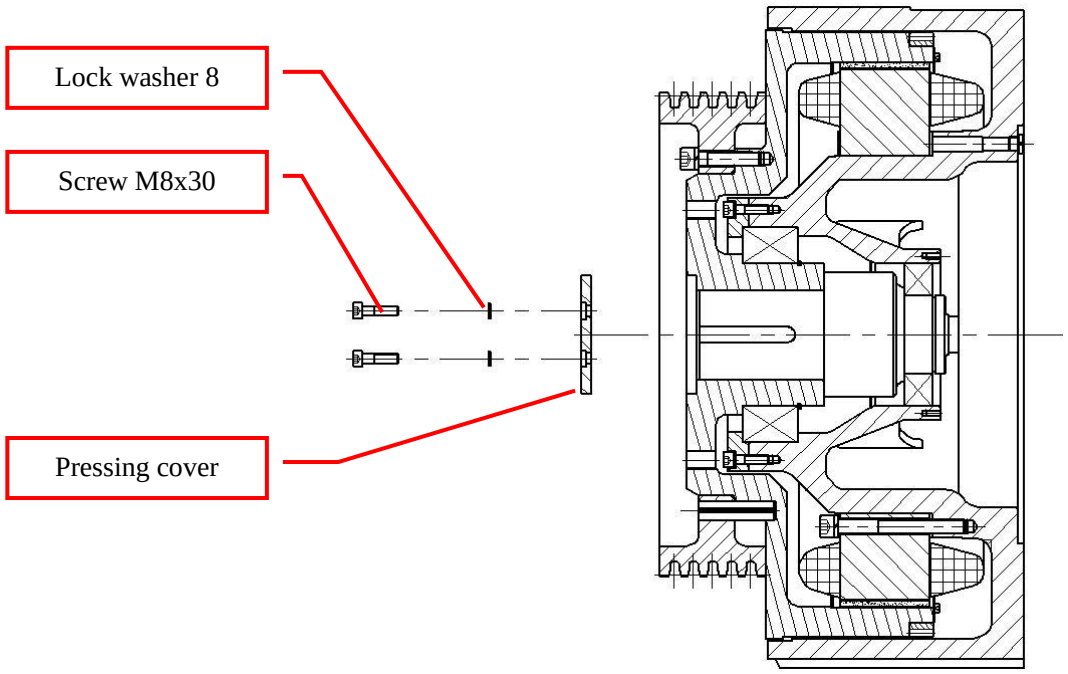


Figure 45: Remove pressing cover

5. Install the puller onto the end face of the traction wheel and screw into two bolts M12x50 to fix, then screw the bolt M24x200 into the puller. See Figure 46.

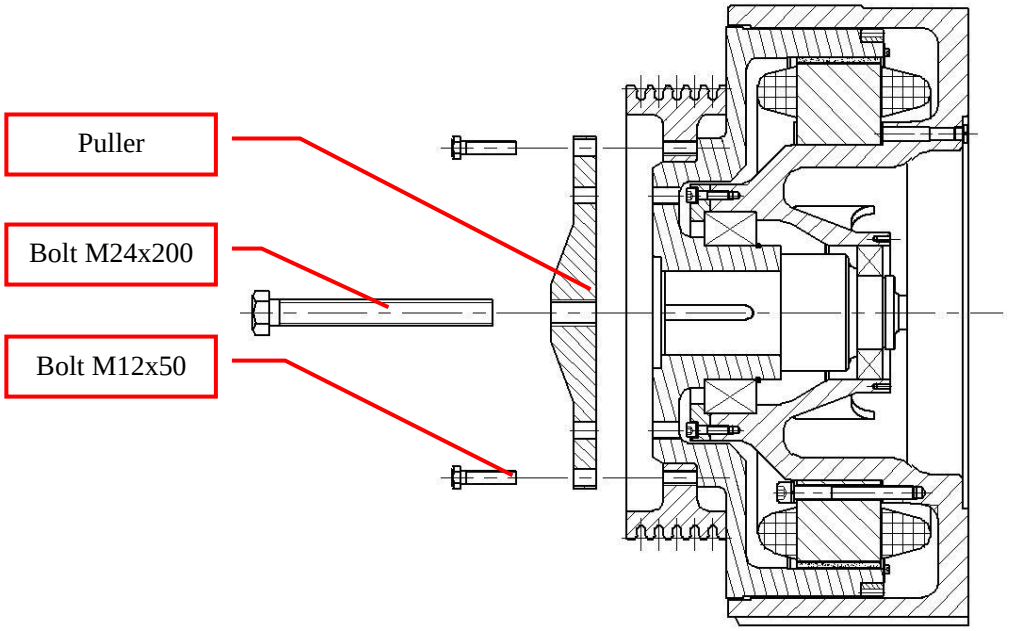


Figure 46: Install puller and M24x200 bolt

6. Tighten the bolt M24x200 slowly to push out the main shaft components. See Figure 47.

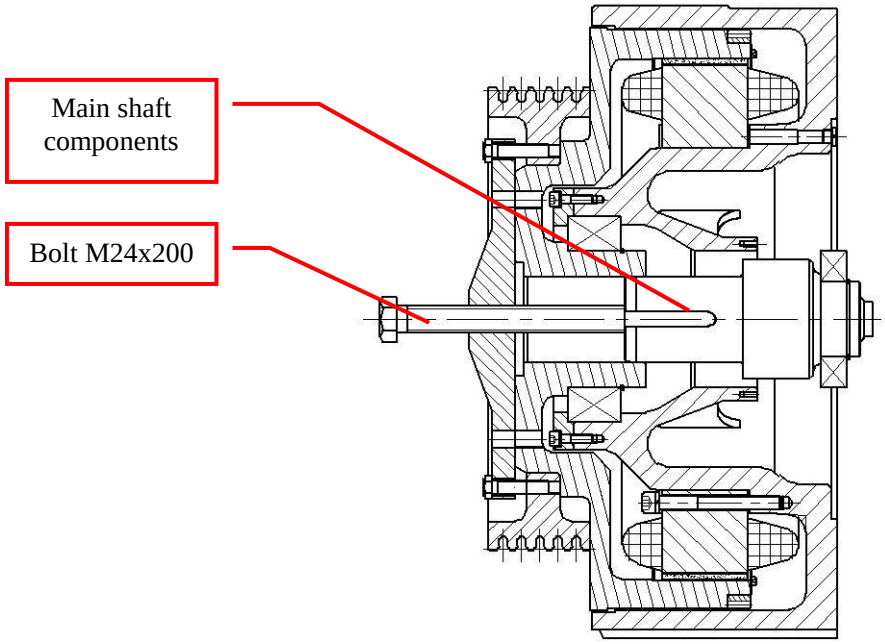


Figure 47: Jack out main shaft components

7. Remove the main shaft components, and screw out the bolts M12x50, then remove the bolt M24x200 and the puller. See Figure 48.

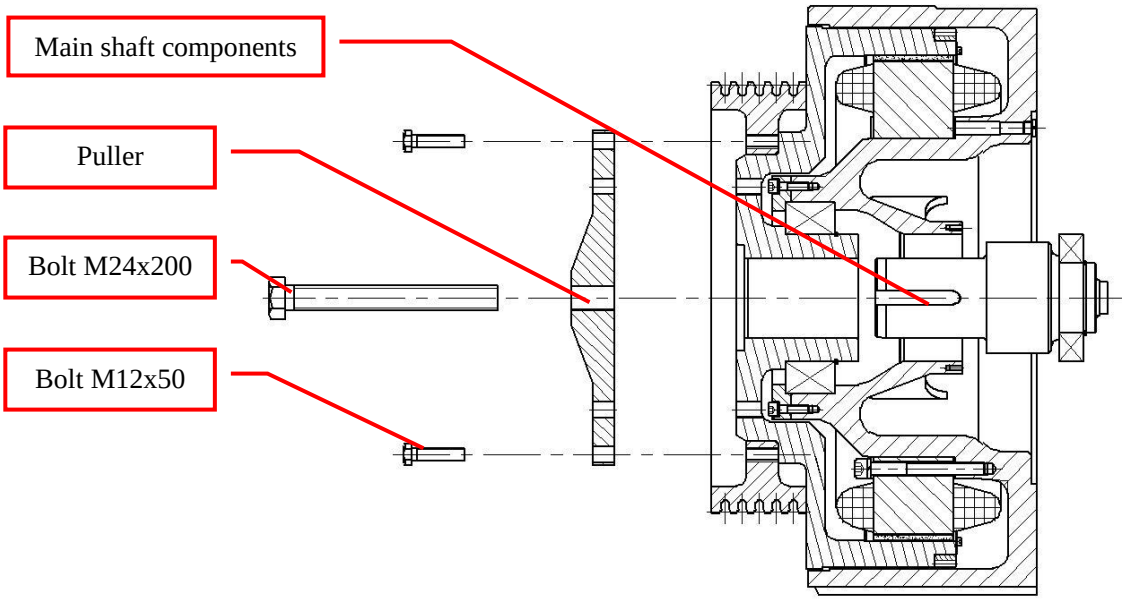


Figure 48: Remove puller

8. Pull out the bearing 6213-2RS with puller. See Figure 49.

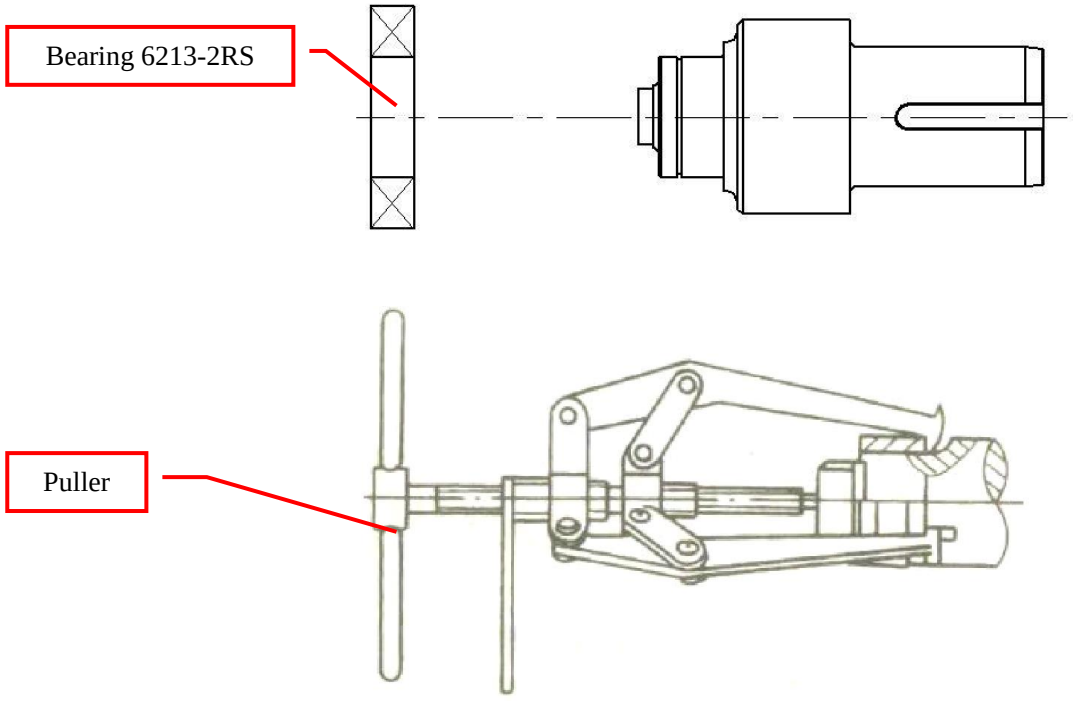


Figure 49: Pull bearing

8.6.1.2 Bearing installation

1. Clean the main shaft, and heat the bearing 6213-2RS to 80℃ (176°F) then install the bearing onto the main shaft. Install the retainer ring 65 onto the main shaft to secure the inner ring of the bearing. Wait for the bearing to cool. See Figure 50.

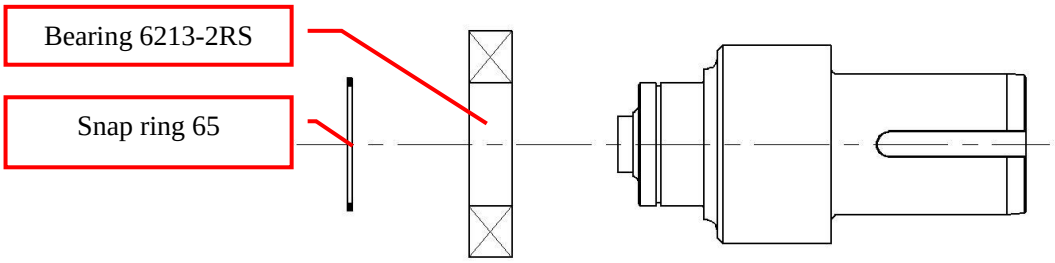


Figure 50: Heat bearing and install

2. Clean the main shaft components and spindle hole of the brake wheel components, and deburr the key. Apply some lubricating oil onto the surface of the main shaft, and then put the main shaft components into the hole of the spindle hole. See Figure 51.

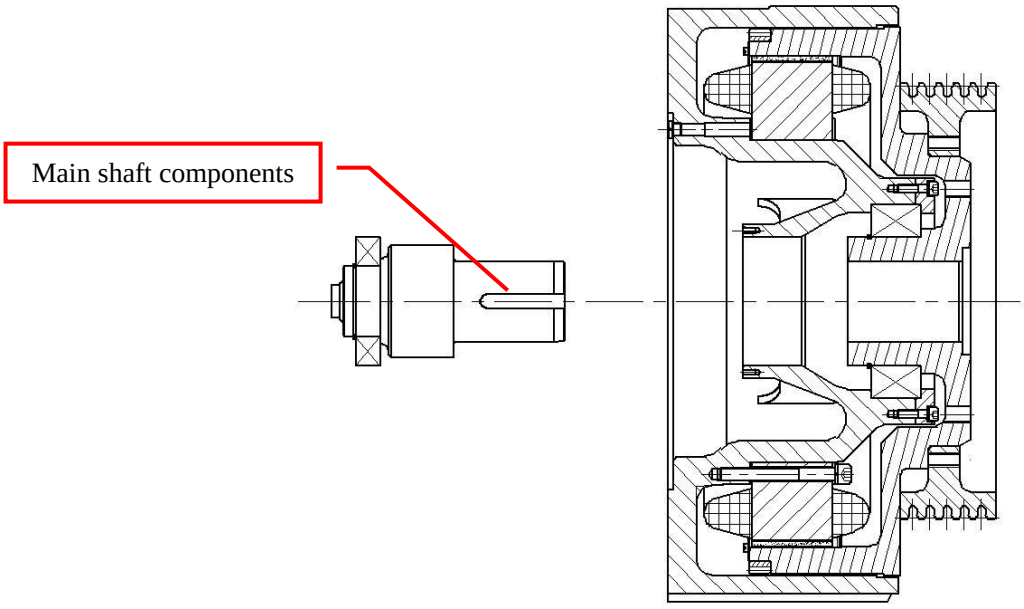


Figure 51: Install main shaft components

3. Screw the screw M12 into the center threaded hole of the main shaft, then install the pressing plate and nut M12 onto the screw M12. See Figure 52.

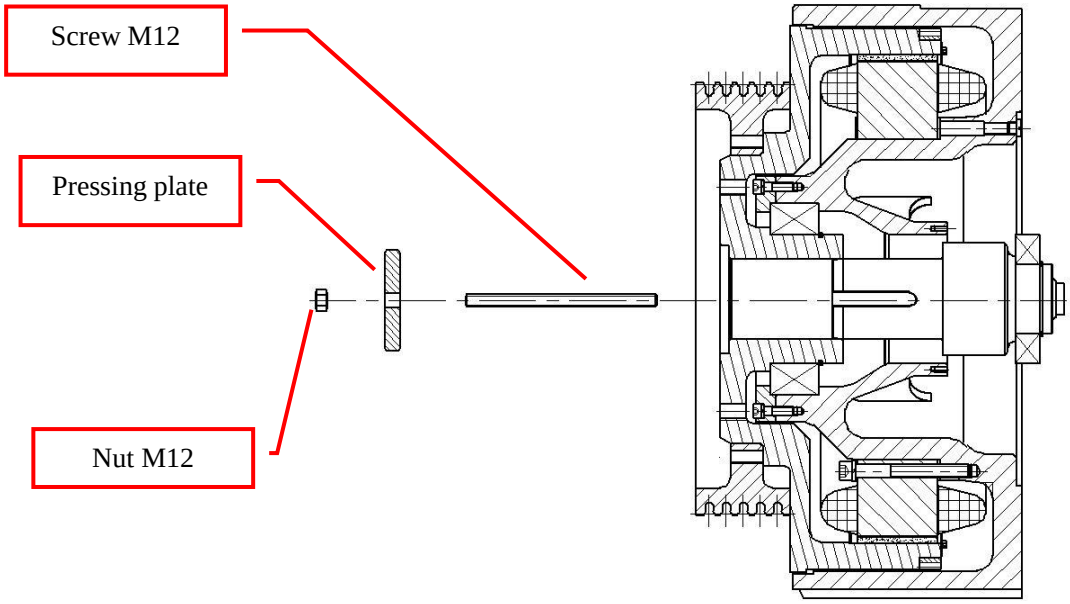


Figure 52: Install pressing plate

4. Tighten the nut M12 with open end wrench (18mm) slowly to pull the main shaft components, make sure that the main shaft components are installed in place. See Figure 53.

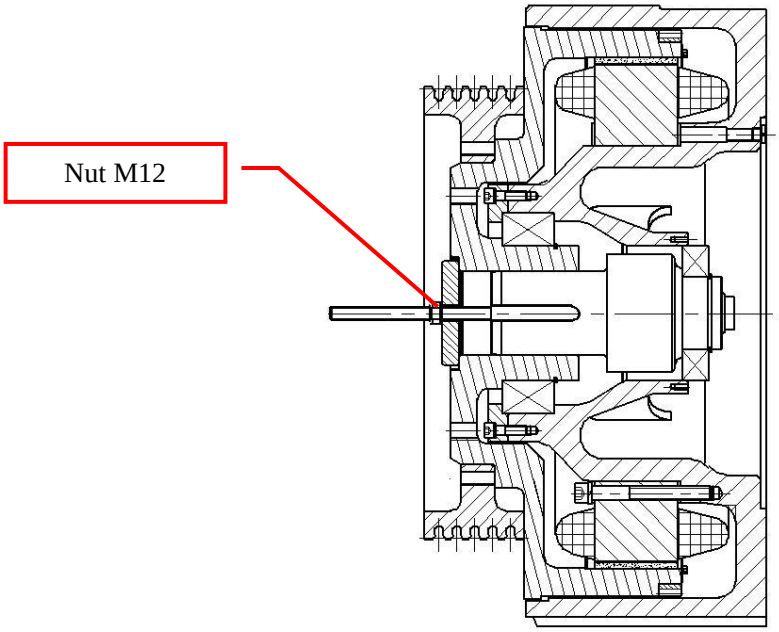


Figure 53: Tighten pressing plate

5. Remove the nut M12, pressing plate and screw M12 with open-ended wrench (18mm). See Figure 54.

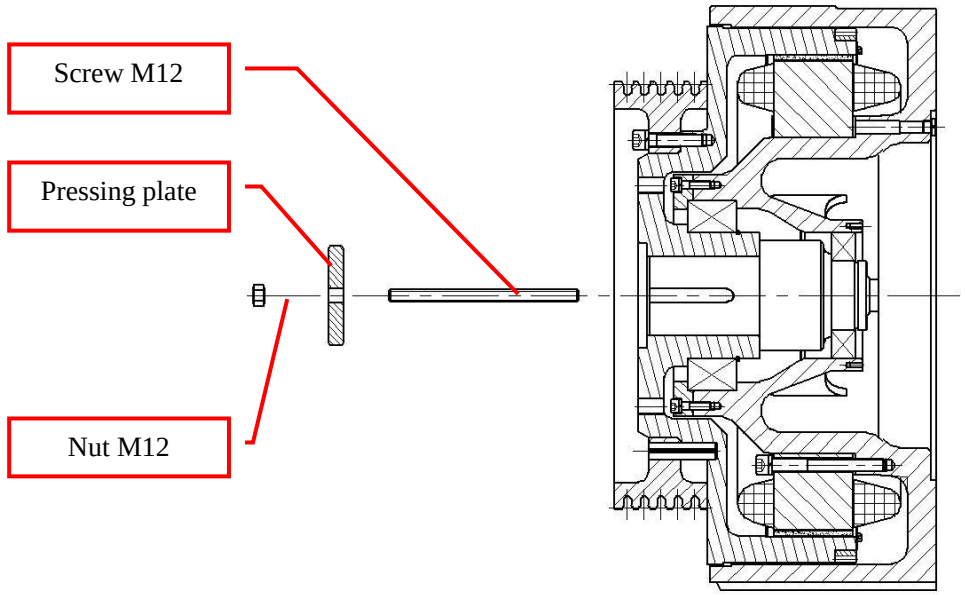


Figure 54: Remove pressing plate

6. Install the pressing cover onto the end face of the sheave, and install the screws M8x30 and lock washers 8 into the corresponding threaded holes (apply some thread locker into the threaded holes), then tighten the screws M8x30 to 20Nm. See Figure 55.

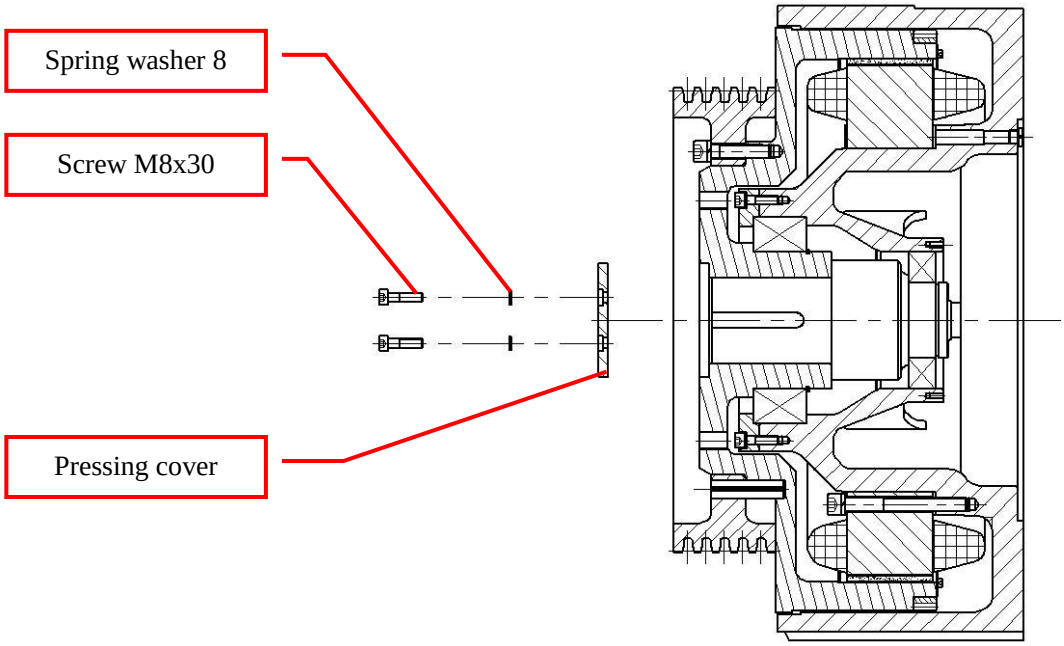


Figure 55: Install Pressing cover

7. Install the wave washer 120 into the bearing hole of the machine base, then install the encoder sleeve, and install the screws M5x12 and lock washers 5 into the corresponding threaded holes (apply some threaded glue into the threaded holes), then tighten the screws M5x12 to 5Nm. See Figure 56.

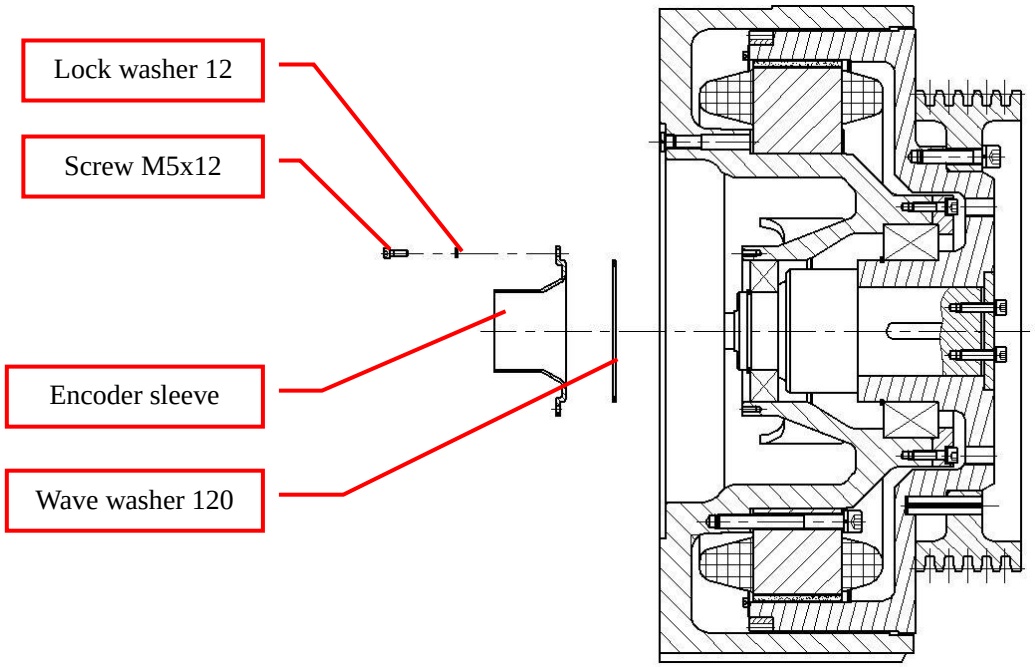


Figure 56: Install Encoder sleeve

8. Install the encoder. Refer to Section 8.1.2 Encoder installation.
9. Turn on the power to the traction machine, and test run.

8.6.2 Rear bearing (23024CA-2CS2) replacement

8.6.2.1 Bearing removal

1. Remove the rope guard and rope retainers. See Section 8.5.1 Drive sheave removal.
2. Remove the brake. See Section 8.2.1 Brake removal.
3. Remove the encoder. See Section 8.1.1 Encoder removal.
4. Remove the encoder sleeve and wave washer 120. See Figure 57.

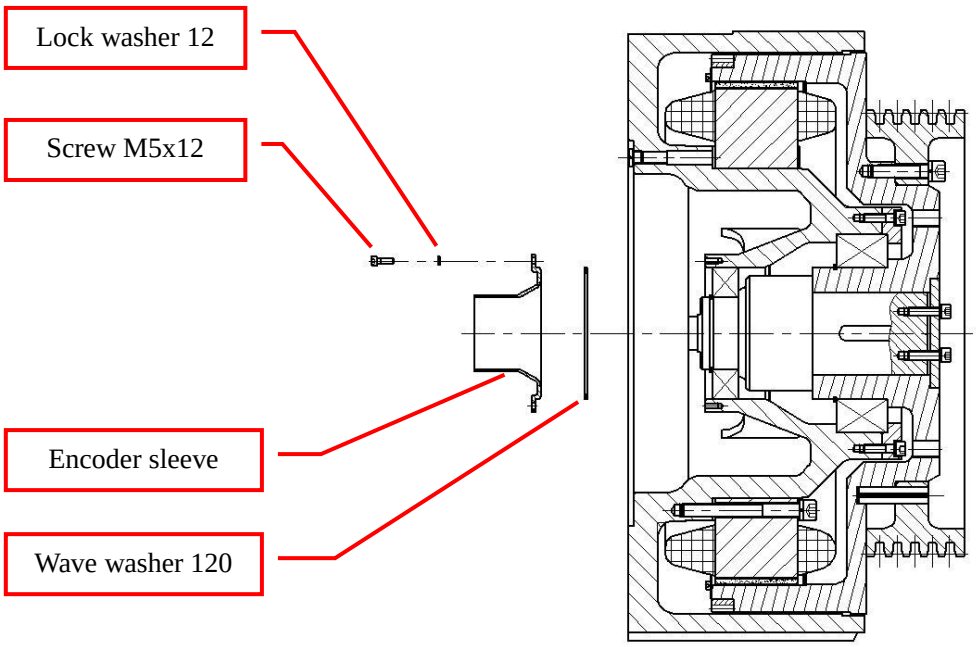


Figure 57: Remove Encoder sleeve and Wave washer

5. Remove the nylon cover M20×1.5 with screwdriver, then make the hex wrench (6mm) pass through the nylon cover hole to remove the screws M8×30 and lock washers 8. See Figure 58.

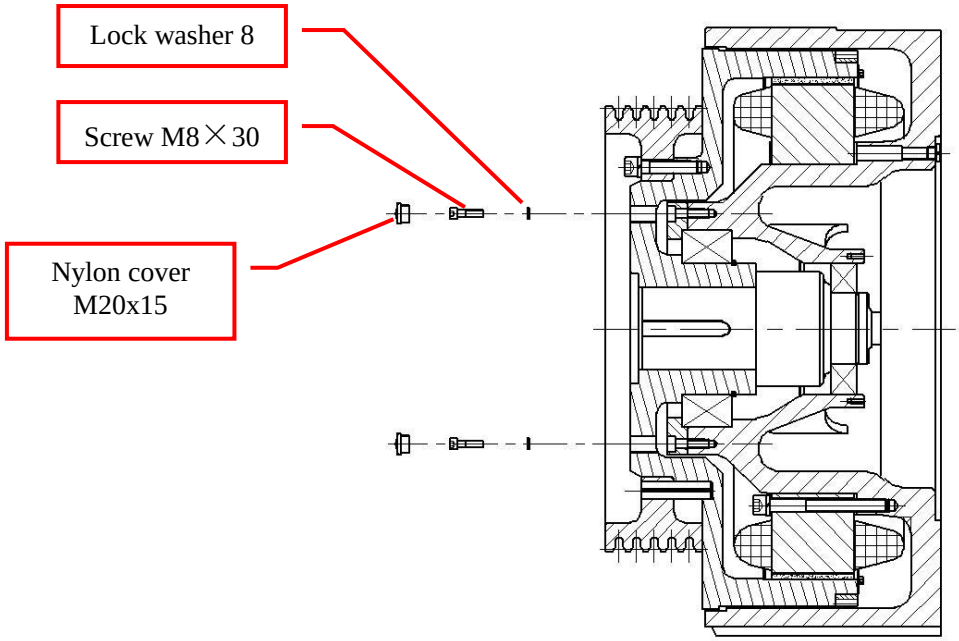


Figure 58: Remove M8x30 screws

6. Remove the screws M8×30 and lock washers 8 with inner hex wrench (6mm), then remove the pressing cover. Remove the snap ring 65 with snap ring pliers. See Figure 59.

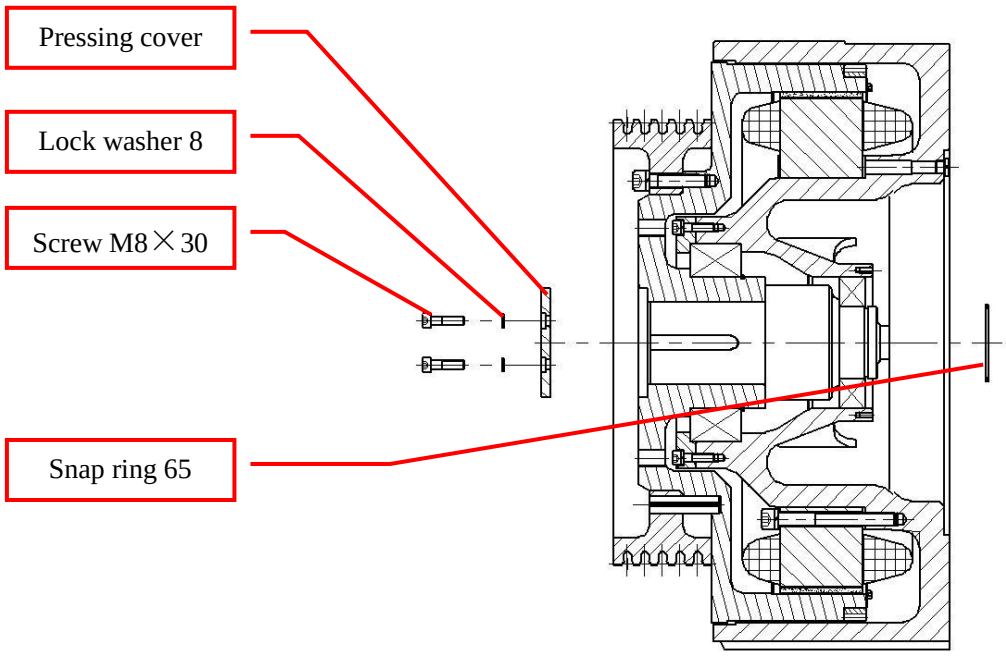


Figure 59: Remove Pressing cover and Snap ring

7. Install a lifting fixture onto the drive sheave, and screw in screw M12×50 to secure it. Connect a lifting rope to the lifting bolt. Install guide sleeve to withstand the bearing. See Figure 60.

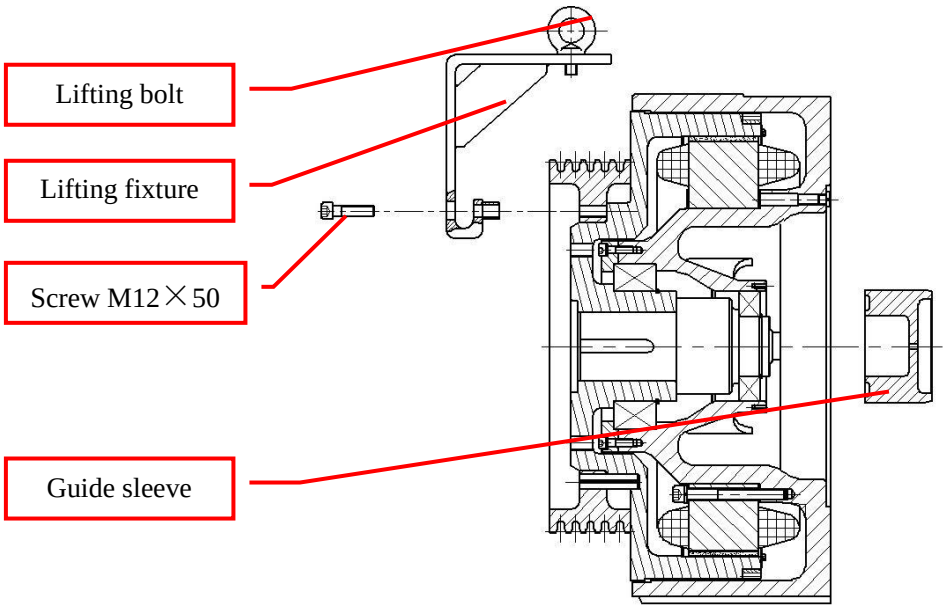


Figure 60: Attach lifting equipment and guide sleeve

8. Install two screws M12×1.5×400 into two corresponding threaded holes of the machine base, then install the puller plate and screw on nuts M12×1.5 to secure it. Put hydraulic jack and heel block between the guide sleeve and the puller, then increase the pressure of the hydraulic jack to push out the rotor components. See Figure 61.

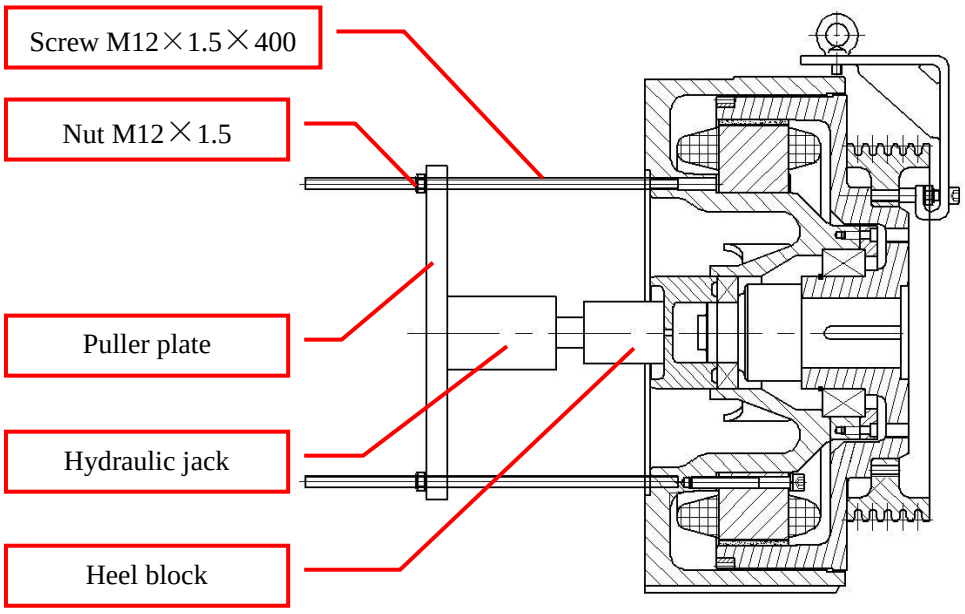


Figure 61: Install Puller plate, hydraulic jack, and heel block

9. Place the rotor assembly on equal height blocks. Using snap ring pliers remove bearing end parts respectively Retainer ring 65 and Retainer ring 120. Remove bearing 6213-2RS with a bearing puller. See Figure 62.

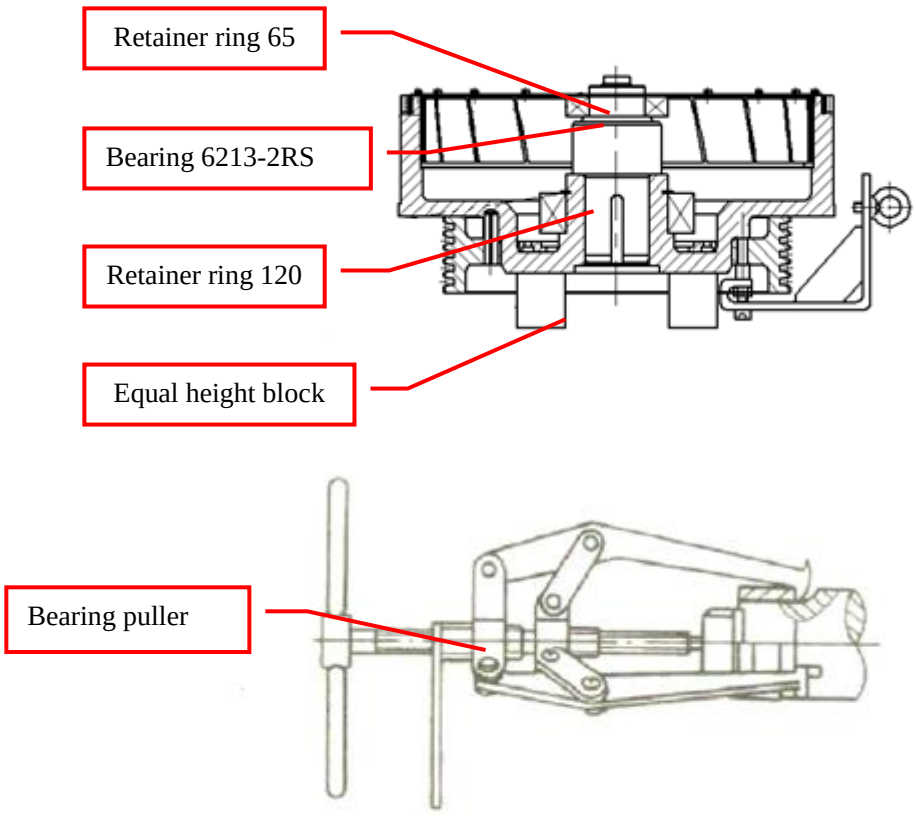


Figure 62: Remove retainer rings and bearing

10. Slide two M8x600 threaded rods into the M20 holes in the brake wheel and pressing cover. Install two M8 nuts on the end of each threaded rod. Position the jack and install the removing plate with two more M8 nuts as shown in Figure 48. Operate the jack to remove the bearing and pressing cover. Once free, remove the jack, removing plate, and threaded rods. See Figure 63.

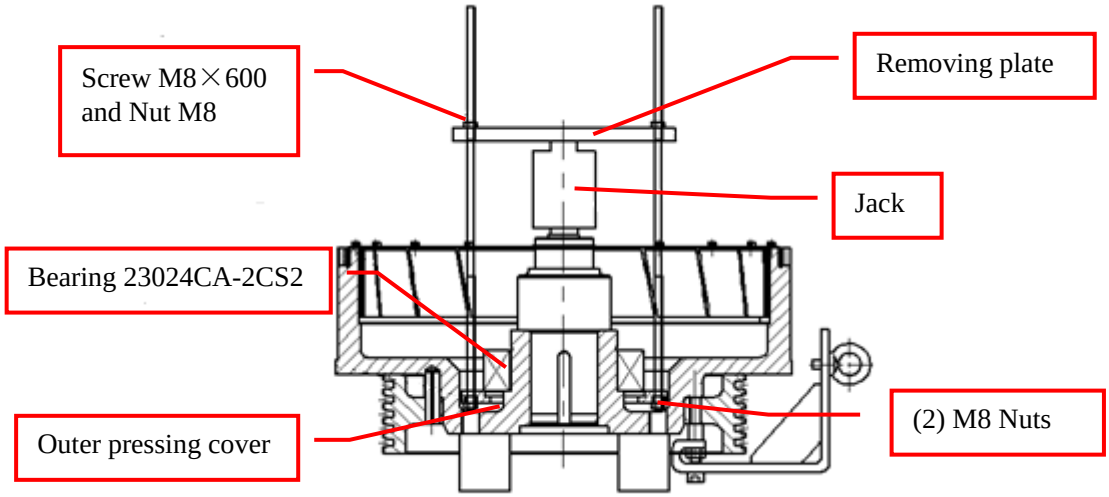


Figure 63: Use Jack to remove bearing and pressing cover

8.6.2.2 Install the bearing 23024CA-2CS2

1. Clean and deburr the shaft of the rotor components, then install the outer pressing cover.

2. Put three washers on the threaded rod M8×600. As shown in Figure 49. Slide the M8x600 threaded rod, washers, and 2 nuts through the brake wheel at the bottom of the 3-M20 hole and the outer pressing cover of 3-Φ9 hole, bearing 23024CA-2CS2 brake wheel bearing, bearing pressing set, jack and removing plate, with nuts M8 fixation. Use the jack to press the bearing 23024 CA-2CS2 into place. Remove the jack, removing device, the screw and nut. See Figure 64.

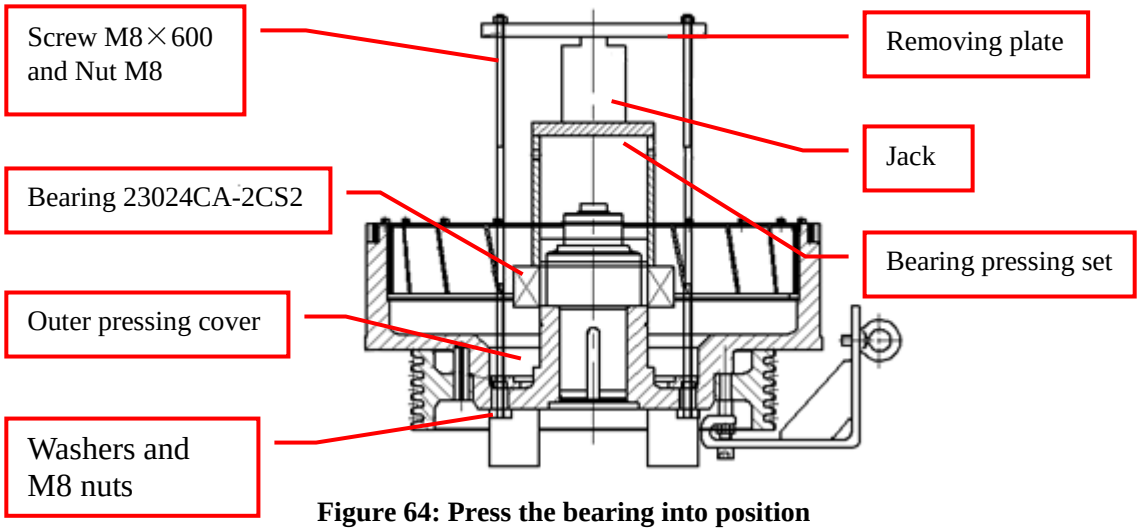


Figure 64: Press the bearing into position

3. Use retainer ring pliers to install retainer ring 120 into ring groove of the brake wheel, above the bearing 23024CA-2CS2. Put the bearing 6213-2RS on the spindle, install the bearing pressing set, and use a rubber mallet tap into place. Use retainer pliers to install retainer ring 65 into ring groove of the spindle, securing the bearing 6213-2RS. See Figure 65.

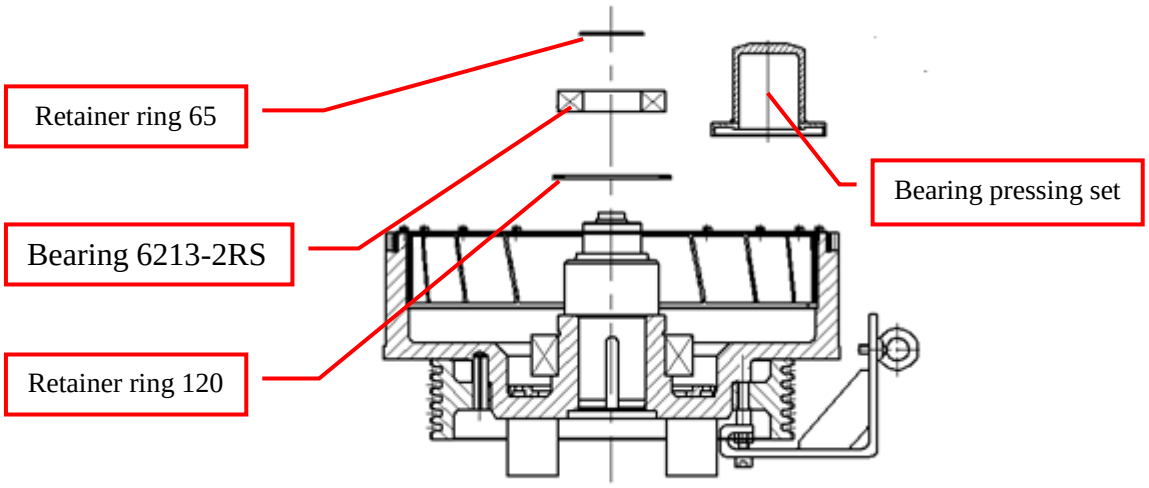


Figure 65: Secure the Bearing 6213-2RS

4. Install the guide sleeve and screw in special screw M5 to secure. Install locating plate, and screw in lifting bolt M12 to secure. See Figure 66.

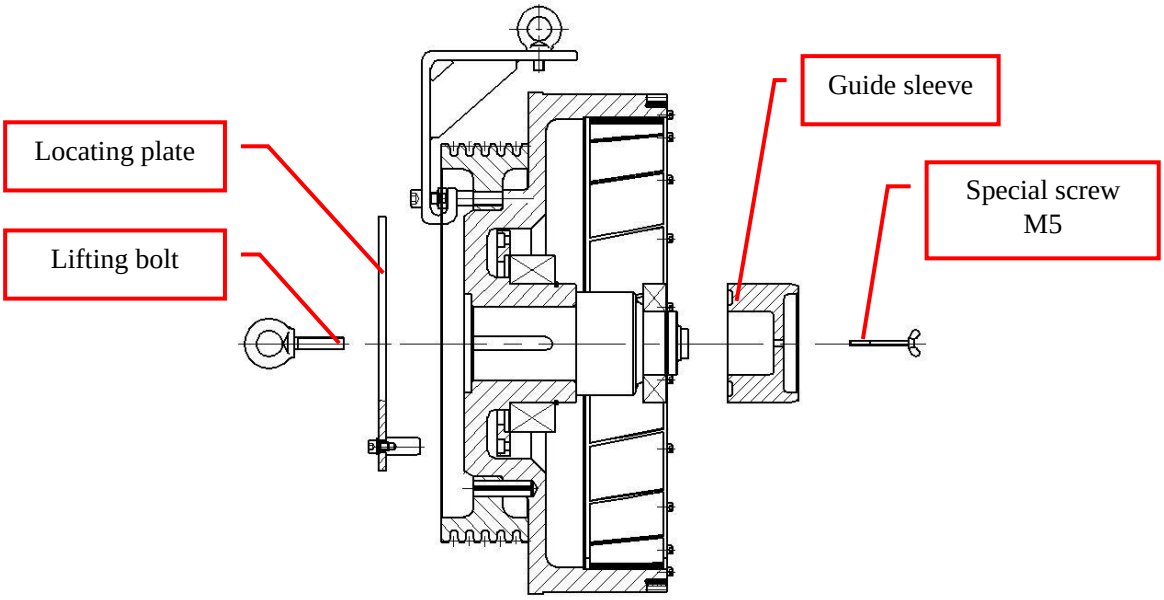


Figure 66: Install guide sleeve and locating plate

5. Lift the rotor assembly parallel to the stator assembly. Align the guide sleeve with the bearing hole. The rotor assembly is pushed into the stator assembly. Remove the special screw ring and self-aligning bearing positioning plate. See Figure 67.

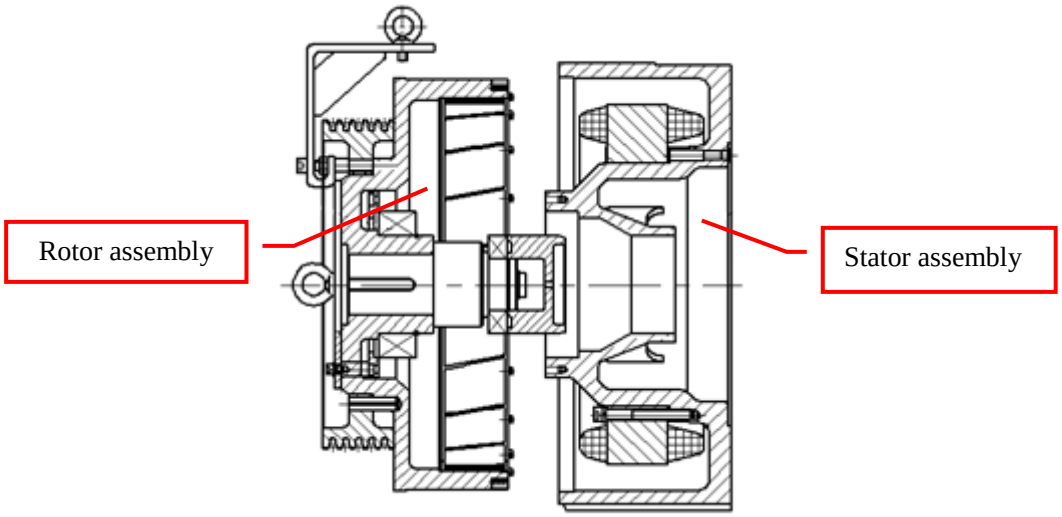


Figure 67:

6. Turn the sheave to align the M20 holes with the M8 threaded holes of the outer pressing cover. Then install screws M8x30 and lock washers 8 to secure. The tightening torque is 20Nm. Then install the nylon covers M20x1.5 onto the end face of the sheave and tighten them with screwdriver. See Figure 68.

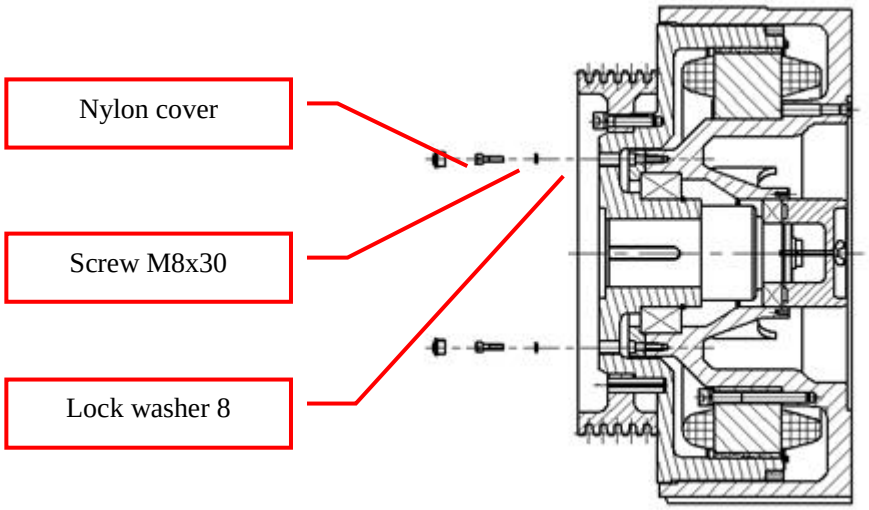


Figure 68: Install M8 screws and Nylon cover

7. Remove the guide sleeve and lifting fixture. Install the pressing cover onto the end face of the sheave and secure it with screws M8×30 and lock washers 8, and then install the snap ring 65 into the retainer ring groove. See Figure 69.

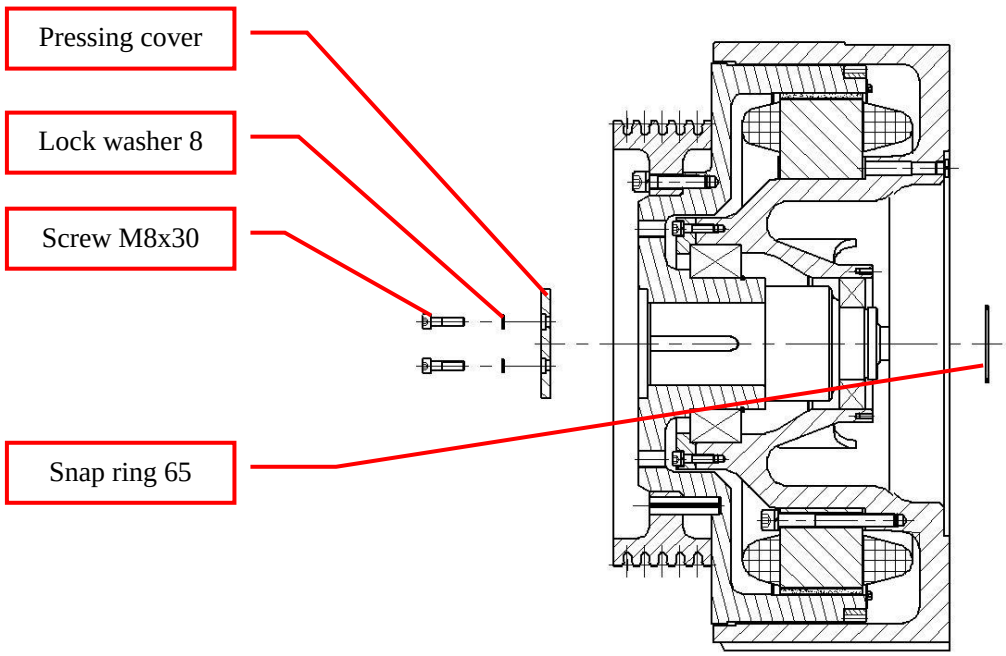


Figure 69: Install pressing cover and retainer ring

1. Install the wave washer 120 and encoder sleeve (Refer to GTW8 elevator traction machine spare parts replacement manual---bearing 6213-2RS replacement)
2. Install the encoder. See Section 8.1.2 Encoder installation.
3. Install the brake. See Section 8.2.2 Brake installation.

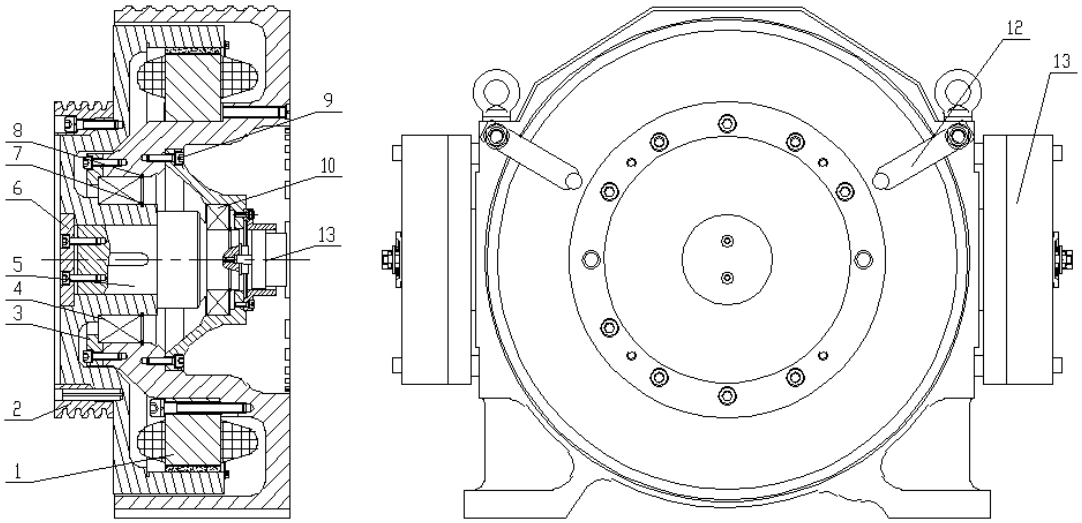
4. Install the protective cover or rope rods (Refer to GTW8 elevator traction machine spare parts replacement manual---traction wheel replacement)
5. Turn on the power of the traction machine, and test run.

9.0 Troubleshooting chart

WARNING! **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

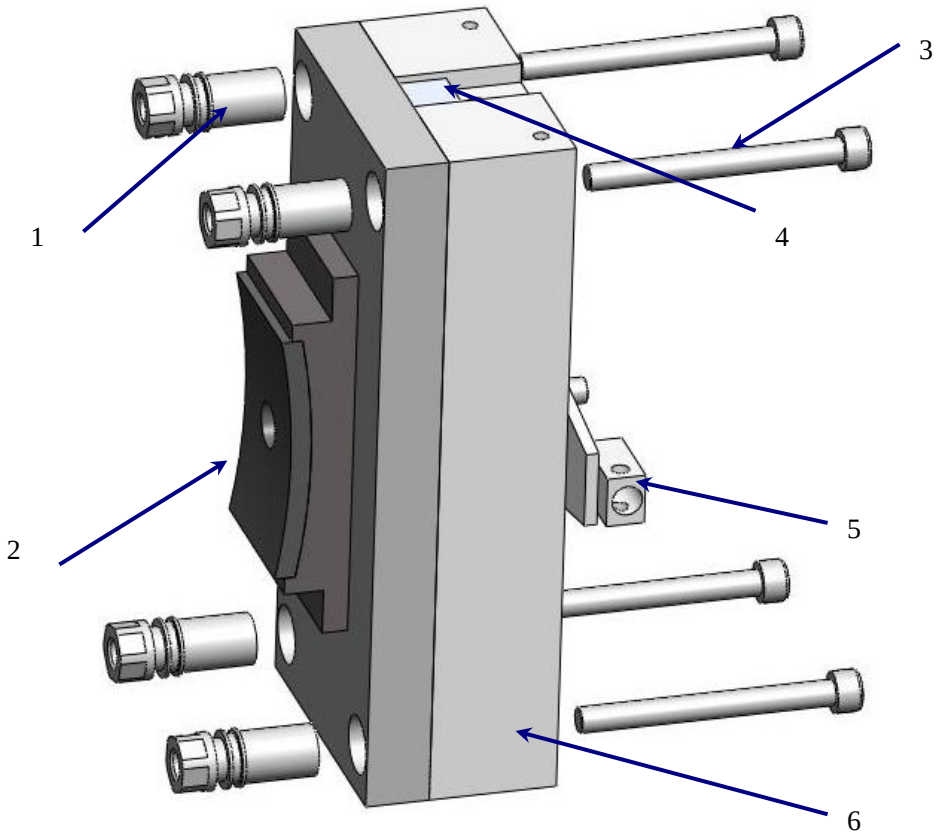
10.0 Machine Assembly



(*) indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	Stator winding
2	MSHB-GTW3M-340	Sheave
3	*	Outside cover
4	PBR026	Sheave side Bearing 23024CA-2CS2
5	*	Spindle
6	*	Cover
7	*	Thackeray washer 120
8	*	Thackeray washer 180
9	*	Rear Cover
10	PBR033	Motor side Bearing 6213-2RS
11	PEN003	Haidenhain Absolute Encoder
12	*	Guard
13	See Brake Assembly	Brake

11.0 Brake Assembly

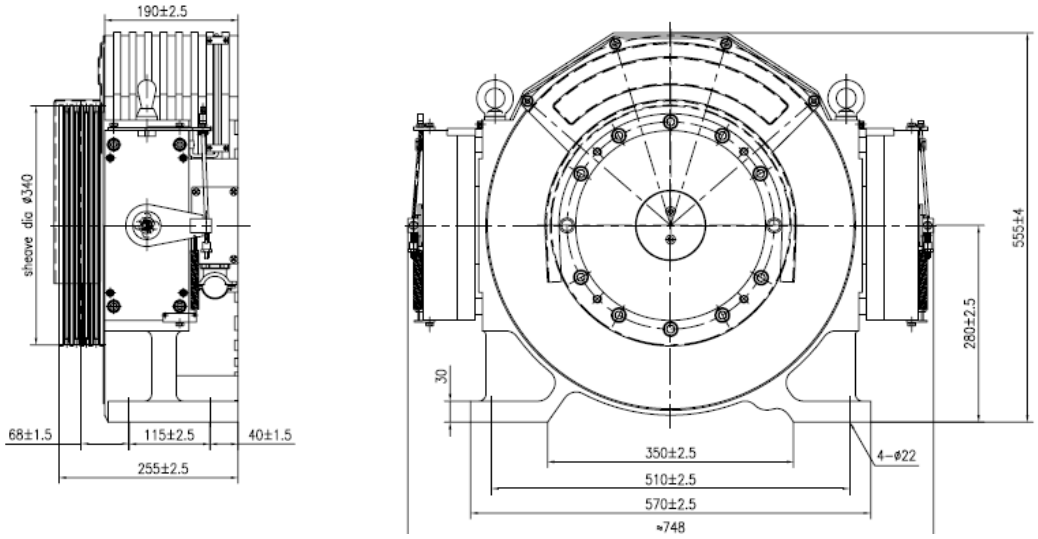


(*) indicates a non-stock item

No.	Torin Drive Part No.	Description
1	*	Guide bushing
2	PBK044	Brake lining
3	*	Bolt M10x110
4	PSW007	Brake switch
5	*	Hand shank
6	PBK010E	TPM1 Brake Assembly, Emergency Brake
	PBK010N	TPM1 Brake Assembly, Normal Brake
	BMRA-TPM1	Manual Brake Release Assembly, Set of 2 including 5m cables and Base/Handle
	PBK045	TPM1 Emergency Brake Assembly Kit
	PBK046	TPM1 Normal Brake Assembly Kit

12.0 MECHANICAL DIMENSIONS

TPM1



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